Curriculum Book

and

Assessment and Evaluation Scheme

based on

Outcome Based Education (OBE)

and

Choice-Based Credit System (CBCS)

in

Bachelor of Technology

4 Year Degree Program

Revised as on 01 August 2023 Applicable w.e.f. Academic Session 2023-24

AKS University

Satna 485001, Madhya Pradesh, India

Faculty of Engineering and Technology
Department of Electrical Engineering

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

CONTENTS

Sl No	Item	Page No
1	Forwarding	I
2	Vice Chancellor Message	II
3	Preface	III
4	Introduction	1
5	Vision & Mission of the Electrical Engineering Department	1
6	Programme Educational Objectives (POE)	1
7	Programme Outcome (POs)	2
8	General Course Structure and theme	4
9	Component of Curriculum	4
10	General Course Structure and Credit Distribution	5
11	Course code and definition	7
12	Category-wise Courses	8
13	Semester wise Course Structure	13
13	Semester wise Course details	13
13.1	Semester I	17
13.2	Semester -II	131
13.3	Semester -III	226
13.4	Semester -IV	308
13.5	Semester -V	391
13.6	Semester -VI	546
13.7	Semester -VII	674
13.8	Semester -VIII	840
13.9	Skill development Programme	846
13.10	Value Added Programme	854

H.O.D. (Elect. Engg..
Faculty of Engg. & Tech
A.K.S. University Satna (M.

Dean
Faculty of Engineering & Technology
AKS University
Sherganj, Satna (MP), 485001

Bachopade

Professor B.A. Chopade
Vice-Chancellor
AKS University
Satna, 485001 (M.P.)

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Forwarding

Dear Esteemed Readers,

It is my distinct honor to extend a warm welcome to you on behalf of the Electrical Engineering Department at AKS University. As the Pro-Chancellor of this esteemed institution, I take immense pride in presenting this preface, reflecting our collective commitment to excellence, innovation, and transformative education.

The Electrical Engineering Department at AKS University stands as a pillar of academic distinction, embodying a tradition of excellence that spans generations. Rooted in a steadfast dedication to advancing knowledge and fostering intellectual curiosity, our department serves as a dynamic hub for cutting-edge research, groundbreaking innovation, and unparalleled academic rigor.

Under the visionary leadership of our faculty members, who are distinguished scholars and practitioners in their respective fields, the Electrical Engineering Department has consistently set new benchmarks of academic excellence and research prowess. Their unwavering commitment to scholarly inquiry, coupled with their passion for teaching and mentorship, ensures that our students receive a world-class education that prepares them to excel in the ever-evolving landscape of electrical engineering.

At AKS University, we recognize the transformative power of education not only to shape individual destinies but also to catalyze societal progress and drive economic development. In this spirit, our Electrical Engineering Department is deeply committed to equipping our students with the knowledge, skills, and ethical values necessary to become visionary leaders, innovative problem-solvers, and responsible global citizens.

Moreover, our department prides itself on fostering a culture of inclusivity, diversity, and collaboration, where students from diverse backgrounds come together to exchange ideas, challenge assumptions, and collaborate on interdisciplinary projects that transcend traditional boundaries. Through experiential learning opportunities, industry partnerships, and community engagement initiatives, we empower our students to make meaningful contributions to society and create positive change in the world.

As we embark on this journey of discovery, innovation, and academic excellence, I am confident that the Electrical Engineering Department at AKS University will continue to be a beacon of inspiration and a catalyst for positive change. Together, let us strive to push the boundaries of knowledge, unlock new frontiers of discovery, and harness the power of technology to build a brighter future for generations to come.

With warm regards,

Er. Anant Kumar Soni
Pro-Chancellor
AKS University

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

From the Desk of the Vice-Chancellor

The curriculum for Electrical Engineering at AKS University. It is with great pleasure that we present this comprehensive guide to the study of Electrical Engineering, a field that is not only at the forefront of technological advancements but also plays a pivotal role in shaping the future of our world.

Electrical Engineering is a dynamic and ever-evolving discipline that encompasses the study, design, and application of electrical systems. From power generation and distribution to electronics, telecommunications, and beyond, the scope of Electrical Engineering is vast and multifaceted. It is a field that bridges theory with practical application, offering opportunities to innovate, problem-solve, and contribute to society in profound ways.

At AKS University, our Electrical Engineering curriculum is designed to provide students with a solid foundation in the fundamental principles of the discipline while also fostering creativity, critical thinking, and technical expertise. Through a combination of rigorous coursework, hands-on laboratory experiences, and real-world projects, students will develop the skills and knowledge necessary to excel in the field of Electrical Engineering.

This curriculum has been carefully crafted to reflect the latest advancements in the field, ensuring that our students are well-prepared to tackle the challenges of tomorrow. Whether you aspire to work in renewable energy, telecommunications, robotics, or any other area within the realm of Electrical Engineering, our program will equip you with the tools and resources you need to succeed.

As you embark on this educational journey, I encourage you to approach your studies with curiosity, enthusiasm, and a passion for learning. Take advantage of the opportunities available to you, seek out mentorship from faculty members and industry professionals, and never stop pushing the boundaries of what you thought possible.

On behalf of the faculty and staff of AKS University, I extend my best wishes to you as you pursue your academic and professional goals in the field of Electrical Engineering. May this curriculum serve as a guiding light on your path to success?

AKS University, Satna
01 August 2023

Professor B. A. Chopade
Vice- Chancellor

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Preface

Dear Readers,

It is with great pleasure and pride that we present to you this preface for the Electrical Engineering Department at AKS University. As we embark on this journeyof discovery and innovation, we are reminded of our commitment to excellence, advancement, and service to society.

At AKS University, our Electrical Engineering Department stands as a beacon of knowledge and innovation in the field. With a rich legacy of academic excellence, research prowess, and industry partnerships, we have consistently strived to nurture the brightest minds and push the boundaries of electrical engineering.

Our department boasts a distinguished faculty comprising seasoned academics, researchers, and industry experts who are dedicated to imparting cutting-edge knowledge and skills to our students. Through a blend of rigorous coursework, hands-on laboratory experiences, and industry internships, we ensure that our graduates are not only well-versed in theory but also equipped with the practical know-how to tackle real-world challenges.

In line with our university's ethos of holistic development, we foster a culture of innovation and entrepreneurship within our department. We encourage our students to think creatively, explore new ideas, and develop solutions that have the potential to transform the world. Through various initiatives such as hackathons, innovation challenges, and collaborative projects, we provide a platform for our students to showcase their ingenuity and make meaningful contributions to society.

Furthermore, our department is committed to staying at the forefront of research and technological advancement. From renewable energy systems and smart grids to artificial intelligence and machine learning applications in electrical engineering, our faculty members are actively engaged in cutting-edge research that addresses the pressing needs of our time.

As we look towards the future, we remain steadfast in our commitment to nurturing the next generation of electrical engineers who will lead with integrity, innovation, and a sense of purpose. We invite you to join us on this exciting journey as we strive to make a positive impact on the world through the power of electrical engineering.

Sincerely,

Dr. Rama Shukla
Head
Electrical Engineering Department
AKS University

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Introduction:

The Department of Electrical Engineering is under the Faculty of Engineering and technology. it prepares the students to meet the demands of changing industrial needs and molds them into successful and ethical professionals, globally accepted in the field of Electrical Engineering and allied fields to contribute nation building.

The Curriculum of the department is prepared with inclusion of various advance courses as per current industrial scenario with focus on areas such as: Network analysis & synthesis, machine analysis & design; control engineering; analog & digital electronics; microprocessor & micro controllers; Artificial Intelligence; Measurement and Instrumentation and power systems etc.

Sincere efforts have been made to improve knowledge and skills of students as per current industrial demands. The department focuses on labs, Industrial Visits, Vocational Trainings, Projects and Internship training to enhance proper understanding of theoretical learning.

The Department has experienced and highly qualified faculty with strong research and professional expertise. Apart from teaching undergraduate and postgraduate courses, the faculty members are also active in research and development.

Vision:

To attain excellence in technical education and research related to Electrical Engineering by transforming students into responsible professionals to contribute in sustainable development of industry, society and nation.

Mission:

M 01: Achieve academic excellence in various domains of Electrical Engineering through an innovative teaching-learning process.
M 02: develop as a center for education and research
M 03: Enhancing resource generation through industrial collaboration and Training programs etc.
M 04: Enable the entrepreneurial skills and competence integrated with teamwork, leadership, social and ethical qualities.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO 01: Plan, design, construct, maintain and improve Electrical engineering systems that are technically sound, economically feasible and socially acceptable.

PEO 02: Apply analytical, computational and experimental techniques to address the challenges faced in Electrical and allied engineering streams.

PEO 03: Communicate effectively using conventional platforms as well as innovative / online tools and demonstrate collaboration, networking & entrepreneurial skills.

PEO 04: Exhibit professionalism, ethical attitude, team spirit and pursue lifelong learning to achieve career, organizational and social goals

Program Outcomes (POs)

B Tech Electrical Engineering Graduate will able to perform:

PO1: Engineering Knowledge: Graduates should possess a solid foundation of knowledge in mathematics, science, and engineering principles, enabling them to analyze and solvecomplex engineering problems.

PO2. Problem Solving: Graduates should be able to identify, formulate, and solve engineering problems using critical thinking, creativity, and appropriate engineering methods.

PO3. **Design Skills**: Graduates should be capable of designing electrical and electronic systems, components, or processes to meet desired needs while considering factors such as safety, ethics, and sustainability.

PO4. Laboratory Skills: Graduates should be adept at using modern engineering tools and techniques in both theoretical and practical contexts, including the ability to design and conduct experiments, as well as to analyze and interpret data.

PO5. Teamwork: Graduates should be able to work effectively as part of interdisciplinary teams, understanding their roles and responsibilities, and contributing constructively to achieve common goals.

PO6. Communication Skills: Graduates should be able to communicate effectively, both in written and oral forms, with technical and non-technical audiences, using appropriate visual aids and documentation.

PO7. Ethical and Professional Behavior: Graduates should demonstrate ethical and professionalconduct in engineering practice, understanding the societal and environmental impacts of their work.

PO8. Lifelong Learning: Graduates should recognize the need for ongoing learning and professional development, staying current with technological advancements and evolving engineering practices.

PO9. Global and Societal Impact: Graduates should understand the impact of engineering solutions on global, economic, environmental, and societal contexts.

PO10. **Project Management**: Graduates should possess the ability to plan, execute, and manage engineering projects, considering constraints such as time, resources, and scope.

PO11. Adaptability: Graduates should be able to adapt to new technologies, tools, and techniques, as well as to changing work environments and emerging engineering trends.

PO12. Professional Development: Graduates should demonstrate an awareness of the engineering profession, including its history, contemporary issues, and potential future directions.

Program Specific Outcomes (PSOs)

On completion of B. Tech. Electrical Engineering program, the students will achieve the following program specific outcomes: -

PSO 1: Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society

PSO 2: Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.

Consistency / Mapping of PEOs with Mission of the Department

PEO	M 1	M 2	M 3	M 4
PEO 1	3	3	2	2
PEO 2	3	3	3	2
PEO 3	2	2	3	3
PEO 4	2	3	3	2

1*: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No correlation*

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

GENERAL COURSE STRUCTURE & THEME

1. Definition of Credit

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hours Practical (P) per week	1 Credit

2. Range of Credits:

In the light of the fact that a typical Model Four-year Under Graduate degree program in Engineering has about 160 credits, the total number of credits proposed for the four-year B. Tech. in Electrical Engineering is kept as 166 considering NEP-20 and NAAC guidelines.

3. Structure of UG Program in Electrical Engineering:

The structure of UG program in Electrical Engineering shall have essentially the following categories of courses with the breakup of credits as given:

Components of the Curriculum

(Program curriculum grouping based on course components)

Sl No	Course Component	% of total number of credits of the Program	Total number of Credits
1	Basic Sciences (BSC)	14.46	24
2	Engineering Sciences (ESC)	13.86	23
3	Humanities and Social Sciences (HSMC)	11.46	19
4	Program Core (PCC)	31.93	53
5	Professional Electives (PEC)	10.84	18
6	Open Electives (OEC)	7.22	12
7	Research Projects/ On job Plant Training (OJT)	7.22	12
8	Major Project (PROJ)	2.41	4
9	Seminar (OC)	0.60	1
Total		100.00	**166**

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

General Couse Structure and Credit Distribution

Curriculum of B.Tech. Electrical Engineering

Semester - I		Semester - II	
Course Title	**Credit**	**Course Title**	**Credit**
1. Physics-1	3:1:2 = 5	1. Chemistry-1	3:0:2 = 4
2. Mathematics-1	3:1:0 = 4	2. Mathematics-2	3:1:0 = 4
3. Biology for Engineers	3:0:0 = 3	3. Programming for Problem Solving	3:0:4 = 5
4. Basic Electrical Engineering	2:1:2 = 4	4. Manufacturing Practice Workshop	1:0:4 = 3
5. Engineering Graphics & Design	1:0:4 = 3	5. Communication Skills (English)	3:0:0 = 3
6. Basic Civil Engineering	3:0:0=3	6. Indian Knowledge system.	2:0:0 = 2
7. Sustainable Development goals	2:0:0 = 2	7. Sports and Yoga	2:0:0 = 0
8. Design Thinking and Idea lab	0:0:2 = 1		
Total Credit	**25**	**Total Credit**	**21**

Semester - III		Semester - IV	
Course Title	**Credit**	**Course Title**	**Credit**
1. Electrical circuit and analysis	3:1:2 = 5	1. Digital Electronics	3:0:2 = 4
2. Analog Electronics	3:0:2 = 4	2. Electrical Machine-II	3:0:2 = 4
3. Electrical Machine-I	3:0:2 = 4	3. Power Electronics	3:0:2 = 4
4. Mathematics-III	3:1:0 = 4	4. Signal and System	2:1:0 = 3
5. Engineering Mechanics	3:0:2 = 4	5. Electromagnetic fields	3:1:0 = 4
6. Universal Human Values	3:0:0 = 0	6. Principle of Management	2:1:0 = 3
		7. Environment Science (Audit)	2:0:0 = 0
Total Credit	**21**	**Total Credit**	**22**

Semester - V		Semester - VI	
Course Title	**Credit**	**Course Title**	**Credit**
1. Power System-1	3:0:2 = 4	1. Power System -II	3:0:2 = 4
2. Control System	3:0:2 = 4	2. Measurement and Instrumentation	3:0:2 = 4
3. Microprocessor and Microcontrollers	3:0:2 = 4	3. Professional Elective-2	3:0:0 = 3
4. Professional Elective-1	3:0:0 = 3	4. Professional Elective-3	3:0:0 = 3
5. Open Elective-1	3:0:0 = 3	5. Open Elective-3	3:0:0 = 3
6. Open Elective-2	3:0:0 = 3	6. Electronics Design Lab	0:0:2 = 1
7. Industrial Psychology/ Operations Research	3:0:0 = 3	7. Project Management	3:0:0 = 3
Total Credit	**24**	**Total Credit**	**21**

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester -VII		Semester - VIII	
Course Title	**Credit**	**Course Title**	**Credit**
1. Professional Elective-4	3:0:0 = 3	Project work-II / On job plant training	0:0:24 = 12
2. Professional Elective-5	3:0:0 = 3		
3. Professional Elective-6	3:0:0 = 3		
4. Open Elective-4	3:0:0 = 3		
5. Project Work-1	0:0:8 = 4		
6. Finance and Accounting	3:0:0 = 3		
7. Seminar	0:0:2 = 1		
Total Credit	**20**	**Total Credit**	**12**

a. **Humanities & Social Sciences & Mgt. Courses (HSMC):** Any 3 courses from the list of those offered besides 5 compulsory subjects.
b. **Open Elective courses (OEC)**: Any 4 courses (from any department), based on individual interest and project.
c. **Industry internship**: Internship in industry in 6th and 7th semester is compulsory. Longer internship for 6-monthy (12 credits) can be taken in VIIIth semester, in lieu of Engineering Project. The internship must be properly evaluated.

Total Credit: 166

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Course code and definition:

L	=	Lecture
T	=	Tutorial
P	=	Practical
C	=	Credit
BSC	=	Basic Science Courses
ESC	=	Engineering Science Courses
HSMC	=	Humanities and Social Sciences including Management courses
PCC	=	Professional core courses
PEC	=	Professional Elective courses
OEC	=	Open Elective courses
LC	=	Laboratory course
MC	=	Mandatory courses

Course level coding scheme:

Three-digit number (odd numbers are for the odd semester courses and even numbers are for even semester courses) used as suffix with the Course Code for identifying the level of the course. Digit at hundred's place signifies the year in which course is offered. e.g.

101, 102 … etc. for first year.
201, 202 …. Etc. for second year.
301, 302 … for third year.
401. 402--- for Fourth year

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Category-wise Courses

HUMANITIES & SOCIAL SCIENCES COURSES [HS] & MANAGEMENT COURSES

Sl.	Code No.	Subject	Semester	Credits
1	HSMC 01	Communication Skills / English (Compulsory)	2	3:0:0 =3
2	HSMC 02	Principle of management (Compulsory)	4	2:1:0 = 3
3	HSMC 03	Industrial Psychology	5	3:0:0 =3
4	HSMC 04	Operations Research		
5	HSMC 05	Project Management	6	3:0:0 =3
6	HSMC 06	Finance & Accounting	7	3:0:0 =3
7	HSMC07	Indian Knowledge system (Compulsory)	2	2:0:0 =2
8	HSMC 08	Sustainable Development Goals (Compulsory)	1	2:0:0 =2
9	HSMC09	YOGA and Sports (Compulsory)	2	2:0:0=0
10	HSMC10	Universal Human Values	3	3:0:0 =0
Total Credits:				**19**

BASIC SCIENCE COURSE [BSC] (TOTAL 6)

Sl.	Code No.	Subject	Semester	Credits
1	BSC 01	Physics-1 (Electromagnetism)	1	3:1:2 =5
2	BSC 02	Mathematics-1 (Calculus & Linear Algebra)	1	3:1:0 =4
3	BSC 03	Chemistry-1	2	3:0:2 =4
4	BSC 04	Mathematics-2 (ODE, Complex variables)	2	3:1:0 =4
5	BSC 05	Biology for Engineers	2	3:0:0 =3
6	BSC 06	Mathematics-3 (PDE, Prob/Stat)	3	3:1:0 =4
Total Credits:				**24**

ENGINEERING SCIENCE COURSE [ESC] (Total 6)

Sl.	Code No.	Subject	Semester	Credits
1	ESC 01	Basic Electrical Engineering	1	2:1:2 =4
2	ESC 02	Engineering Graphics & Design	1	1:0:4 =3
3	ESC 03	Design Thinking + Idea Lab (Audit)	1	0:0:2 =1
4	ESC 04	Programming for Problem Solving	2	3:0:4 =5
5	ESC 05	Manufacturing Practice Workshop	2	1:0:4 =3
6	ESC06	Basic Civil Engineering	1	3:0:0=3
7	ESC 07	Engineering Mechanics	3	3:0:2 =4
Total Credits:				**23**

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

PROFESSIONAL CORE COURSES [PCC] (Total 13)

Sl.	Code No.	Subject	Semester	Credits
1	PCC-EE 01	Electrical Circuit Analysis	3	3:1:2 = 5
2	PCC-EE 02	Analog Electronics	3	3:0:2 = 4
3	PCC- EE 03	Electrical Machines-I	3	3:0:2 =4
4	PCC-EE 04	Digital Electronics	4	3:0:2 =4
5	PCC- EE 05	Electrical Machine-2	4	3:0:2 =4
6	PCC- EE 06	Power Electronics	4	3:0:2 =4
7	PCC- EE 07	Signal and System	4	2:1:0 =3
8	PCC- EE 08	Electromagnetic Fields	4	3:1:0 =4
9	PCC- EE 09	Power System-1	5	3:0:2 =4
10	PCC- EE 10	Control System	5	3:0:2 =4
11	PCC- EE 11	Microprocessor and Microcontroller	5	3:0:2 =4
12	PCC- EE 12	Power System-2	6	3:0:2 =4
13	PCC- EE 13	Measurement and Instrumentation	6	3:0:2 =4
14	PCC- EE 14	Electronic Design Lab	6	0:0:2 =1
Total Credits:				**53**

PROFESSIONAL ELECTIVE [PEC]

Total 6 to be taken, at least one from each group based on individual interest.

Sl.	Code No.	Subject	Semester	Credits
Professional Elective-1 (any one)				
1	PEC - EE 01	Wind and solar energy system	5	3:0:0 = 3
2	PEC - EE 02	Electrical Drives		
Professional Elective-2 (any one)				
1	PEC -EE 03	Power system Protection	6	3:0:0 =3
2	PEC -EE 04	HVDC Transmission System		
Professional Elective-3 (any one)				
1	PEC -EE 05	High Voltage Engineering	6	3:0:0 =3
2	PEC -EE 06	Power Quality and FACTS		
Professional Elective-4 (any one)				
1	PEC -EE 07	Electrical Energy Conversion and Auditing	7	3:0:0 =3
2	PEC -EE 08	Electrical Machine Design		
3	PEC -EE 09	Computational Electromagnetics		

Professional Elective-5 (any one)				
1	PEC -EE 10	Power System Dynamics and Control	7	3:0:0 =3
2	PEC -EE 11	Electric and Hybrid Vehicles		
3	PEC -EE 12	Advance electrical Drives		
Professional Elective-6 (any one)				
1	PEC -EE 13	Industrial Electrical System	7	3:0:0 =3
2	PEC -EE 14	Digital Control System		
3	PEC -EE 15	Digital Signal Processing		
Total Credit				**18**

OPEN ELECTIVE (Total 4 from the Open elective subjects)

Sl.	Code No.	Subject	Semester	Credits
Open Elective-1				
1	OEC 01	Electronic Devices	5	3:0:0=3
2	OEC 02	Data Structures and Algorithms		
3	OEC 03	Analog and Digital Communication		
Open Elective-2				
1	OEC 04	Computer Network	5	3:0:0=3
2	OEC 05	Embedded System		
Open Elective-3				
1	OEC 06	Power Plant Engineering	6	3:0:0=3
2	OEC 07	Strength of material		
3	OEC 08	Fluid Machinery		
Open Elective-4				
1	OEC 09	Electrical Materials.	7	3:0:0=3
2	OEC 10	Modern Manufacturing Process.		
3	OEC 11	Internet of Things.		
4	OEC 12	Big Data Analysis.		
Total Credit				**12**

PROJECTS

Sl.	Code No.	Subject	Semester	Credits
1	PROJ- EE 01	Project Work-I	7	0:0:8=4
2	PROJ-EE 02/OJT- EE 01	Project work-II / On job plant Training	8	0:0:24=12
Total Credit				**16**

OTHER COURSES

Sl.	Code No.	Subject	Semester	Credits
3	OC 01	Environmental Science	4	2:0:0=0
4	OC 02	Seminar	7	0:0:2 =1
Total Credit				**01**

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Induction Program

Induction program for students to be offered right at the start of the first year. It ismandatory. AKS University has designed an induction program for 1st year student, details are below:

i. Physical activity
ii. Creative Arts
iii. Universal Human Values
iv. Literary
v. Proficiency Modules
vi. Lectures by Eminent People
vii. Visits to local Areas
viii. Familiarization to Dept./Branch & Innovations

Mandatory Visits/ Workshop/Expert Lectures:

i. It is mandatory to arrange one industrial visit every semester for the students.

ii. It is mandatory to conduct a One-week workshop during the winter break after fifth semester on professional/ industry/ entrepreneurial orientation.

iii. It is mandatory to organize at least one expert lecture per semester for each branch by inviting resource persons from industry.

Evaluation Scheme:

1. **For Theory Courses:**
   - The weightage of Internal assessment is 50% and
   - End Semester Exam is 50%

   The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.
2. **For Practical Courses:**
   - The weightage of Internal assessment is 50%
   - End Semester Exam is 50%

   The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.
3. **For Summer Internship / Projects / Seminar etc.**
   Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester wise Course Structure

Semester wise Brief of total Credits and Teaching Hours

Semester	L	T	P	Total Hour	Total Credit
Semester -I	17	03	10	30	25
Semester -II	17	01	10	28	21
Semester -III	15	02	08	25	21
Semester - IV	18	03	06	27	22
Semester -V	21	00	06	27	24
Semester -VI	18	00	06	24	21
Semester - VII	15	00	10	25	20
Semester -VIII	0	0	24	24	12
Total	121	9	80	210	166

Details of Semester Wise Course Structure

Semester – I

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	BSC	BSC 101	Physics-1	3	1	2	6	5
2	BSC	BSC 102	Mathematics-1	3	1	0	4	4
3	BSC	BSC 105	Biology for Engineers	3	0	0	3	3
4	ESC	ESC 101	Basic Electrical Engineering	2	1	2	5	4
5	ESC	ESC 102	Engineering Graphics & Design	1	0	4	5	3
6	ESC	ESC 103	Design Thinking & Idea Lab	0	0	2	2	1
7	ESC	ESC106	Basic Civil Engineering	3	0	0	3	3
8	HSMC	HSMC08	Sustainable Development Goals	2	0	0	2	2
Total				17	3	10	30	25

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester – II

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	BSC	BSC 103	Chemistry-1	3	0	2	5	4
2	BSC	BSC 104	Mathematics-2	3	1	0	4	4
3	ESC	ESC 104	Programming for Problem Solving	3	0	4	7	5
4	ESC	ESC 105	Manufacturing Practice Workshop	1	0	4	5	3
5	HSMC	HSMC 01	Communication Skills (English)	3	0	0	3	3
6	HSMC	HSMC 07	Indian Knowledge System	2	0	0	2	2
7	HSMC	HSMC 09	Sports, NSS/NCC	2	0	0	2	0
Total				17	1	10	28	21

Semester – III

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	PCC	EE 201	Electrical circuit and analysis	3	1	2	6	5
2	PCC	EE 202	Analog Electronics	3	0	2	5	4
3	PCC	EE 203	Electrical Machine-I	3	0	2	5	4
4	BSC	BSC 206	Mathematics-III	3	1	0	4	4
5	ESC	ESC 207	Engineering Mechanics	3	0	2	5	4
6.	HSMC	HSMC10	Universal Human Values	3	0	0	3	0
Total				15	2	8	25	21

Semester – IV

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	PCC	EE 204	Digital Electronics	3	0	2	5	4
2	PCC	EE 205	Electrical Machine-II	3	0	2	5	4
3	PCC	EE 206	Power Electronics	3	0	2	5	4
4	PCC	EE 207	Signal and System	2	1	0	3	3
5	PCC	EE 208	Electromagnetic fields	3	1	0	4	4
6	HSMC	HSMC02	Principle of Management	2	1	0	3	3
7	OTHER	OC201	Environmental Science (Audit)	2	0	0	2	0
Total				18	3	6	27	22

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester – V

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	PCC	EE 309	Power System-1	3	0	2	5	4
2	PCC	EE 310	Control System	3	0	2	5	4
3	PCC	EE 311	Microprocessor and Microcontrollers	3	0	2	5	4
4	PEC	EE301 EE302	Professional Elective-1	3	0	0	3	3
5	OEC	OEC 301 OEC 302 OEC 303	Open Elective-1	3	0	0	3	3
6	OEC	OEC 304 OEC 305	Open Elective-2	3	0	0	3	3
7	HSMC	HSMC 03 HSMC 04	Industrial Psychology Operations Research	3	0	0	3	3
Total				21	0	6	27	24

Semester – VI

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	PCC	EE 312	Power System -II	3	0	2	5	4
2	PCC	EE 313	Measurement and Instrumentation	3	0	2	5	4
3	PCC	EE 314	Electronics Design Lab	0	0	2	2	1
4	PEC	EE 303 EE 304	Professional Elective-2	3	0	0	3	3
5	PEC	EE 305 EE 306	Professional Elective-3	3	0	0	3	3
6	OEC	OEC 306 OEC 307 OEC 308	Open Elective-3	3	0	0	3	3
7	HSMC	HSMC 05	Project Management	3	0	0	3	3
Total				18	0	6	24	21

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester VII

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	PEC	EE 407 EE 408 EE 409	Professional Elective-4	3	0	0	3	3
2	PEC	EE 410 EE 411 EE 412	Professional Elective-5	3	0	0	3	3
3	PEC	EE 413 EE 414 EE 415	Professional Elective-6	3	0	0	3	3
4	OEC	OEC 409 OEC 410 OEC 411 OEC 412	Open Elective-4	3	0	0	3	3
5	PROJ	PROJ-EE 401	Project work-1(Literature review)	0	0	8	8	4
6	HSMC	HSMC 06	Finance and Accounting	3	0	0	3	3
7	OTHER	OC402	Seminar	0	0	2	2	1
Total				15	0	10	25	20

Semester VIII

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	PROJ/ OJT	PROJ-EE 402/ OJT- EE 4 01	Project work-2 (Design and testing)/ On Job Industrial Training	0	0	24	24	12
Total				**0**	**0**	**24**	**24**	**12**

Total credit: 166

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-I

Course Title: **Physics-I**
Course Code: **BSC 101**
Prerequisite: Students should review the fundamentals of Electrostatics, Magneto statics, Wave optics and Modern physics.
Rationale: The program aims to develop advanced problem-solving and analytical skills and prepares students for careers in academia, research, industry, or other sectors that require advanced physics expertise.

Course Outcomes (CO): After the completion of this course students will be able to:

BSC 101.1: Find how to extend the basic concepts of motion of charged particles in electric magnetic fields to solve numerical problems and to relate to applications to electron optic device and CRO.
BSC 101.2: Apply concepts in interference and diffraction to solve relevant numerical problems and to relate to relevant engineering applications.
BSC 101.3: Learn the basic concepts of dual nature of matter and wave packet and apply them to analyze various relevant phenomenon and to solve related numerical problem.
BSC 101.4: Recall the basic concepts of crystal structure and apply them in solving numerical problems based on them in relating to applications for determination of crystal structure
BSC 101.5: Relate the basic idea of total internal reflection to the propagation of light in an optical fiber and make use of the fiber concepts to solve numerical problems and relate to applications in engineering.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Basic Science Course (BSC)	BSC 101	Physics-1	4	2	1	1	8	5

Legend:
CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others)
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other

locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.)
SL: Self Learning,
C: Credits

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Class/ Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
BSC	BSC 101	Physics -I	15	20	5	5	5	50	50	100

Practical

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
BSC	BSC 101-L	Physics -I Lab	35	10	5	50	50	100

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

BSC 101.1: Find how to extend the basic concepts of motion of charged particles in electric magnetic fields to solve numerical problems.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	6
SW	1
SL	2
Total	21

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the concept of Electric charge electric field intensities. **SO1.2** Understand the electrostatic potential, Calculation of electric field and electrostatic potential for a charge distribution **SO1.3** Understand the Dielectrics, Dielectric	1.Measuring the magnetic field for a straight conductor and on circular conductor loops 2.Measuring the magnetic field for a straight conductor andon circular conductor	**Unit-1.0** 1.1 Electric charge electric field intensities 1.2 electrostatic potential, Calculation of electric field and electrostatic potential for a charge distribution 1.3 Introduction to. Quantization & conservation of charge 1.4 Coulomb's law, vector form of Coulomb's law 1.5 superposition principle, charge densities,electric field	**SL.1** Define Electric charge electric field intensities **SL.2** Define Quantization& conservation of charge

substance in an electric field **So1.4** Understand Biot Savart law & its application **So1.5** Understand the magnetic materials.	loops at small currents 3. Measuring the magnetic field for a straight conductor and on Straight Wire -	1.6 Dielectrics, Dielectric substance in an electric field, 1.7 V-I phase dependence for ideal & real dielectrics 1.8 Biot Savart law & its application 1.9 current carrying conductor moving charge in a magnetic field 1.10 comparison of electric field and magnetic field 1.11 magnetic induction and intensity, magnetization 1.12 classification of magnetic materials.	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Analyze and sketch the graph of a V-I phase dependence for ideal & real dielectrics
ii. Calculation of electric field and electrostatic potential for a charge distribution
iii. Apply Biot Savart law in different problems.

b. Mini Project:

Oral presentation, Poster presentation, Power Point Presentation.

C. Other Activities (Specify):

Quiz, Class Test.

BSC 101.2: Apply concepts in interference and diffraction to solve relevant numerical problems and to relate to relevant engineering applications.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	6
SW	1
SL	2
Total	21

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Define and understand the basic concepts of coherent sources, etc **SO2.2** Define and understand the basic concepts of Interference of light. **SO2.3** Understand the Michelson's Interferometer,	**1.** To determine the Refractive Index of Prism by using spectrometer. 2. To determine the wavelength of sodium light by using Newton's Ring apparatus 3. to determine the wavelength of prominent lines of mercury by plane	**Unit-2.0** **2.1** coherent sources, principle of superposition **2.2** Interference: -, definition and types of interference **2.3** Interference from parallel thin films **2.4** wedge shaped films **2.5** Newton's rings **2.6** Michelson's Interferometer, experiments and their applications **2.7** Michelson's Interferometer, experiments and their applications	**SL.1** Define coherent sources, principle of superposition. **SL.2** Define Fresnel diffraction, Fraunhofer diffraction from a single slit diffraction.

.

experiments and their applications **SO2.4** Define and understand the basic concepts of diffraction of light. **SO2.5** Understand dispersive power of grating and, resolving powerof grating.	transmission diffraction grating -	**2.8** Diffraction: - Fresnel diffraction , **2.9** Fraunhofer diffraction from a single slit diffraction **2.10** double slit diffraction **2.11** N-Slit Diffraction grating **2.12** dispersive power of grating and, resolving power of grating.	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Write the application of Interference of light in daily life.
2. Write the application of diffraction of light in daily life.
3. Write a short note on Newton's rings with example.
4. Describe the method of calculation of Michelson's Interferometer with example

b. Mini Project:

Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

BSC 101.3: Learn the basic concepts of dual nature of matter and wave packet and apply them to analyzevarious relevant phenomenon and to solve related numerical problem

Approximate Hours

Item	AppX Hrs
Cl	12
LI	6
SW	1
SL	2
Total	21

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Define Quantum mechanics. **SO3.2** Understand the Wave particle duality **SO3.3** Explain operators in quantum mechanics. **SO3.4** Understand Uncertainty principle with elementary proof and applications	1. To determine Planck's Constant and work function using photo electric effect. 2. Davisson–Germer experiment - this showed the existence of electron matter waves and that they would be diffracted by a crystal 3. Compton effect - evidence for particle nature of light-	**Unit-3.0** 3.1 Introduction to Quantum mechanics 3.2 Wave particle duality 3.3 de-Broglie's concept of matter waves 3.4 Free-particle wave function and wave-packets 3.5 Phase & Group velocities and their relationship 3.6 Compton Effect 3.7 Uncertainty principle with elementary proof and applications 3.8 Uncertainty principle with elementary proof and applications 3.9 operators	**SL.1** Define Wave particle duality. **SL.2** Define operators in quantum mechanics.

SO3.5 To Understand Time-dependent and time independent Schrodinger equation for wave function.		3.10 Time-dependent and time independent Schrodinger equation for wave function. 3.11 Time-dependent Schrodinger equation for wave function. 3.12 time independent Schrodinger equation for wave function	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Write the Application of Uncertainty principle with elementary proof in real life.
ii. Explain the difference between Time-dependent and time independent Schrodinger equation for wave function.
iii. Write the properties of wave-packets.
iv. Define Phase & Group velocities.

b. Mini Project:

Oral presentation,

c. Other Activities (Specify):

Quiz, Class Test.

BSC 101.4: Recall the basic concepts of crystal structure and apply them in solving numerical problems based on them in relating to applications for determination of crystal structure

Approximate Hours

Item	AppX Hrs
Cl	12
LI	6
SW	1
SL	2
Total	21

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand the Free electron theory of metals **SO4.2** Understand the Fermi level of Intrinsic and extrinsic **SO4.3** Understand the Kronig-Penney model and origin of energy bands. **SO4.4** Understand the intrinsic & extrinsic semiconductor **SO4.5** Understand the tunnel diode, and it's applications	1.To draw the characteristics curve of p-n junction. 2.To draw the characteristics curve of zener diode 3.Study the temperature dependence of resistivity of a semiconductor (Four probe method) and to determine band gap of experimental material (Ge). **-**	**Unit-4.0** **4.1** Free electron theory of metals **4.2** Fermi level of Intrinsic and extrinsic **4.3** Kronig-Penney model (no derivation) and origin of energy bands. **4.4** classification of conductors, semiconductors and insulators on the basis of energy band theory **4.5** classification of conductors, semiconductors and insulators on the basis of energy band theory **4.6** semiconductors and it's classification **4.7** semiconductors and it's classification **4.8** intrinsic & extrinsic semiconductor **4.9** P-N junction **4.10** Zener diode **4.11** tunnel diode, and it's applications, **4.12** Hall effect	**SL.1** Define Free electron theory of metals **SL.2** Define semiconductors andit's classification.

SW-2 Suggested Sessional Work (SW):
a. Assignments:

1. Explain Kronig-Penney model and origin of energy bands.
2. Explain Free electron theory of metals.
3. Explain Hall effect with example

b. Mini Project:
Oral presentation,

C. Other Activities (Specify):
Quiz, Class Test.

BSC 101.5: Relate the basic idea of total internal reflection to the propagation of light in an optical fiber and make use of the fiber concepts to solve numerical problems and relate to applications in engineering.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	6
SW	1
SL	2
Total	21

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO5.1 Understand and state the Fundamental properties of laser beam **SO5.2** Understand and state the Einstein's theory of matter radiation	1. To study the intensity distribution due to diffraction from single slit and to determine the slit width. 2. Study the characteristics of led and laser sources. -	**Unit-5.0** **5.1** Absorption **5.2** Stimulated and Spontaneous emission **5.3** coherence, pumping, population Inversion **5.4** Principle & properties of laser beam **5.5** Einstein's theory of matter radiation interaction and A and B coefficients	**SL.1** Define Absorption, Stimulated and Spontaneous emission, coherence, pumping, population Inversion. **SL.2** Define Principle & properties of laser beam.

.

interaction and A and B coefficients **SO5.3** Understand the different types of lasers **SO5.4** Understand Solid-State laser (Ruby & Nd-YAG) **SO5.5** Understand applications of lasers in science, engineering and medicine.	3.Energy gap of a material of p-n junction	**5.6** different types of lasers: gas laser (He-Ne), **5.7** different types of lasers: gas laser (He-Ne), **5.8** different types of lasers: gas laser (He-Ne), **5.9** Solid-State laser (Ruby & Nd-YAG) **5.10** solid-state laser (Ruby& Nd-YAG) **5.11** applications of lasers in science, engineering and medicine. **5.12** applications of lasers in science, engineering and medicine.	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Write the Principle & properties of laser beam.
ii. Write the applications of lasers in science, engineering and medicine.

b. Mini Project:

Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
BSC 101.1 Find how to extend the basic concepts of motion of charged particles in electric magnetic fields to solve numerical problems and to relate to applications to electron optic device and CRO.	12	6	1	2	21
BSC 101.2 Apply concepts in interference and diffraction to solve relevant numerical problems and to relate to relevant engineering applications.	12	6	1	2	21
BSC 101.3 Learn the basic concepts of dual nature of matter and wave packet and apply them to analyze various relevant phenomenon and to solve related numerical problem.	12	6	1	2	21
BSC 101.4 Recall the basic concepts of crystal structure and apply them in solving numerical problems based on them in relating to applications for determination of crystal structure	12	6	1	2	21
BSC 101.5 Relate the basic idea of total internal reflection to the propagation of light in an optical fiber and make use of the fiber concepts to solve numerical problems and relate to applications in engineering	12	6	1	2	21
Total Hours	60	30	5	10	105

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Electrostatics & Magnetostatics	02	04	05	11
CO-2	Wave optics	03	07	04	14
CO-3	Quantum mechanics	02	06	02	10
CO-4	Introduction to solids & semiconductors	03	03	02	08
CO-5	Lasers	03	02	02	07
Total		13	22	15	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Physics-1 will be held with written examination of 50 marks
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies

1. Improved Lecture
2. Tutorial
3. Presentation
4. Group Discussion
5. Online sources
6. Seminar
7. Workshop

Suggested Learning Resources:

a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	AICTE's Prescribed Textbook: Physics (Introduction to Electromagnetic Theory) with Lab Manual	Bhattacharya & Nag, Engineering Physics	Khanna Book Publishing Company.	2nd Edition 2021
2	Introduction to Electrodynamics	David Griffiths	Tata McGraw Hill	11th Reprint, 2010.
3	Physics	Halliday and Resnick	Tata McGraw Hill	10th Edition 2018
4	Electricity, magnetism and light	W. Saslow	Academic Press	1st Edition 2002
5	Engineering Physics	Malik, Singh	Tata McGraw Hill	10th Edition 2020

****

Curriculum Development Team

1. **Dr. Omkar Prasad Tripathi HOD, Department of Physics.**
2. **Dr. Lovely Singh Gaharwar , Associate Professor, Department of Physics.**
3. **Dr. C.P. Singh , Assistant Professor, Department of Physics.**
4. **Dr. Saket Kumar, Assistant Professor, Department of Physics**
5. **Mr. Manish Agrawal, Assistant Professor, Department of Physics**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: BSC101
Course Title: Physics-1

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: Find how to extend the basic concepts of motion of charged particles in electric magnetic fields to solve numerical problems and to relate to applications to electron optic device and CRO.	**2**	**2**	**3**	**2**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**2**	**2**	**2**
CO2: Apply concepts in interference and diffraction to solve relevant numerical problems and to relate to relevant engineering applications.	**3**	**2**	**1**	**3**	**1**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
CO3: Learn the basic concepts of dual nature of matter and wave packet and apply them to analyze various relevant phenomenon and to	**3**	**3**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**2**	**3**	**2**	**2**

solve related numerical problem.														
CO4: Recall the basic concepts of crystal structure and apply them in solving numerical problems based on them in relating to applications for determination of crystal structure	**2**	**3**	**1**	**2**	**1**	**2**	**1**	**3**	**2**	**1**	**2**	**2**	**2**	**3**
CO5: Relate the basic idea of total internal reflection to the propagation of light in an optical fiber and make use of the fiber concepts to solve numerical problems and relate to applications in engineering	**2**	**3**	**1**	**1**	**1**	**3**	**2**	**3**	**1**	**2**	**2**	**2**	**3**	**2**

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum

Map:POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1, 2	**CO1:** Find how to extend the basic concepts of motion of charged particles in electric magnetic fields to solve numerical problems and to relate to applications to electron optic device and CRO.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1, 2, 3	**Unit-1: Electrostatics & Magnetostatics** 1.1, 1.2, 1.3, 1.4, 1.5, 1.6,1.7,1.8,1.9,1.10,1.11,1.12	1, 2
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1, 2	**CO2:** Apply concepts in interference and diffraction to solve relevant numerical problems and to relate to relevant engineering applications.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	1, 2, 3	**Unit-2: Wave optics** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9,2.10,2.11,2.12	1, 2
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1, 2	**CO3:** Learn the basic concepts of dual nature of matter and wave packet and apply them to analyze various relevant phenomenon and to solve related numerical problem.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	1, 2,3	**Unit-3 : Quantum mechanics** 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, 3.11,3.12	1, 2
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1, 2	**CO4:** Recall the basic concepts of crystal structure and apply them in solving numerical problems based on them in relating to applications for determination of crystal structure	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	1, 2, 3	**Unit-4: Introduction to solids & semiconductors** 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11,4.12	1, 2
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1, 2	**CO5:** Relate the basic idea of total internal reflection to the propagation of light in an optical fiber and make use of the fiber concepts to solve numerical problems and relate to applications in engineering	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	1, 2, 3	**Unit 5: Lasers** 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9,5.10,5.11,5.12	1, 2

Semester-I

Course Title: Mathematics –I

Course Code: BSC 102

Prerequisite: Students should review the fundamentals of calculus and basic knowledge of differentiation and integration.

Rationale: The program aims to develop advanced problem-solving and analytical skills and prepares students for careers in academia, research, industry, or other sectors that require advanced mathematical expertise.

Course Outcomes (CO): After the completion of this course the students will be able to

BSC 102.1: Define and understand the concept of limits, Evaluate limits algebraically and graphically, apply the basic rules of differentiation, including the power rule, product rule, quotient rule, and chain rule. Use linear approximation and differentials to estimate values of functions

BSC 102.2: Define and understand the basic concepts of matrices, Differentiate between different types of matrices Perform basic matrix operations, Use matrices to represent and solve systems of linear equations. Explore more advanced topics, such as linear transformations, matrix norms, and applications in optimization and computer graphics.

BSC 102.3: Define and compute partial derivatives of functions of several variables, Define and compute the gradient vector of a scalar function, Apply the chain rule to compute derivatives of composite functions involving multiple variables, Identify critical points of multivariable functions.

BSC 102.4: Understand the definition of a first-order ordinary differential equation, Solve separable differential equations using the separation of variables technique, Sketch direction fields to visualize the behavior of solutions, Apply first-order ODEs to model and analyze various phenomena

BSC 102.5: Understand and state the Fundamental Theorem of Calculus, both parts and apply the Fundamental Theorem to evaluate definite integrals. Apply integration techniques, including substitution, integration by parts, and partial fractions.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Basic Science Course (BSC)	BSC 102	Mathematics -I	4	0	1	1	6	4

Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others)

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.)

SL: Self Learning,

C: Credits

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT+ AT)		
BSC	BSC 102	Mathematics -I	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self -Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in theoverall achievement of Course Outcomes (COs) upon the course's conclusion.

BSC 102.1

Define and understand the concept of limits, evaluate limits algebraically and graphically, Apply the basic rules of differentiation, including the power rule, product rule, quotient rule, and chain rule. Use linear approximation and differentials to estimate values of functions

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Understand the concept of local and global extreme. **SO1.2** Understand the geometric interpretation of the derivative as the slope of a tangent line **SO1.3** Apply implicit differentiation to find derivatives of implicitly defined functions	-	**Unit-1.0** 1.1. Rolle's Theorem, 1.2. Mean value theorems 1.3. applications, extreme values of functions 1.4. linear approximation, Indeterminate forms 1.5. L' Hospital's rule 1.6 Tutorial-1 1.7. curvature, 1.8. Radius of curvature 1.9evolutes and involutes 1.10Expansion of functions by Maclaurin's series	**1** Define the derivative of a function at a point using the limit definition. **2** Apply implicit differentiation to find derivatives of implicitly defined functions **3** Apply derivatives to solve problems in optimization, curve

So1.4 Understand the hypothesis of L' Hospital's rule **So1.5** Understand the concept of curvature.		1.11 Expansion of functions by Taylor's series for one variable 1.12 Tutorial- 2	sketching, and related rates.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Analyze and sketch the graph of a function using information from its derivative.
ii. Identify critical points, inflection points, and concavity.
iii. Apply L'Hôpital's Rule to find limits involving indeterminate forms

b. Mini Project:

i. Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

i. Quiz, Class Test.

BSC 102.2 Define and understand the basic concepts of matrices, differentiate between different types of matrices Perform basic matrix operations, Use matrices to represent and solve systems of linear equations. Explore more advanced topics, such as linear transformations, matrix norms, and applications in optimization and computer graphics.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Define and understandthe basic concepts of matrices, determinant,etc **SO2.2** Perform basic matrix operations, including addition, subtraction, and scalar multiplication **SO2.3** Understand the connection between matrix equations and systems of linear equations **SO2.4** Define and computethe determinant of amatrix **SO2.5** Understand numerical techniques	-	**Unit-2.0** 2.1. Rank of a Matrix 2.2. Determinant, 2.3. Inverse of a matrix, 2.4-Nullity 2.5. system of linear equations, 2.6.Symmetric,skew-symmetric 2.7. orthogonal matrices 2.8. Eigen values and Eigen vectors, orthogonal transformation, 2.9. Diagonalization of matrices, Cayley-Hamilton Theorem, 2.10.linear systems of equations, 2.11 linear independence and linear dependence 2.12 Tutorial-1	**1.** Explore more advanced topics, suchas linear transformations, matrix norms, and applications in optimization and computer graphics **2.** Understand numerical techniquesfor solving matrix problems, such as Gaussian elimination and iterative methods **3.** Apply matrix operations and concepts to solve real-world problemsin various fields, such as physics, computer science, engineering, and economics

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Write the application of Matrices in Real Life.
ii. Write the properties of Eigen values.
iii. Write a short note on types of matrix with example.
iv. Describe the method of calculation of rank with example

b. Mini Project:

Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

BSC 102.3 : Define and compute partial derivatives of functions of several variables, Define and compute the gradient vector of a scalar function, Apply the chain rule to compute derivatives of composite functions involving multiple variables, Identify critical points of multivariable functions.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Define and compute partial derivatives of functions of several variables **SO3.2** Understand the directional derivative and its relation to the gradient vector **SO3.3** Apply the chain rule to compute derivatives of composite functions	-	**Unit-3.0** 3.1. Limit and continuity 3.2. total derivative, 3.3. Euler's theorem on Homogeneous function. 3.4. Application of Euler's theorem in approximation and errors, 3.5. Application of Euler's theorem in errors	**1** Apply Lagrange multipliers to solve constrained optimization problems **2** Apply the second derivative test

involving multiple variables **SO3.4** Understand mixed partial derivatives and Clairaut's theorem **SO3.5** Identify critical points of multivariable functions		3.6. Tangent plane and normal line. 3.7 maxima, minima 3.8 saddle points, 3.9. Method of Lagrange multipliers 3.10. partial derivatives 3.11 Questions of partial differential. 3.12 Tutorial-1	to determine local extreme. **3** Solve optimization problems involving multiple variables

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Write the Application of Euler’s theorem in real life.
ii. Explain the difference between differential and partial differential
iii. Write the properties of maxima, minima.
iv. Define saddle points, point of inflection.

b. Mini Project:

Oral presentation,

c. Other Activities (Specify):

Quiz, Class Test.

BSC 102.4: Understand the definition of a first-order ordinary differential equation, Solve separable differential equations using the separation of variables technique, Sketch direction fields to visualize the behavior of solutions, Apply first-order ODEs to model and analyze various phenomena

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand the definition of a first-order ordinary differential equation **SO4.2** Solve separable differential equations using the separation of variables technique **SO4.3** Identify and use integrating factors to solve linear first-order ODEs **SO4.4** Identify autonomous differential equations and their significance **SO4.5** Recognize and solve exact differential equations	-	**Unit-4.0** 4.1.Order and degree of equation 4.2Exact equations. 4.3.Questions of Exact equations , 4.4. Linear equations 4.5 Tutorial-1 4.6. Bernoulli's equations. 4.7. Equations not of first degree: 4.8 Equations solvable for p, 4.9. Equations solvable for y, 4.10. Equations solvable for x 4.11 Equations Clairaut's type 4.12 Tutorial-2	**SL.1** Apply first-order ODEs to model and analyze various phenomena, such as population growth, chemical reactions, and electrical circuits **SL.2** Apply integrating factors to convert inexact equations into exact ones **SL.3** Analyze and interpret solutions in the context of applications

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Explain degree and order of differential equation with example.

b. Other Activities (Specify):

Quiz, Class Test.

BSC 102.5: Understand and state the Fundamental Theorem of Calculus, both parts and apply the Fundamental Theorem to evaluate definite integrals. Apply integration techniques, including substitution, integration by parts, and partial fractions.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self - Learning (SL)
SO4.1 Understand and state the Fundamental Theorem of Calculus **SO4.2** Find anti derivatives of elementary functions **SO4.3** Understand the concept of a definite integral	-	**Unit-5.0** 5.1. Evaluation of definite and improper integrals, 5.2. Beta and Gamma functions 5.3. Properties of Beta and Gamma functions, 5.4 Relation between Beta and Gamma functions 5.5. Double integrals (Cartesian), 5.6 questions of double integrals	**SL.1** Apply calculus techniques to analyze curves defined in polar form **SL.2** Use numerical methods, such as the trapezoidal rule and Simpson's rule, to approximate definite integrals **SL.3** Apply tests for convergence, such as

as a limit of Riemann sums **SO4.4** Interpret definite integrals as areas under curves **SO4.5** Understand and evaluate improper integrals.		5.7. Change of order of integration in double integrals, 5.8 Change of order of integration questions 5.9. Triple integrals (cartesian), 5.10. simple applications involving cubes and sphere 5.11 Rectangular parallelepipeds 5.12 Tutorial-1	the comparison test and the integral test

SW-2 Suggested Sessional Work (SW):

a. Assignments:

iii. Write the application of double and tripal integration.
iv. Write the Properties of Beta and Gamma functions.

b. Mini Project:

i. Power Point Presentation.

c. Other Activities (Specify):
Quiz, Class Test.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
BSC102.1: Define and understand the concept of limits, Evaluate limits algebraically and graphically, Apply the basic rules of differentiation, including the power rule, product rule, quotient rule, and chain rule. Use linear approximation and differentials to estimate values of functions	12	1	1	14
BSC102.2: Define and understand the basic concepts of matrices, Differentiate between different types of matrices Perform basic matrix operations, Use matrices to represent and solve systems of linear equations. Explore more advanced topics, such as linear transformations, matrix norms, and applications in optimization and computer graphics.	12	1	1	14
BSC102.3: Define and compute partial derivatives of functions of several variables, Define and compute the gradient vector of a scalar function, Apply the chain rule to compute derivatives of composite functions involving multiple variables, Identify critical points of multivariable functions.	12	1	1	14
BSC102.4: Understand the definition of a first-order ordinary	12	1	1	14

differential equation, Solve separable differential equations using the separation of variables technique, Sketch direction fieldsto visualize the behavior of solutions, Apply first-order ODEsto model and analyze various phenomena**.**				
BSC102.5: Understand and state the Fundamental Theorem of Calculus, both parts and apply theFundamental Theorem to evaluatedefinite integrals. Apply integration techniques, including substitution, integration by parts, and partial fractions.	12	1	1	14
Total Hours	60	5	5	70

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	**Unit Titles**	**Marks Distribution**			**Total Marks**
		R	**U**	**A**	
CO-1	Single-variable Calculus	02	04	05	07
CO-2	Matrices	03	07	04	14
CO-3	Multivariable Calculus	02	06	02	10
CO-4	First order ordinary differential equations	03	03	02	11
CO-5	Integral Calculus.	03	02	02	08
Total		13	22	15	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Mathematics-1 will be held with writtenexamination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies

1. Improved Lecture
2. Tutorial
3. Presentation
4. Group Discussion
5. Online sources
6 .Seminar
7. Workshop

Suggested Learning Resources:

a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Engineering Mathematics-I ,	D.K, Jain	Shree Ram Prakashan.	7th Edition 2015-16
2	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	36th Edition, 2010
3	Engineering Mathematics-I	D.C. Agrawal	Shree Sai Prakashan	10th Edition 2018
4	Higher Engineering Mathematics	B.V. Ramana	Tata McGraw Hill	11th Reprint, 2010.

****

Curriculum Development Team

1. **Dr.Sudha Agrawal, HOD, Department of Mathematics.**
2. **Dr.Ekta Shrivastava , Assistant Professor, Department of Mathematics.**
3. **Mr.Neelkanth Napit, Assistant Professor, Department of Mathematics.**
4. **Mrs.Vandana Soni, Assistant Professor, Department of Mathematics.**
5. **Mr.Radhakrishna Shukla, Assistant Professor, Department of Mathematics.**
6. **Mr.Ghanhyam sen, Assistant Professor, Department of Mathematics.**
7. **Ms. Pushpa Kushwaha, Assistant Professor, Department of Mathematics.**
8. **Ms. Arpana Tripathi, Assistant Professor, Department of Mathematics.**

Cos, POs and PEOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: BSC102
Course Title: Mathematics-1

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Define and understand the concept of limits, Evaluate limits algebraically and graphically, Apply the basic rules of differentiation, including the power rule, product rule, quotient rule, and chain rule. Use linear approximation and differentials to estimate values of functions	3	1	2	2	2	2	3	1	2	2	1	2	2	2
CO 2: Define and understand the basic concepts of matrices, Differentiate between different types of matrices Perform basic matrix operations, Use matrices to represent and solve systems of linear equations. Explore more advanced topics, such as linear transformations, matrix norms, and applications in optimization and computer graphics.	2	2	3	2	1	2	2	1	1	1	2	3	2	2
CO 3: Define and compute partial derivatives of functions of several variables, Define and compute the gradient vector of a scalar function,	2	2	1	1	2	2	2	1	1	2	1	2	2	1

Apply the chain rule to compute derivatives of composite functions involving multiple variables, Identify critical points of multivariable functions.														
CO 4: Understand the definition of a first-order ordinary differential equation, Solve separable differential equations using the separation of variables technique, Sketch direction fields to visualize the behavior of solutions, Apply first-order ODEs to model and analyze various phenomena**.**	**3**	**2**	**2**	**2**	**3**	**1**	**3**	**1**	**2**	**1**	**2**	**2**	**3**	**3**
CO 5: Understand and state the Fundamental Theorem of Calculus, both parts and apply the Fundamental Theorem to evaluate definite integrals. Apply integration techniques, including substitution, integration by parts, and partial fractions.	**2**	**2**	**2**	**2**	**1**	**1**	**3**	**1**	**1**	**1**	**2**	**2**	**3**	**3**

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO1:** Define and understand the concept of limits, Evaluate limits algebraically and graphically, Apply the basic rules of differentiation, including the power rule, product rule, quotient rule, and chain rule. Use linear approximation and differentials to estimate values of functions	SO1.1, SO1.2 SO1.3, SO1.4 SO1.5		Unit-1. Single-variable Calculus 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10, 1.11,1.12	1,2,3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO 2:** Define and understand the basic concepts of matrices, Differentiate between different types of matrices Perform basic matrix operations, Use matrices to represent and solve systems of linear equations. Explore more advanced topics, such as linear transformations, matrix norms, and applications in optimization and computer graphics.	SO2.1, SO2.2 SO2.3, SO2.4 SO2.5		Unit-2 Matrices 2.1, 2.2, 2.3, 2.4,2.5.2.6,2.7,2.8,2.9,2.10,2.11,2.12	1,2,3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO 3:** Define and compute partial derivatives of functions of several variables, Define and compute the gradient vector of a scalar	SO3.1,SO3.2 SO3.3,SO3.4 SO3.5		Unit-3 : Multivariable Calculus 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,3.11,3.12	1,2,3

	function, Apply the chain rule to compute derivatives of composite functions involving multiple variables, Identify critical points of multivariable functions.				
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO 4:** Understand the definition of a first-order ordinary differential equation, Solve separable differential equations using the separation of variables technique, Sketch direction fields to visualize the behavior of solutions, Apply first-order ODEs to model and analyze various phenomena**.**	SO4.1, SO4.2 SO4.3, SO4.4 SO4.5		Unit-4 : First order ordinary differential equations 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9 ,4.10,4.11, 4.12	1,2,3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO 5:** Understand and state the Fundamental Theorem of Calculus, both parts and apply the Fundamental Theorem to evaluate definite integrals. Apply integration techniques, including substitution, integration by parts, and partial fractions.	SO5.1, SO5.2 SO5.3, SO5.4 SO5.5		Unit 5: Integral Calculus. 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10. 5.11,5.12	1,2,3

Semester-I

Course Code: BSC105

Course Title: Biology for Engineers.

Pre-requisite: Student should have basic knowledge of biology

Rationale: Engineering combines scientific knowledge with creative activities to move beyond current knowledge and produce original solutions to important problems. Biological systems are subject to the laws of chemistry and physics, which are also the basis of engineering, biological systems can provide excellent examples of the applications of statics, dynamics, chemical affinities, energy relations, and other concepts taught in undergraduate engineering science courses.

Course Outcomes: After completion of the course students will be able to:

BSC105.1: convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry

BSC105.2: convey the classification of organism underlying criterion, such as morphological, biochemical or ecological be highlighted.

BSC105.3: convey that "Genetics is to biology what Newton's laws are to Physical Sciences" and understand the molecular basis of coding and decoding genetic information is universal

BSC105.4: convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine. To convey that without catalysis life would not have existed on earth

BSC105.5: convey the concept of microbes and their role in environment.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	BSC105	Biology for Engineers	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T)and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work(includes assignment, seminar, mini project etc.),
SL: Self-Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT+ AT)		
BSC	BSC 105	Biology For Engineers	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instructionincluding Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self- Learning (SL).As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

BSC105.1: Convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry

Approximate Hours

Item	AppX. Hrs.
Cl	9
LI	0
SW	1
SL	2
Total	12

Session Outcomes (SOs)	Class room Instruction (CI)	Self-Learning (SL)
1.1 Why we need to study biology 1.2 To know the differences and similarities between human eye and camera. 1.3 Analyze the mechanism of birds flying with Aircraft. 1.4 Gain knowledge about the role of biology with discoveries in living world. 1.5 To understand the concept and amazing facts about living organisms. 1.6 Describe various criteria of classification of organism. 1.7 In depth study about the cell and cell theory. 1.8 Brief about the role of biological observations in major discoveries. 1.9 Understanding Binomial system of nomenclature	**Unit1**.*(2hours)-Introduction* 1.1 Introduction to biology branches and scopes 1.2 comparison between eye and camera 1.3 Comparison between Bird flying and aircraft. 1.4 Important discoveries of biology. 1.5 Living organisms, characteristics of living organism 1.6 classification of living organisms 1.7 Cell theory 1.8 Discuss how biological observations of 18th Century that lead to major discoveries. 1.9 Understanding Binomial system of nomenclature	1 Importance of Biology in engineering 2 Discuss how biological observations of 18th Century that lead to major discoveries

Suggested Sessional Work (SW): ***anyone***

a. **Assignments**
   1. Compare living and non-living

b. **Mini Project**
   1. Make a model of camera

c. **Other Activities (Specify)**
   1. try to make a flying object

BSC105.2: Convey the classification of organism underlying criterion, such as morphological, biochemical or ecological be highlighted

Approximate Hours

Item	AppX. Hrs.
Cl	9
LI	0
SW	1
SL	2
Total	12

Session Outcomes(SOs)	Class room Instruction (CI)	Self-Learning (SL)
2.1 Describe hierarchy of life forms at phenomenological level. 2.2: Understand ultra structure of prokaryotic and eukaryotic organism, 2.3 Study mode of nutrition in organism. 2.4 Analyze the made of nutrition in Autotroph 2.5 Explain the mechanism of of obtaining nutrition by Heterotrophs. 2.6 Define lithotrophs and their occurrence. 2.7 Build up the concept of Molecular taxonomy and its uses in biology. 2.8 To understand the major types of kingdoms. 2.9 : Able to define the Diversity of living organisms	**Unit2**. *Classification* 2.1 Discuss classification based on cellularity- Unicellular or multicellular 2.2: Discuss classification based on Ultra structure- prokaryotes or eukaryotes. 2.3 classification based on . energy and Carbon utilization – 2.4Autotrophs 2.5 heterotrophs, 2.6 Lithotrophs. 2.7 Molecular taxonomy- 2.8 Three major kingdoms of life. 2.9 Diversity of living organisms	2.1: Study different examples of unicellular and multicellular organisms. 2.2: Gain knowledge about the basic structure of cell and functions of cell organelles

Suggested Sessional Work (SW): ***anyone***

a. Assignments

1. Differentiate between prokaryotic cell and eukaryotic cell.

b. Mini Project

1. Prepare the poster explaining classification of organism

c. **Other Activities (Specify)**

1. Grow yeast or fungus and observe the growth

BSC105.3: Convey that "Genetics is to biology what Newton's laws are to Physical Sciences and Understand the molecular basis of coding and decoding genetic information is universal

Approximate Hours

Item	AppX. Hrs.
Cl	9
LI	0
SW	1
SL	4
Total	14

Session Outcomes (SOs)	Class room Instruction (CI)	Self-Learning (SL)
3.1 Illustrate how genetic material passes from parent to offspring? Concepts of recessive Ness and dominance. 3.2 Describe the concept of allele. 3.3 Understand the cell cycle and its importance. 3.4 Discuss types of cell division 3.5 Able to realize concept of mapping of phenotype to genes. 3.6 Discuss about the single gene disorders in humans. 3.7 Analyze the molecular basis of information transfer and study the DNA structure and compacting of genome 3.8 Define concept of genetic code. 3.9 Gaining knowledge about the universality and degeneracy of genetic code.	***Unit3.Genetics& Information Transfer*** 3.1 Mendel's laws, Concept of segregation and independent assortment. 3.2 Concept of allele. 3.3 cell cycle 3.4 Meiosis and Mitosis 3.5 Genome mapping 3.6 Gene disorders in humans 3.7 DNA as a genetic material. Hierarchy of DNA structure-from single stranded to double helix to nucleosomes. 3.8 Concept of genetic code 3.9 Universality and degeneracy of genetic code	3.1: Build-up the concept onthe phenotype and genotype. Concepts of recessive Ness and dominance 3.2 basic knowledge of celland cell theory 3.3: concepts of physical and genetic mapping. 3.4: Boost your knowledgeon some genetic disorders in human. And mutation.

Suggested Sessional Work (SW): ***anyone***

a. **Assignments**
   1. Differentiate between mitosis and meiosis

b. **Mini Project**
   1. Explain different types of crosses of Mendelian genetics

c. **Other Activities (Specify)**
   1. Make a model of DNA and RNA and chart of cell cycle

BSC105.4 Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine. To convey that without catalysis life would not have existed on earth

Approximate Hours

Item	Approx. Hrs
Cl	9
LI	0
SW	1
SL	3
Total	13

Session Outcomes (SOs)	Class room Instruction (CI)	Self-Learning (SL)
4.1: In this context discuss monomeric units and polymeric structures. 4.2To know about the structure and functions of carbohydrates. 4.3 Define structure and function of starch. 4.4 Analyze the structure and properties of cellulose. 4.5 Able to know about the building blocks of proteins. 4.6 Understand proteins- structure and function. 4.7 Describe hierarchy in protein structure. Primary secondary, tertiary and quaternary structure. 4.8 Analyze the how does an enzyme catalyze reactions. 4.9 Explain the chemical composition and types of Nucleotides.	Unit 4- Biochemistry and metabolism and Enzymes 4.1 Molecules of life 4.2: Discuss about sugars, 4.3 starch 4.4 cellulose. 4.5 Amino acids 4.6 Proteins 4.7Primary, secondary, tertiary and quaternary structure of proteins. 4.8 Enzyme classification. Mechanism of enzyme action. 4.9 Nucleotides and DNA/RNA	4.1: Study about the various disorders related to carbohydrate metabolism. 4.2 Learn names of essential and non-essential aminoacids. 4.3 To know about the important enzymes of human body and discusstwo examples.

Suggested Sessional Work (SW): ***anyone***

a. **Assignments**
   1. Write a detail note on Classification of Carbohydrate

b. **Mini Project**
   1. Make a chart explaining bio molecules.

c. **Other Activities (Specify)**
   1. List out important enzymes of human body

BSC105.5: To convey the concept of microbes and their role in environment.

Approximate Hours

Item	Appx. Hrs.
Cl	9
LI	0
SW	1
SL	2
Total	12

Session Outcomes (SOs)	Class room Instruction (CI)	Self-Learning (SL)
5.1 Gain the knowledge of different microscopic techniques. 5.2 To know the methods of identification of microorganism. 5.3 Able to classify microorganism 5.4 Explain the Concept of single celled organisms. 5.5To gain knowledge about different bacterial species and strain. 5.6 Define the process of sterilization. 5.7 Understand principle and types of sterilization used in microbiology. 5.8 Study the different components used in media and preparation of medium 5.9 Analyze the microbial growth curve.	**Unit 5**. Microbiology 5.1 Microscopy 5.2 staining methods 5.3 classification of microorganisms(types) 5.4 Concept of single celled organisms 5.5 Concept of species and strains 5.6 Sterilization 5.7Types of sterilization. 5.8media compositions. 5.9 Growth kinetics.	5.1 Concept of single celled organisms 5.2 Ecological aspects of single celled organisms

Suggested Sessional Work (SW): anyone

a. **Assignments**
   1. Draw and explain simple and compound microscope and their parts.
   2. Describe Bacterial growth curve

b. **Mini Project**

1. Make a chart showing different sterilization techniques.

c. **Other Activities (Specify)**

1. Try to make a simple microscope model.

Brief of Hours suggested for the Course Outcome: -

Course Outcomes (COs)	Class lecture (CI)	Sessional work (SW)	Self-Learning (SL)	Total Hours (CI+SL+SW)
BSC105.1: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.	9	1	2	12
BSC105.2: To convey the classification of organism underlying criterion, such as morphological, biochemical or ecological be highlighted.	9	1	2	12
BSC105.3: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences" and understand the molecular basis of coding and decoding genetic information is universal	9	1	4	14
BSC105.4 To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine. To convey that without catalysis life would not have existed on earth	9	1	3	13
BSC105.5: To convey the concept of microbes and their role in environment	9	1	2	12
Total Hours	45	5	13	63

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	**U**	**A**	
CO-1	Introduction	02	03	05	10
CO-2	Classification	02	05	03	10
CO-3	Genetics& Information Transfer	02	02	06	10
CO-4	Biochemistry and metabolism and Enzymes	02	03	05	10
CO-5	Microbiology	02	04	04	10
Total		10	17	23	50

Suggested Instructional/ Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Role-play
5. Presentations
6. Extempore
7. Speeches
8. Brainstorming

Suggested Learning Resources:

(a) Books:

S.no.	Title	Author	Publisher	Edition & Year
1	Biology for engineers	Arthur T johanson	CRC press Taylor and Francis group	Second edition in 2019
2	Biology for engineers	Dr. Tanu Allen Dr. Sohini singh	vayu education of india	First edition in 2020
3	Biology for engineers	Tanushree Chakraborti	PHI Learning	First edition in 2022

****

Curriculum Development Team

1. Mr. Paras Koshe Assistant professor Department of biotechnology
2. Dr. Kamlesh chaure Head , department of biotechnology

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: BSC105
Course Title: Biology for engineers

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO 1	PO 2	PO 3	PO4	PO5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical & Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.	3	3	2	3	3	2	1	2	3	2	2	3	3	2
CO2: To convey the classification of organism underlying criterion, such as morphological, biochemical or ecological be highlighted.	3	3	3	2	2	2	1	2	1	2	2	2	2	2
CO3: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences" and Understand the molecular basis of coding and decoding genetic information is universal	3	3	2	2	3	1	2	2	1	2	2	3	2	2
CO4 To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine. To convey that without catalysis life would not have existed on earth	3	3	2	2	2	1	1	3	2	2	2	2	3	3
BSC107.5: To convey the concept of microbes and their role in environment	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOsNo.	COs No.& Titles	SOs No.	Classroom Instruction (CI)	Self-Learning (SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO1:** To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.	1.1, 1.2, 1.3, 1.4,1.5 1.6,1.7,1.8,1.9	Unit-1. Introduction 1.1,1.2,1.3,1.4,1.5,1.6, 1.7,1.8,1.9	1, 2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO2:** To convey the classification of organism underlying criterion, such as morphological, biochemicalor ecological be highlighted.	2.1, 2.2,2.3,2.4,2.5 2.6,2.7,2.8,2.9	Unit-2 Classification analytic methods using R 2.1, 2.2, 2.3, 2.4,2.5,2.6,2.7,2.8,2.9	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO3:** To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences” and understand the molecular basis of coding and decoding genetic information is universal	3.1,3.2,3.3, 3.4,3.5 ,3.6,3.7,3.8,3.9	Unit-3 : Genetics& Information Transfer3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8, 3.9	1,2,3,4
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO4** To convey that all forms of life have the same building blocks and yet the manifestations are as diverseas one can imagine. To convey that without catalysislife would not have existed on earth	4.1,4.2, 4.3, 4.4 ,4.5,4.6,4.7,4.8,4.9	Unit-4 : Biochemistryand metabolism and Enzymes 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8, 4.9	1,2,3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO5:** To convey the concept of microbes andtheir role in environment	5.1, 5.2, 5.3,5.4,5.5,5.6,5.7,5.8,5.9	Unit-4 : Microbiology4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9	1,2

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-I

Course Code:	**ESC 101**
Course Title :	**Basic Electrical Engineering**
Pre-requisite:	Students should have basic knowledge of Basic Circuit Elements with brief information of AC, DC, and electromagnetic concepts.
Rationale:	A process of introducing formal knowledge of basic electrical elements and AC, DC, and magnetic circuit in electrical and electronic devices along with necessary knowledge about single-phase Transformer and DC machine.

Course Outcomes:

ESC 101.1: Apply network theorems to solve electrical DC circuits.
ESC 101.2: Understand the concept of sinusoidal quantities and solve single phase AC circuits.
ESC 101.3: Analyze the three phase AC circuits and solve series and parallel magnetic circuits.
ESC 101.4: Understand the basic operating principle, types, efficiency of Transformers
ESC 101.5: Understand the basic operating principle, types of machines.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hour (CI+LI+SW+SL)	
Engineering Science Courses (ESC)	ESC 101	BASIC ELECTRICAL ENGINEERING	3	2	1	1	7	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self-Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA + ESA)
ESC	ESC 101	BASIC ELECTRICAL ENGINEERING	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
ESC	ESC 101-L	BASIC ELECTRICAL ENGINEERING Lab	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

ESC 101.1: Apply network theorems to solve electrical DC circuits.

Approximate Hours

Item	AppX Hrs
Cl	07
LI	12
SW	2
SL	1
Total	22

Session Outcomes (SOs)	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the Classification of electrical elements. **SO1.2**Understand the concept of voltageand current source. **SO1.3**Understand the concept of mathematical analysis based on KCL and KVL. **SO1.4**Analyze different network theorems.	1. Verification ofKVL. 2. Verification ofKCL. 3. Identification of different electrical and electronic components. 4. Calculation of Power, Impedance and P.F. in R-L-C Circuits. 5. Verification of Superposition Theorem.	**Unit-1: DC Network** 1.1 Classification of elements – active, passive, unilateral, bilateral, linear, nonlinear, lumpedand distributed 1.2 classification of voltage & currentsources 1.3 mesh and nodalanalysis 1.4 Superpositiontheorem 1.5 Star-Delta Transformations	1. Learn the theoretical concept of circuit element.

SO1.5 Understand the concept of star-delta transformation.	6. Verification of Thevenin's Theorem.	(Numerical only). 1.6 Thevenin's theorem (Only independent sources). 1.7 Numerical	

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Numerical Problems on mesh and nodal analysis.

b. **Mini Project:**
   i. Derive different network theorems.

ESC 101.2: Understand the concept of sinusoidal quantities and solve single phase AC circuits.

Approximate Hours

Item	AppX Hrs
Cl	7
LI	2
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 To Understand the concept of sinusoidal periodic waveforms. **SO2.2** To understand the concept of phase difference. **SO2.3**To understand the different triangles. **SO2.4** To understand the different connections.	1. Study about different types of connection in AC circuit.	**Unit-2Single-Phase AC Circuits** 2.1 Sinusoidal periodic waveforms: frequency, cycle, time period, peak value, root mean square value, average value, form factor and peak factor. 2.2 Phasor representation of alternating quantities. 2.3 Concept of phase difference, The j operator 2.4 Rectangular and polar form 2.5 Power Triangle 2.6 Impedance Triangle, Power factor 2.7 Solution of series, parallel, series-parallel network.	1. Remember different concept related to the Sinusoidal Periodic Waveform.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Numerical Problems on Sinusoidal Network.
ii. Numerical Problems on Power Triangle and Impedance Triangle.
iii. Numerical Problems on Series and Parallel Circuit.

Mini Project:

a. Draw the chart of Phasor Representation.

ESC 101.3: Analyze the three phase AC circuits and solve series and parallel magnetic circuits.

Approximate Hours

Item	AppX Hrs
Cl	9
LI	4
SW	2
SL	1
Total	16

Session Outcomes (SOs)	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning(SL)
SO3.1 To Understand the basic concept of three-phase AC circuit. **SO3.2**To understand the different types of connection of three-phase winding. **SO3.3**To Understand the three-phase power equations. **SO3.4**To Understand the concepts of magnetic circuit. **SO3.5** To understand the concept of leakage flux and fringing	1. Study about the different types of three-phase AC circuits. 2. Study different concepts relatedwith Magnetic Circuit.	**Unit-3: Three-Phase AC Circuit** 3.1.Introduction 3.2.phase sequence, balanced load 3.3.Connection of Three-phase Windings (delta and star connection): line and phase quantities. 3.4.phasor diagrams, Three phase power equations in balanced conditions (Elementary Numerical). 3.5.Magnetic Circuits: Introduction 3.6.magneto motive force (MMF) 3.7.magnetic field strength, magnetic flux, reluctance 3.8.Comparison of the electric and magnetic circuits. 3.9.Solution of simple magnetic circuits (only for constant permeability materials). Leakage flux and fringing.	1. Basic principle of three-phase AC Circuit.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**

i. Numerical Problems on three-phase load.
ii. Numerical Problems on Magnetic circuit.

ESC 101.4: Understand the basic operating principle, types, efficiency of Transformers.

Approximate Hours

Item	AppX Hrs
Cl	10
LI	8
SW	2
SL	2
Total	22

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 To Understand the constructional and operational features of Single-phase Transformer. **SO4.2** Understanding the classification of Transformer. **SO4.3**Understand the different concept related with transformer **SO4.4** Derive EMF equation of transformer. **SO4.5** Understand the Phasor Diagram at different loads. **SO4.6** Understand the different concepts relatedto efficiency for single- phase transformer.	1. Study the construction details of transformer. 2. Perform open circuit and ShortCircuit test on single-phase transformer. 3. Study and Verification of Transformer RatioPolarity. 4. Perform Back to back Test on Transformer	**Unit-4 :Single-Phase Transformer** 4.1 Introduction 4.2 principles of operation 4.3 Construction 4.4 classification of transformers 4.5 Rating of transformer 4.6 EMF equation, ideal and practical transformer 4.7 phasor diagram under no load and loaded conditions 4.8 losses, efficiency calculations, Condition of Maximum Efficiency 4.9 All day efficiency 4.10 (Elementary Numerical)	1. Remember different parts of transformer. 2. Calculate Losses and Efficiency of transformer.

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Numerical Problems on transformer

b. Mini Project:

i. Draw phasor diagram of transformer at different loads.

ESC 101.5: Understand the basic operating principle, types of machines.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	4
SW	2
SL	1
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning(SL)
SO5.1 Understand the constructional details of DC machines. **SO5.2**Derive EMF andTorque equations. **SO5.3** Evaluate differenttypes of dc machine. **SO5.4** Understanding the Electrical Installation.	1. Study different components of DC Motor and Three Phase Starter. 2. Study of different components of Induction Motor and Star-Delta Starter.	**Unit 5: DC Machines** 5.1.Common Construction features of DC Machines 5.2.EMF equation 5.3.types of DC machines (Separately & self-excited) 5.4.Elementary numerical 5.5.Components of LT Switchgear 5.6.Switch fuse unit(SFU) 5.7.MCB, ELCB, MCCB 5.8.Types of wires 5.9.Earthing 5.10. Cables 5.11. Torque equation 5.12. Compound DC Machine	1. Remember the Constructional features of DC Machine.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Numerical Problem based on EMF and Torque equation of DC machine.

b. **Mini Project:**
   i. Draw the chart of different types of cable and earthing.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Lecture (Ll)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
ESC 101.1: Apply network theorems to solve electrical DC circuits.	7	12	2	1	22
ESC 101.2: Understand the concept of sinusoidal quantities and solve single phase AC circuits.	7	2	2	1	12
ESC 101.3: Analyze the three phase AC circuits and solve series and parallel magnetic circuits.	9	4	2	1	16
ESC 101.4: Understand the basic operating principle, types, efficiency of Transformers.	10	8	2	2	22
ESC 101.5: Understand the basic operating principle, types of machines.	12	4	2	1	19
Total Hours	45	30	10	6	91

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	DC Network	03	01	01	05
CO-2	Single-Phase AC Circuit	02	03	02	07
CO-3	Three-Phase AC Circuit	02	04	04	10
CO-4	Single-Phase Transformer	03	07	05	15
CO-5	DC Machines	01	06	06	13
Total		11	23	16	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Basic Electrical Engineering will be held with written examination of50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to electrical power plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

S. No.	Title	Author	Publisher	Edition & Year
1	Basic Electrical Engineering	Fitzrald and Higgonbothom	Tata McGraw-Hill	Fifth
2	Theory and Problems of Basic Electrical Engineering	D.P. Kothari and I. J. Nagrath	Prentice Hall India Learning Private Limited	2016 - Second
3	Basic Electrical Engineering	D. C. Kulshreshtha	McGraw Hill	2009
4	Fundamentals of Electrical Engineering	Ashfaq Hussain	Dhanpat Rai and Co	Third
5	Lecture note provided by Dept. of electrical engineering, AKS University, Satna.			

Suggested Learning Resources:

(a) **Books**:

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Dr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: ESC 101
Course Title: Basic Electrical Engineering

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Teamwork	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: Apply network theorems to solve electrical DC circuits.	2	2	3	2	2	1	1	1	2	1	1	2	2	2
CO2: Understand the concept of sinusoidal quantities and solve single phase AC circuits.	2	2	1	3	1	2	1	1	1	1	2	2	2	2
CO3: Analyze the three phase AC circuits and solve series and parallel magnetic circuits.	3	3	2	1	1	2	2	2	1	1	2	3	1	2
CO 4: Understand the basic operating principle, types, efficiency of Transformers.	2	3	3	2	3	2	1	3	2	1	2	2	3	3
CO 5: Understand the basic operating principle, types of machines.	2	3	3	1	2	3	2	3	1	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1, 2	CO-1: Apply network theorems to solve electrical DC circuits.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1, 2, 3, 4, 5, 6	**Unit-1: DC Network** 1.1, 1.2, 1.3, 1.4, 1.5, 1.6,1.7	1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1, 2	CO-2: Understand the concept of sinusoidal quantities and solve single phase AC circuits.	SO2.1 SO2.2 SO2.3 SO2.4	1	**Unit-2: Single-Phase AC Circuit** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7,	1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1, 2	CO-3: Analyze the three phase AC circuits and solve series and parallel magnetic circuits.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	1, 2	**Unit-3 : Three-Phase AC Circuit** 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9,	1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1, 2	CO-4: Understand the basic operating principle, types, efficiency of Transformers.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5 SO4.6	1, 2, 3, 4	**Unit-4: Single-Phase Transformer** 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10,	1,2
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1, 2	CO-5: Understand the basic operating principle, types of machines.	SO5.1 SO5.2 SO5.3 SO5.4	1,2	**Unit 5: DC Machines** 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9,5.10,5.11,5.12	1

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-I

Course Code: **ESC 102**

Course Title: **Engineering Graphics & Design**

Pre- requisite: Student should have basic knowledge of Geometry, Geometrical Shapes, basic knowledge of Computer, Mouse and keyboard use, navigating menus and dialogs, managing files and directories, etc.

Rationale: The students studying Graphics are essential in mechanical engineering, allowing engineers to visualize and communicate complex ideas clearly and concisely. Using graphics, engineers can create detailed plans for construction projects, analyses structural components, and convey design concepts to clients and stakeholders.

Course Outcomes:

ESC 102.1: Get introduced with Engineering Graphics and visual aspects of design.
ESC 102.2: Know and use common drafting tools with the knowledge of drafting standards.
ESC 102.3: Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.
ESC 102.4: Produce part models; carry out assembly operation and show working procedure of a designed project work using animation.
ESC 102.5: To make the student understand the viewing perception of a solid object in Isometric and perspective Projection, Design modulation and simulation by Auto CAD

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (ESC)	ESC 102	Engineering Graphics & Design	1	4	1	1	7	3

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/ Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+ SA+CAT +AT)		
ESC	ESC 102	Engineeringg Graphics& Design	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	CourseTitle	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
ESC	ESC 102-L	Engineeringg Graphics& Design Lab	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

ESC 102.1: Get introduced with Engineering Graphics and visual aspects of design.

Approximate Hours

Item	AppX Hrs
Cl	03
LI	12
SW	2
SL	2
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Proficiency in using plain scales for measurement and drawing and understanding of representative factors in scales. SO1.2 Construction of ellipses, parabolas, and hyperbolas using various methods SO1.3 Knowledge and construction of special curves like cycloids, epicycloids, hypocycloids, involutes, and Archimedean spirals. SO1.4 Application of these curves in various engineering and mathematical contexts.	**Unit-1.0 ENGINEERING CURVES & SCALE** **Practice of Following** 1.1 Construction of ellipse by different methods; Normal and Tangent. 1.2. Construction of parabola by different methods; Normal and Tangent. 1.3. Construction of involute such as polygons and circle 1.4. Construction of Cycloid, Epi-cycloid,Hypo-cycloid 1.5. Constructio n ofSimple Scale, 1.6. Diagonal Scale & Scale of Chord	**S Unit-1.0 ENGINEERING CURVE& SCALE** 1.1Introduction of Engineering Drawing, Drawing material and their uses Application of mini drafter, compass, divider, French curves, pencils grades and their uses. 1.2Construction of ellipse by different methods; Normal and Tangent. Construction of parabola by different methods; Normal and Tangent. 1.3Construction of Cycloid, Epi-cycloid, Hypo-cycloid. Construction of Simple Scale, Diagonal Scale & Scaleof Chord	**1.** Const ruction of Involutes **2.** Const ruction of Archimean Spiral

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Ellipse by concentric circle method, Cycloid, Involutes of Circle

b. Mini Project:

i. Model of Hexagon, Pentagon, Square

ESC 102.2: Know and use common drafting tools with the knowledge of drafting standards.

Approximate Hours

Item	AppX Hrs
Cl	03
LI	12
SW	1
SL	2
Total	18

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Differentiate between various types of projections when and where each type of projection is commonly used in engineering and technical design. SO2.2 Be able to create orthographic projection views of objects, including front view, top view, and side views. SO2.3 Able to project points and lines onto different planes using orthographic projection. SO2.4 Learn how to find the traces of straight lines in orthographic projection and use these traces to determine the positionsof lines in different planes.	**Unit-2.0 Projection of Point and Line** **Practice of Following** 2.1 Projection of Point 2.2 Projection of Point in different co-ordinate 2.3 Projection of Straight Line 2.4 Projection of Straight Line in different Position w.t.r. H.P. & V.P. 2.5 Projection of Straight Line in different Position w.t.r. H.P. & V.P. 2.6 Projection of Straight Line in different Position w.t.r. H.P. & V.P.	**Unit-2.0 Projection of Point and Line** 2.1 Introduction of Projection 2.2 Projection of Point 2.3 Projection of Straight Line	1. Point Projection in different co-ordinate 2. Projection of Straight Line in different Position w.r.t. H.P. & V.P.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**

i. Projection of point & Projection of Straight Line

ESC 102.3: Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.

Approximate Hours

Item	AppX Hrs
Cl	03
LI	12
SW	2
SL	2
Total	19

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction (CI)	Self-Learning(SL)
SO3.1 Projection of Planes like circle and polygons in different positions. SO3.2 Projection of polyhedrons like prisms, pyramids, and solids of revolutions like cylinder, cones in different positions	**Unit-3.0 Projection ofPlane & Solid** **Practice of Following** 3.1 Introduction , Projection of plane 3.2 plane perpendicularto any one and parallel to other 3.3 plane perpendicularto any one and inclined to other 3.4 Introduction , Projection of solid 3.5 Axis of solid perpendicular to any one and parallel toother 3.6 Axis of solid perpendicular to anyone and inclined to other, Axis of solid inclined to both theplane HP&VP	**Unit-3.0 Projection ofPlane & Solid** 3.1 Introduction of Projection Plane 3.2 Projection of Plane in different position 3.3 Introduction of projection of Solid, Projection of solid in different position	1. Projection of Plane in different Position w.r.t. H.P. & V.P. 2. Projection of solid indifferent Position w.r.t. H.P. &V.P.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Draw three problems of projection of plane
ii. Draw three problems of projection of solid

b. Mini Project:

i. Make models of plane and solid by thermocol.

ESC 102.4: Produce part models; carry out assembly operation and show working procedure of a designed project work using animation.

Approximate Hours

Item	AppX Hrs.
Cl	03
LI	12
SW	2
SL	2
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning(SL)
SO4.1 Learn the techniques for sectioning right solids using bothnormal and inclined planes. SO4.2 solve practical problems related tothe section of solids and planes. SO4.3 Learn the parallel line method and radial-line methodfor developing surfaces in right solids including how to create accurate representations.	**Unit-4.0 Developmentof Solid & Section of Solid** **Practice of Following** 4.1 Sectioning ofCone 4.2 Sectioning ofpyramid 4.3 Sectioning ofCylinder & Prism 4.4 Development of cylinder and prism 4.5 Development and sectioning ofpyramid 4.6 development and sectioning of cone	**Unit-4.0 Development of Solid & Section of Solid** 4.1 Introduction of Sectioning and sectioning lines 4.2 Sectioning of Cone 4.3 Sectioning of pyramid, Sectioning of Cylinder & Prism, Development of cylinder and prism, Development andsectioning of pyramid, development andsectioning of cone	1. Development and sectioning of cylinder 2. Development and sectioning of prism

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Develop prism and cylinder

ii. Develop pyramid and Cone

ESC 102.5: To make the student understand the viewing perception of a solid object in Isometric and perspective Projection, Design modulation and simulation by Auto

Approximate Hours

Item	AppX Hrs
Cl	03
LI	12
SW	2
SL	2
Total	19

Session Outcomes (SOs)	Laboratory Instruction(LI)	Class roomInstruction (CI)	Self Learning(SL)
SO5.1 -Students will learn about the scale and the specific axes used in isometric drawings. SO5.2 -Students will learn the process of converting two-dimensional orthographic (multi view) drawings into isometric projections.	**Unit-5.0 Isometric projection and Auto CAD Practice of Following** 5.1 Introductionof isometric scale and vies 5.2 Isometric view of circle,cylinder and cone 5.3 Isometric view of prism	**Unit-5.0 Isometric projection and AutoCAD** 5.1 Introduction of Isometric Projection 5.2 Isometric view of circle, cylinder and cone 5.3 Isometric view of prism and pyramid Isometric view by orthographic view, Introduction ofAuto CAD, Description ofAuto CAD	1. Draw Isometric viewof plane and solid 2 Draw Isometric view of plane and solid byusing Auto CAD command

SO5.3 -Students will learn solving practical design and projection problems using CAD software and how to use CAD tools to create detailed drawings and projections of objects.	5.4 Isometricview of pyramid 5.5 Isometric view by orthographic view 5.6 Drawing of different orthographic view of planesand solid by Auto CAD commands	commands Drawing of different orthographic view of planes and solid by AutoCAD commands	

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Draw Isometric view of a cone resting centrally on a cube

ii. Explain five edit and draw commands

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture(Cl)	Lab Lecture (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+LI+SW+SI)
ESC 102.1: Get introduced with Engineering Graphics and visual aspects of design.	3	12	2	2	19
ESC 102.2: Know and use common drafting tools with the knowledge of drafting standards.	3	12	1	2	18
ESC 102.3: Apply computer aided drafting techniqueto represent line, surfaceor solid models in different Engineering viewpoints.	3	12	2	2	19

ESC 102.4: Produce part models; carry out assembly operation and show working procedure of a designed project work using animation.	3	12	2	2	19
ESC 102.5: To make the student understand the viewing perception of a solid object in Isometric and perspective Projection, Design modulation and simulation by Auto CAD	3	12	2	2	19
Total Hours	15	60	9	10	94

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Get introduced with Engineering Graphics and visual aspects of design.	03	01	01	05
CO-2	Know and use common drafting tools with the knowledge of drafting standards.	02	06	02	10
CO-3	Apply computer aided drafting technique to represent line, surface or solid models in different Engineering viewpoints.	03	07	05	15
CO-4	Produce part models; carry out assembly operation and show working procedure of a designed project work using animation.	-	10	05	15
CO-5	Produce part models; carry out assembly operation and show working procedure of a designed project work using animation.	03	02	-	05
Total		11	26	13	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Engineering Graphics & Design will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT ,Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition &Year
1	Computer Aided Engg drawing	VTU Belgaum	Visvesvaraya Tech.University	Revised edition 21 edition 2020
2	Engineering Drawing	Bhatt N.D., Panchal V.M. & Ingle P.R.,	Charotar Publishing House	1999
3	Engineering Drawing	R.K. Dawan	S. Chand Publication.	1985
4	Engineering Drawing	Agrawal and Agrawal	TMH	2018
7	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna .			

****

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Curriculum Development Team

1. **Mr. S.S. Parihar, Head of Deptt. Mech. Engg., AKS University**
2. **Mr. Alok Ranjan Tiwari , Assistant Professor, Dept. of Mechanichal Engg.**
3. **Mr Deepak Pandey , Assistant Professor , Dept. of Mechanichal Engg**
4. **Mr.,Keshav Pratap Singh, Assistant Professor , Dept. of Mechanichal Engg**
5. **Mr.Amar Soni , Assistant Professor , Dept of Mechanichal Engg**
6. **Mr K.P Tiwari , Assistant Professor , Dept. of Mechanichal Engg**
7. **Mr. Ketan Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
8. **Mr. K.C. Kori, Faculty, Assistant Professor , Dept. of Mechanichal Engg**
9. **Mr,Lokesh Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
10. **Mr. Ram Narayan Shukla, Assistant Professor , Dept. of Mechanichal Engg**
11. **Mr. Rishi Kumar Sharma, Assistant Professor , Dept. of Mechanichal Engg**
12. **Mr. Naveen Kumar Soni, Assistant Professor , Dept. of Mechanichal Engg**

Cos,POs and PSOs Mapping

Programme Title: B. Tech Electrical Engineering

Course Code : ESC 102

Course Title: Engineering Graphics and Design

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical & Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1 : Get introduced with Engineering Graphics and visual aspects of design.	1	1	2	2	2	2	3	1	2	2	1	2	2	2
CO 2 : Know and use common drafting tools with the knowledge of drafting standards.	1	2	2	2	1	2	2	1	1	1	2	3	2	2
CO3 : Apply computer aided drafting technique to represent line, surface or solid models in different Engineering viewpoints.	2	2	1	1	2	2	2	1	1	2	1	2	2	1
CO 4: Produce part models; carry out assembly operation and show working procedure of a designed project work using animation.	3	2	2	-	3	1	3	1	2	1	-	2	3	3
CO 5: Produce part models; carry out assembly operation and show working procedure of a designed project work using animation.	1	2	2	-	1	1	3	1	1	1	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO1: Get introduced with Engineering Graphics and visual aspects of design.	SO1.1, SO1.2 SO1.3, SO1.4 SO1.5	1.1,1.2,1.3,1.4,1.5,1.6	Unit-1.0 ENGINEERING CURVE& SCALE 1.1,1.2,1.3	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO 2: Know and use common drafting tools with the knowledge of drafting standards.	SO2.1, SO2.2 SO2.3, SO2.4 SO2.5	2.1, 2.2, 2.3, 2.4, 2.5, 2.6	Unit-2 Projection of Point and Line 2.1, 2.2, 2.3	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO3: Apply computer aided drafting technique to represent line, surface or solid models in different Engineering viewpoints.	SO3.1, ,SO3.2 SO3.3,SO3.4 SO3.5	3.1, 3.2,3.3,3.4,3.5,3.6	Unit-3 : Projection of Plane & Solid 3.1, 3.2,3.3	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO 4: Produce part models; carry out assembly operation and show working procedure of a designed project work using animation.	SO4.1, SO4.2 SO4.3, SO4.4 SO4.5	4.1, 4.2,4.3,4.4,4.5,4.6	Unit-4 : Development of Solid & Section of Solid 4.1, 4.2,4.3,	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO 5: Produce part models; carry out assembly operation and show working procedure of a designed project work using animation.	SO5.1, SO5.2 SO5.3, SO5.4 SO5.5	5.1,5.2,5.3,5.4,5.5, 5.6	Unit 5: Isometric projection and Auto CAD 5.1,5.2,5.3	1,2

Semester-I

Course Code: **ESC103-L**

Course Title: **Design Thinking & Idea Lab**

Pre-requisite: There is no such pre requisite for Design Thinking and Idea. This course is intended for students from any discipline who require an understanding of design thinking for brand, product, and service development.

Rationale: Students will learn a series of design thinking concepts, methods and techniques that are used to bring about innovation in business and in the social sector. The- course will be a mix of lecture, case discussions, participative and immersive learning. It will be a predominantly student driven learning to acquire the requisite skills.

Course Outcomes:

ESC103.1: Identify the problems that fall under the purview of human centered design process for creative problem solving.

ESC103.2: Create empathy maps to visualize user attitudes and develop innovative products or services for a customer base using ideation techniques.

ESC103.3: Build simple prototypes for problems using gathered user requirements.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
ESC	ESC103-L	Design Thinking & Idea Lab	0	2	1	1	4	1

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial(T) and others),

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self-Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Practical

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
ESC	ESC 103-L	Design Thinking & IdeaLab	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses,students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

E**SC103.1**: Identify the problems that fall under the purview of human centered design process for creative problem solving.

Approximate Hours

Item	AppX Hrs
Cl	0
LI	10
SW	2
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Identifying the problem that can be solved using Design Thinking approach. SO1.2 Obtain the insights into user's problems and make Problem statement. SO1.3 Carry out Brain storming between the groups and generate as many as ideas possible. SO1.4Obtain the insights to creativity and innovation.	**Unit- 1.0INTRODUCTION TO DESIGN THINKING** 1.1 Definition of Design Thinking, 1.2. Need & Objective of Design Thinking. 1. 3. Stages of Design Thinking Process. 1.4 Brainstorming. 1.5 Innovative Triangle		**3.** Develop ability to express their views.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Detail explanation of Stages of Design Thinking.

b. **Mini Project:**
   i. To create a prototype eof users need using Design Thinking Stages.

ESC103.2: Create empathy maps to visualize user attitudes and develop innovative products or services for a customer base using ideation techniques

Approximate Hours

Item	AppX Hrs
Cl	0
LI	10
SW	2
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning(SL)
SO2.1 Differentiate between Design thinking and Creative thinking. SO2.2 Learn different types of creative thinking techniquesfor generating creative ideas. SO2.3 Be able to solve a problem using creativity.	**Unit-2.0Introduction to Creativity** 2.1 Introduction of Creative Thinking. 2.2 Creative Thinking Process 2.3 Creative Problem Solving. 2.4 Creative Thinking Techniques and Tools. 2.5 Divergent and Convergent Thinking.		1.Different Convergentand divergent thinking tools.

SW-2 Suggested Sessional Work (SW):

a. Assignments:
   i. Presentation by student's team on their own creative work.

b. Mini Project:
   i. To create a prototype of a product using their own creativity.

ESC103.3: Build simple prototypes for problems using gathered user requirements.

Approximate Hours

Item	AppX Hrs
Cl	0
LI	10
SW	2
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Understanding of Prototyping. SO3.2 Develop understanding of various prototype testing methods. S03.3 Understanding of Product Design	**Unit-3.0Introduction to Prototype** 3.1 Prototyping as a mindset, prototype examples 3.2 Introduction to Rapid Prototyping. 3.3 Process of prototyping-Minimum Viable prototype 3.4Process of Engineering Product Design 3.5 Stages of Product Design		1.Solving Practical Engineering Problem through Innovative Product Design & Creative Solution

SW-3 Suggested Sessional Work (SW):

a. Assignments:
i. Presentation by student teams on their own developed prototype.

b. Mini Project:
Make a prototype using stages of product design

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Lecture (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+LI+SW+SI)
ESC103.1: Create empathy maps to visualize user attitudes and develop innovative products or services for a customer base using ideation techniques.	00	10	2	1	13
ESC103.2: Identify the problems that fall under the purview of human centered design process for creative problem solving.	00	10	2	1	13
ESC103.3: Build simple prototypes for problems using gathered user requirements.	00	10	2	1	13
Total Hours	00	30	06	03	39

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Create empathy maps to visualize user attitudes and develop innovative products or services for a customer base using ideation techniques.	07	05	03	15
CO-2	Identify the problems that fall under the purview of human centered design process for creative problem solving.	06	06	03	15
CO-3	Build simple prototypes for problems using gathered user requirements.	07	07	06	20
Total		20	18	12	50

Legend: R: Remember, U:Understand, A:Apply

The end of semester assessment for Design Thinking & Idea Lab will be held with practical examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition& Year
1	Paul Harris, Basics Design-Design Thinking	Gavin Ambrose	AVA Publishing	2010
2	Prototyping for Designers: Developing the best Digital and Physical Products	Kathryn McElroy	O'Reilly,	2017
3	"Design Thinking – New Product Essentials from PDMA	Michael G. Luchs, Scott Swan, Abbie Griffin	Wiley,	2015

****

Curriculum Development Team

1. **Mr. S.S. Parihar, Head of Deptt. Mech. Engg., AKS University**
2. **Mr. Alok Ranjan Tiwari , Assistant Professor, Dept. of Mechanichal Engg.**
3. **Mr Deepak Pandey , Assistant Professor , Dept. of Mechanichal Engg**
4. **Mr.,Keshav Pratap Singh, Assistant Professor , Dept. of Mechanichal Engg**
5. **Mr.Amar Soni , Assistant Professor , Dept of Mechanichal Engg**
6. **Mr K.P Tiwari , Assistant Professor , Dept. of Mechanichal Engg**
7. **Mr. Ketan Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
8. **Mr. K.C. Kori, Faculty, Assistant Professor , Dept. of Mechanichal Engg**
9. **Mr,Lokesh Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
10. **Mr. Ram Narayan Shukla, Assistant Professor , Dept. of Mechanichal Engg**
11. **Mr. Rishi Kumar Sharma, Assistant Professor , Dept. of Mechanichal Engg**
12. **Mr. Naveen Kumar Soni, Assistant Professor , Dept. of Mechanichal Engg**

Cos, POs and PSOs Mapping

Programme Title: B.tech. Electrical Engineering

Course Code: ESC103-L

Course Title: Design Thinking & Idea Lab

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	Engineering Knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, system and services.
CO1: Create empathy maps to visualize user attitudes and develop innovative products or services for a customer base using ideation techniques.	3	2	-	-	-	-	-	-	2	2	-	2	3	2
CO 2 : Identify the problems that fall under the purview of human centered design process for creative problem solving.	1	3	-	-	-	-	-	-	2	3	-	2	-	2
CO3 : Build simple prototypes for problems using gathered user requirements.	2	2	1	1	2	2	2	1	1	2	1	2	2	-

Legend: 1–Low, 2–Medium, 3–High

Course Curriculum Map:

POs & PSOs No.	Cos No .& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO1,2, 9,10,12 PSO1,2	CO1 Create empathy maps to visualize user attitudes and develop innovative products or services for a customer base using ideation techniques.	SO1.1 SO1.2 SO1.3 SO1.4	Unit-1.0INTRODUCTION TO DESIGN THINKING 1.1,1.2,1.3,1.4,1.5.		1
PO1,2, 9,10,12 PSO2	CO 2 : Identify the problems that fall under the purview of human centered design process for creative problem solving.	SO2.1 SO2.2 SO2.3	Unit-2Introduction to Creativity 2.1,2.2,2.3,2.4,2.5.		1
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1	CO3 : Build simple prototypes for problems using gathered user requirements.	SO3.1 SO3.2 SO3.3	Unit-3: Introduction to Prototype3.1. 3.2, 3.3, 3.4, 3.5.		1

Semester-I

Course Code: **ESC106**

Course Title : **Basic Civil Engineering**

Pre-requisite: Student should have basic knowledge of Cement, Concrete, Roads and Infrastructure.

Rationale: The department of civil engineering has been constantly contributing high-quality technical manpower needed by the industry. The broad objective of the department is to achieve recognition for excellence in research and teaching in the country. The Department is well suited to meet the ever changing requirements of engineers with courses that combine the study of management, business skills and computers with engineering. The Department also encourages its students to engage in extra-curricular and co-curricular activities, essential for development of team spirit and organizational skills.

Course Outcomes:

ESC106.1 Impart the knowledge on importance of Civil Engineering in the infrastructural development of society

ESC106.2: Identify the types, uses and properties of various building materials.

ESC106.3: Identify the type of construction for different components of a building

ESC106.4: Establish an idea about the different types of masonry work

ESC106.5: Analyze various types of roofs and floors.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
ESC	ESC106	Basic Civil Engineering	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self-Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks CA+ CT+SA+CAT+ AT)		
ESC	ESC106	Basic Civil Engineering	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

ESC106.1 Impart the knowledge on importance of Civil Engineering in the infrastructural development of society

Approximate Hours

Item	AppX Hrs
Cl	08
LI	0
SW	2
SL	2
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1. Overview of Civil Engineering. **SO1.2** types of infrastructures **SO1.3** public-private partnership (PPP) **SO1.4** talent shortage and global trends in workshop mobility **SO1.**5 skill demands .	.	**Unit-1.0** Importance of Civil Engineering in the infrastructural development of society 1.1 types of infrastructures. 1.2 Effect of infrastructure facilities on economy and environment. 1.3 Role of Civil Engineers in the infrastructural Development Introduction to sub domains of Civil Engineering. 1.4 Industry emerging trends in infra spending through public and public-private partnership (PPP) 1.5 global trends in workshop mobility Concise 1.6 Talent Shortage 1.7 Skill Demand 1.8 PPP	1. Advantages of Infrastructure 2. Public Private Partnership

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Industry emerging trends in infra spending through public and public-private partnership (PPP)
   ii. Role of Civil Engineer for Infrastructure Development
b. **Mini Project:**
   i. Affecting Factors of PPP.
c. **Other Activities (Specify):**
   Note on Different fields of Civil Engineering.

ESC106.2: Identify the types, uses and properties of various building materials.
Approximate Hours

Item	AppXHrs
Cl	09
LI	0
SW	2
SL	2
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 To what extent you are able to Identify the types, uses and properties of various building materials **SO2.2**To learns about Design, Construction & Maintenance. **SO2.3**To Learn About Demolition / Recycling.	.	Unit- Stages in the life of construction 2.1 Design 2.2 Construction. 2.3 Maintenances 2.4 Repair. 2.5 Recycling; an overview of Indian standards. 2.6 unit and conversion factors for lengths	1. Construction Life Cycle 2. Unit Conversion

SO2. To learn about overview of Indian standards **SO2.**5 Interdisciplinary nature of civil engineering projects.		2.7 areas, volumes and weights 2.8 Opportunities and challenge of India's Infrastructure 2.9 Interdisciplinary nature of civil engineering projects.	

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Recycling of Building Materials
   ii. Prepare Detail project on Construction Life Cycle.

Mini Project:

Interdisciplinary nature of civil engineering projects.

b. **Other Activities (Specify):**
   Challenges of Indian Infrastructure

ESC106.3: Identify the type of construction for different components of a building

Approximate Hours

Item	AppX Hrs
Cl	10
LI	0
SW	2
SL	2
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Types of Roads Used in India **SO3.2**Component and use of Roads **SO3.3.** Analyze various types of bridges and Its parts. **SO3.4.** To what extent you are able to Analyze various types of Dams .	.	**Unit-3 :** Types Of Roads Used In Construction 3.1 Types of Roads 3.2 Types of Pavement flexible & Rigid, 3.3 Road function & Component, 3.4 Road Plan 3.5 Bridges: important parts 3.6 classification of bridges 3.7 Component of Bridges 3.8 Types Of Dams 3.9 Function of Dams 3.10 Components & Uses Of Dams	i. History Of Road Development in India ii. Advantages of Bridges & Dams

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Road Plans in India.
   ii. Different types of Bridges.
b. **Mini Project:**
   Make Project Report on Dams In India
c. **Other Activities(Specify):**
   Make Report on Road Plans.

ESC106.4: Establish an idea about the different types of masonry work

Approximate Hours

Item	AppX Hrs
Cl	11
LI	0
SW	2
SL	2
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO4.1 To what extent you are able to Identify the type of construction for different components of a building. **SO4.** To what extent you are able to Establish an idea about the different types of masonry work **SO4.3**Understanding the Building Material **SO4.4** Understand the Different grades of Concrete & Steel	.	**Unit-4 :Building Materials** 4.1 Properties of common building materials 4.2 Classification of building materials. 4.3 Rocks 4.4 Types Stones & its properties. 4.5 Types Bricks & its properties. 4.6 Types Sand & its properties. 4.7 Types Lime & its properties. 4.8 Types of Cement 4.9 Uses & Various types of Cement Test 4.10 Concrete Uses & Properties 4.11 Various Grades used in Steel	1. Preparation of process flow chart of Portland cement manufacture 2. Draw a typical lay out of a cement plant showing various sections.

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Identify masonry for the construction of a building

ii. Describe briefly the dry process cement manufacture.

b. Mini Project:

i. Set out buildings using modern methods.

b. Other Activities (Specify):

Power Point Presentation of Portland cement manufacture.

ESC106.5: Analyze various types of roofs and floors.

Approximate Hours

Item	AppX Hrs
Cl	07
LI	0
SW	2
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	ClassroomInstruction (CI)	Self Learning (SL)
SO5.1 To what extent you are able to Impart the knowledge on importance of Civil Engineering in development of society **SO5.2** Overview ofIndian Road Congress **SO5.3** Role of the new technologies in the field of civil engineering		**Unit 5:** Indian Road Congress 5.1 History of IndianRoad Congress. 5.2 Advantages of IRC 5.3 Overview of National Highway Authority of India(NHAI) 5.4 Various Road Planintroduced in NHAI 5.5 Overview of American Societyof Civil Engineers (ASCE)	1. History of IRC. 2. Role of ASCE for Civil Engineers.

		5.6 Emerging areas annew technologiesin the field of civil engineering 5.7 Advance Technologies in civil Engineering	

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Identify pavement components and design bituminous mixes
   ii. Evaluate structural conditions of pavements.

b. **Mini Project:**
   Prepare Project Report on Road Development in India.

c. **Other Activities(Specify):**
   Advantages of ASCE For Civil Engineers.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
ESC106.1: Importance of Civil Engineering in the infrastructural development of society	8	2	02	12
ESC106.2: Acquire knowledge regarding Stages in the life of construction.	09	2	02	13
ESC106.3: Gain an understanding of the various types of Road in India and their utilization in infrastructure development.	10	2	02	14
ESC106.4:Analyze the strength and properties of various building materials.	11	2	2	15
ESC106.5: Overview of National Highway Authority of India (NHAI)	7	2	1	10
Total Hours	45	10	09	64

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Importance of Civil Engineering in the infrastructural development of society	03	01	01	05
CO-2	Stages in the life of construction	02	06	02	10
CO-3	Types Of Roads Used In Construction	03	07	05	15
CO-4	Building Materials	-	10	05	15
CO-5	Indian Road Congress	03	02	-	05
Total		11	26	13	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Introduction to Portland cement will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role-Play
6. Visit to cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Law of Contract	W. H Duda	Oxford University Press	Anson W.R.(1979)
2	Legal Aspects of Building and Engineering Contract	W. H Duda	Oxford University Press	Patil, B.S.(1974)
3	Engineering Construction and Architectural management	A K Chatterjee	Vol-10 Iss 2 pp 117-127	Vee, Charles & Skitmore, Martin (2003)
4	Cement Production Principle and Practice	A K Chatterjee	Vol-10 Iss 2 pp 117-127	2018
5	Holcim Training Manual			
6	FLS Training Manual			
7	Lecture note provided by Dept. of Cement Technology, AKS University, Satna.			

****

Curriculum Development Team

1. **Mr. Vishutosh Bajpai ,Assistant Professor, Dept. of Civil Engineering**
2. **Mr. Aditya Budhadra , Assistant Professor, Dept. of Civil Engineering**
3. **Mrs. Richa Tripathi , Assistant Professor , Dept. of Civil Engineering**
4. **Mrs. Shraddha Panday, Teaching Associate, Dept. of Civil Engineering**
5. **Mrs. Garima Panday, Teaching Associate, Dept. of Civil Engineering**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: ESC 106
Course Title: Basic Electrical Engineering

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Teamwork	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: Importance of Civil Engineering in the infrastructural development of society	3	2	1	1	2	2	1	2	1	1	1	1	2	2
CO2: Acquire knowledge regarding Stages in the life of construction.	1	3	1	1	2	3	1	2	1	1	1	1	2	2
CO3: Gain an understanding of the various types of Road in India and their utilization in infrastructure development.	2	2	1	1	1	2	1	2	2	2	1	1	1	2
CO4: Analyze the strength and properties of various building materials.	1	1	1	1	1	1	1	1	1	1	1	1	3	3
CO5: Overview of National Highway Authority of India (NHAI)	1	1	1	1	1	1	1	1	1	1	1	1	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1, 2	CO1: Importance of Civil Engineering in the infrastructural development of society	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**Unit-1:** Importance of Civil Engineering in the infrastructural development of society 1.1, 1.2, 1.3, 1.4, 1.5, 1.6,1.7,1.8	1,2
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1, 2	CO2: Acquire knowledge regarding Stages in the life of construction.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		**Unit-2**: Stages in the life of construction .1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9	1.2
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1, 2	CO3: Gain an understanding of the various types of Road in India and their utilization in infrastructure development.	SO3.1 SO3.2 SO3.3 SO3.4		**Unit-3 :** Types Of Roads Used In Construction 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10	1,2
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1, 2	CO4: Analyze the strength and properties of various building materials.	SO4.1 SO4.2 SO4.3 SO4.4		**Unit-4:** Building Materials 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11	1,2
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1, 2	CO5: Overview of National Highway Authority of India (NHAI)	SO5.1 SO5.2 SO5.3		**Unit 5:** Indian Road Congress 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7	1,2

Semester-I

Course Code:	**HSMC08**
Course Title :	**Sustainable Development Goals (SDGs)**
Pre-requisite:	Student should have basic knowledge of Environment, Natural resources, Climate change and sustainability.
Rationale:	To inculcate the knowledge base on sustainable development with a view to balance our economic, environmental and social needs, allowing prosperity for now and future generations. To train students to undertake major initiatives in the efficient management of natural resources and the prevention of environmental pollution with focus on Sustainable Development. To use environmental management tools that help to improve the quality of environment, To assess local vulnerabilities with respect to climate, natural disasters and to achieve sustainable developmental needs.

Course Outcomes:

HSMC08.1: Examine critically the 17 newly minted UN Sustainable Development Goals and understand the historical evolution, key theories, and concepts of sustainable development.

HSMC08.2: Identify and apply methods for assessing the achievement of sustainable development and discover the science, technology, economics, and politics underlying the concepts of sustainability.

HSMC08.3: Understand the implications of overuse of resources, population growth and economic growth and sustainability and explore the challenges the society faces in making transition to renewable resource use.

HSMC08.4: Develop skills to understand attitudes on individuals, society and their role regarding causes and solutions in the field of sustainable development and apply critical thinking skills to evaluate the quality, credibility and limitations of an argument for solution.

HSMC08.5: Describe the steps of the design thinking methodology and how design thinking can accelerate effective SDG implementation. Deepen knowledge and pedagogical tools to incorporate values-based education for sustainable development in educational programmes and processes.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Scheme of Studies:

Course category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hour (CI+LI+SW+SL)	
HSMC	HSMC08	Sustainable Development Goal	2	0	1	1	4	2

Legend: **CI:** Class room Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Scheme of Assessment:

Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 bestout of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
HSMC	HSMC08	Sustainable DevelopmentGoal	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

HSMC08.1: Examine critically the 17 newly minted UN Sustainable Development Goals and understand the historical evolution, key theories, and concepts of sustainable development.

Approximate Hours

Item	AppX Hrs
Cl	06
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self -Learning (SL)
SO1.1 Understand about Sustainable Development **SO1.2** Understand the Need andImportance of SDGs. **SO1.3** Understand the historical evolution of SDGs		**Unit-1.0** Introduction to Sustainable Development **1.1** Need and Importance of Sustainable Development **1.2** Historical & Policy perspectives of Sustainable Development	**1.** Different SDG goalsdetails andits importance

SO1.4 Gain knowledge of SDGs Different goals and their importance **SO1.5** Explain the Challenges & strategies of attaining SDGs in countries.		**1.3** Sustainable Development: World and India Perspective **1.4** Introduction to 17 SDGs **1.5** Specific learning objectives for differentSDGs **1.6** Challenges & strategies of attaining in developedand developing Nations	

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
Overview of SDGs, Sustainable Consumption and Production, Details of 17 SDGs

b. **Other Activities (Specify):**
Note down the different challenges in our state and district to achieve SDG

HSMC08.2: Identify and apply methods for assessing the achievement of sustainable development and discover the science, technology, economics, and politics underlying the concepts of sustainability and measuring.

Approximate Hours

Item	AppX Hrs
Cl	06
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self Learning (SL)
SO2.1 Explain Sustainable Development **SO2.2** Understand the NEP-2020 and SDG **SO2.3** Discuss higher Educationrole to achieve SDGs **SO2.4** Explain how education for Sustainable Development **SO2.5** Explain the measuring techniques for Sustainability		**Unit-2.0** Special focus on SDG 4- Quality Education and Lifelong Learning: **2.1** Focus of NEP-2020 on SDG **2.2** Education for Sustainable Development(ESD): **2.3** Berlin Declaration 2021 on ESD **2.4** Integration of ESD in curriculum and textbooks **2.5** Tools, Systems, and Innovation for Sustainability **2.6** Measuring Sustainability: How do we measure sustainability	**1** NEP2020 objectives and concept for SDGs

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
Education role to achieve SDGs, The role of education in Sustainable Development, Measuring techniques of sustainability, Sustainability Indicators

b. **Other Activities (Specify):**
Seminar and group discussion on ESD and measuring sustainability Millennium Development Goals (MDGs)

HSMC08.3: Understand the implications of overuse of resources, population growth and economic growth and sustainability and explore the challenges the society faces in making transition to renewable resource use.

Approximate Hours

Item	AppX Hrs
Cl	06
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Understand current economicissues in the context of the global sustainable development debate. **SO3.2** Outline of health, hygieneand water sanitation issues. **SO3.3** Discuss the renewable energy resources and its importance in present scenario **SO3.4** Explain the importance ofsustainable production and consumption		**Unit-3.0** Understanding the SDGs **3.1** Circular economy (basic model ofreuse, recycle, and reduce) **3.2** Rural & urban Problems & Challenges **3.3** Sustainable production and consumption **3.4** Renewable energy **3.5** Health & Hygiene, water ,	**1.** Water Treatment and managementnt practices.

SO3.5 Explain the problems and solution inrural and urban areas.		sanitation& water management **3.6** Waste Management	

SW-1 Suggested Sessional Work (SW):

Smart cities

a. **Assignments:**
Ecofriendly energy resources importance, types of waste and its management, Urban Problems & Challenges

b. **Other Activities (Specify):**
Visit of waste water treatment plant, Visit of water treatment process.

HSMC08.4: Develop skills to understand attitudes on individuals, society and their role regarding causes and solutions in the field of sustainable development and apply critical thinking skills to evaluate the quality, credibility and limitations of an argument for solution.

Approximate Hours

Item	AppX Hrs
Cl	06
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO4.1 Understand environmental sustainability is crucial in reducing the impactsof climate change **SO4.2** Discuss causes of emission of GHGs and its consequences **SO4.3** Explain how climate change and sustainable development both play a role in shaping the human and environmental factors of the world. **SO4.4** Explain the importance ofsustainable production and consumption **SO4.5** Climate change is disrupting national economies and affecting lives and livelihoods, especially for the mostvulnerable and its mitigation.		**Unit-4.0 Climate Change, Energy and Sustainable Development** **4.1** The greenhouse effect: Causes and Consequences **4.2** Climate Change: A Threat to Sustainable Development **4.3** Adaptation to Current and FutureClimate Regimes **4.4** The consequences: crop failure **4.5** Solutions technology and lifestylechanges **4.6** Mitigating Climate Change	1. Agreement on Climate Change, Trade, and Sustainability Carbon Credit, carbon trading

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
Urban Sustainability and Climate Change, Sustainable Development Policies, Agreement on Climate Change, Trade and Sustainability, Resilient cities – What makes a city sustainable, green, and resilient.

HSMC08.5: Describe the steps of the design thinking methodology and how design thinking can accelerate effective SDG implementation. Deepen knowledge and pedagogical tools to incorporate values-based education for sustainable development in educational programmes and processes.

.**Approximate Hours**

Item	AppX Hrs
Cl	06
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self - Learning (SL)
SO4.1 Understand the relevance and theconcept of sustainability and the global initiatives in this direction **SO4.2** Understand role of Corporationsand Ecological Sustainability. **SO4.3** Explain role of CSR in Sustainability. **SO4.4** Understand the SD challenge forcompanies, their		**Unit-5.0 Sustainable BusinessPractices:** **5.1** Corporate Social Responsibility **5.2** Sustainable products and services, Business and Environment **5.3** Corporations and EcologicalSustainability **5.4** Life Cycle Assessment: LCA Overview and Application	Local to the Global: Can Sustainabl e Developm ent Work

responsibility and their potentialsfor action **SO4.5** Discuss the role of world government for world justice and peace		**5.5** World peace and justice: **5.6** United nations goals for peace and justice, World Government for peace	

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
Consumption Patterns and Lifestyles, Company Perspectives for Environmental Sustainability, an Introduction to Economic Growth

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
HSMC08.1: Examine critically the 17 newly minted UN Sustainable Development Goals and understand the historical evolution, key theories, and concepts of sustainable development.	6	1	1	8
HSMC08.2: Identify and apply methods for assessing the achievement of sustainable development and discover the science, technology, economics, and politics underlyingthe concepts of sustainability.	6	1	1	8
HSMC08.3: Understand the implications of overuse of resources, population growth and economic growth and sustainability and explore the challenges the society faces in making transition to renewable resource use.	6	1	1	8
HSMC08.4: Develop skills to understand attitudes on individuals, society and their role regarding causes and solutions in the field of sustainable development and apply critical thinking skills to evaluate the quality,	6	1	1	8

credibility and limitations of an argument for solution.				
HSMC08.5: Describe the steps of the design thinking methodology and how design thinking can accelerate effective SDG implementation. Deepenknowledge and pedagogical tools to incorporate values-based education for sustainable development in educational programmes and processes.	6	1	1	8
Total Hours	30	5	5	40

Suggestion for End Semester Assessment

Suggested Specification Table(For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Need and Importance of Sustainable Development	03	01	01	05
CO-2	Education for Sustainable Development (ESD): Tools,Systems, and Innovation forSustainability	02	06	02	10
CO-3	Discuss the sustainable production and consumption	03	07	05	15
CO-4	How Climate Change may be Threat to Sustainable Development	-	10	05	15
CO-5	Role of Corporations and Ecological Sustainability	03	02	-	05
Total		11	26	13	50

Legend: **R: Remember,** **U: Understand,** **A: Apply**

The end of semester assessment for Sustainable Development Goals will be held with written examination of 50marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers canalso design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to industry, water treatment plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	The Economics of Sustainable Development: The Case of India (Natural Resource Management and Policy)"	Surender Kumar and Shunsuke Managi	Springer Switzerland	2009
2	Corporate Social Responsibility in Developing and Emerging Markets	Onyeka Osuji	Cambridge	New Edition June 2022
3	Smart Cities for Sustainable Development	Ram Kumar Mishra, Ch Lakshmi Kumari, Sandeep Chachra, P.S. Janaki Krishna	Springer Switzerland	March 2022

4	Sustainable Development: LinkingEconomy, Society, Environment	Tracey Strange andAnne Bayley		
5	Management Of Resources ForSustainable Devpt	Sushma Goyal	The Orient Blackswan	2016
6	Energy, Environment and SustainableDevelopment: Issues and Policies	S. Ramaswamy Sathis G. Kumar	Regal Publications	2009
7	The New Map: Energy, Climate, and theClash of Nations	Daniel Yergin	Penguin Press	Septe mber 2015
8	Contributions of Education for Sustainable Development (ESD) toQuality Education:	Laurie, R., Nonoyama-Tarumi, Y., Mckeown, R., & Hopkins, C.	A Synthesis of Research. Journal of Education for Sustainable Development, 10(2), 226–242.	2016
9	Sustainable Results in Development: Using the SDGs for Shared Results and Impact	OECD	OECD Publishing, Paris	2019
10	Development Discourse and Global History from colonialism to the sustainable development goals	Ziai, Aram	Routledge, London & New York	2016
11	Sustainable Development Goals AnIndian Perspective,	Hazra, Somnath., Bhukta, Anindya	Springer Switzerland	2020
12	Environmental Ecology, Biodiversityand Climate Change	HM Saxena	Rawat Publication	January 2021
13	https://www.un.org/sustainabledevelopment/			
14	https://www.aiu.ac.in/documents/AIU_Publications/UN-SDG goals			
15	https://www.unesco.org/en/education-sustainable-development			
16	https://onlinecourses.nptel.ac.in/noc23_hs57/preview			
17	ttps://www.iau-hesd.net/news/5180-berlin-declaration-education-sustainable development-adopted-unesco-esd-conference-17-19			

****

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Curriculum Development Team

1. **Dr. Akhilesh K. Waoo, HOD, Department of Computer Science and Engineering.**
2. **Dr. Pramod Singh, Assistant Professor, Department of Computer Science and Engineering.**
3. **Ms. Shruti Gupta, Assistant Professor, Department of Computer Science and Engineering.**
4. **Ms. Pragya Shrivastava, Assistant Professor, Department of Computer Science and Engineering.**
5. **Mr. Lokendra Gaur, Assistant Professor, Department of Computer Science and Engineering.**
6. **Mr. Vinay Kumar Dwivedi, Assistant Professor, Department of Computer Science and Engineering.**
7. **Ms. Pinki Sharma, Assistant Professor, Department of Computer Science and Engineering.**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: HSMC08
Subject Title: Sustainable Development Goals

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Teamwork	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: Examinecritically the 17 newly minted UN Sustainable Development Goals and understand thehistorical evolution, keytheories, and concepts of sustainable Development.	1	1	1	2	3	2	3	2	2	1	3	2	2	3
CO2: Identify andapply methods for assessing the achievement ofsustainable development anddiscover the science,technology, economics, andpolitics underlying theconcepts of Sustainability.	1	1	2	2	1	2	3	2	1	1	2	2	2	2

CO3: Understand the implications ofoveruse of resources,population growth and economic growth and sustainability and explore the challengesthe society faces in making transition to renewable resource use.	**2**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**1**
CO4: Develop skillsto understand attitudes on individuals, society and their role regarding causes andsolutions in the field ofsustainable development and applycritical thinking skillsto evaluate the quality,credibility and limitations of anargument for solution.	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**1**	**2**	**3**	**3**	**3**
CO5: Describe the steps of the design thinking methodology and how design thinking can accelerate effective SDG implementation. Deepen knowledge and pedagogical toolsto incorporate values-based education for sustainable development in educational programmes and processes	**-**	**-**	**-**	**1**	**1**	**3**	**3**	**3**	**1**	**1**	**2**	**2**	**3**	**3**

Legend:1–Low,2–Medium, 3–High

Course Curriculum Map:

Os & PSOs No.	Cos No. & Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO1:** Examine critically the 17 newly minted UN Sustainable Development Goals and understand the historical evolution, key theories, and concepts of sustainable development.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 Introduction to Sustainable Development: 1.1,1.2,1.3,1.4,1.5,1.6,	1
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO2:** Identify and apply methods for assessing the achievement of Sustainable development and discover the science, technology, economics, and politics underlying the concepts of sustainability.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2 Special focus on SDG 4-Quality Education and Lifelong Learning: 2.1,2.2,2.3,2.4,2.5,2.6	1,
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO3:** Understand the implications of overuse of resources, population growth and economic growthand sustainability and explore the challenges the society faces in making transition to renewable resource use.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 : Understanding the SDGs: 3.1, 3.2,3.3,3.4,3.5,3.6	1,

PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO4:** Develop skills to understand attitudes on individuals, society and their role regarding causes and solutions in the field of sustainable development and apply critical thinking skills to evaluate the quality, credibility and limitations of an argument for solution.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 : Climate Change, Energy and Sustainable Development 4.1, 4.2,4.3,4.4,4.5,4.6	1,
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO5:** Describe the steps of the design thinking methodologyand how design thinking can accelerate effective SDG implementation. Deepen knowledge and pedagogical tools to incorporate values-based education for sustainable development in educational programmes and processes	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit 5: Sustainable Business Practices, LCA and World peace and justice 5.1,5.2,5.3,5.4,5.5,5.6	1

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-II

Course Code: **BSC103**

Course Title: **Chemistry-1**

Pre- requisite: Students must have fundamental knowledge of mathematics, nature of molecule, valence shell electron pair repulsion theory, and different concentration terms to understand the concept of engineering chemistry.

Rationale: The students studying Chemistry-1 should possess foundational understanding about basic mathematics, different concentration terms and valence shell electron pair repulsion theory to understand the basic principle of chromatography and spectroscopic analysis.

Course Outcomes: After the completion of this course, the learner will able to

BSC103.1: Apply VSEPR theory to predict the three-dimensional shapes of molecules.

BSC103.2: Describe the concept of symmetry, chirality and optical activity and synthesize chiral drug

BSC103.3: Explain and apply the concept of Intermolecular forces, Hydrogen bond, and transition metal complexes.

BSC103.4: Predict the concept of thermodynamics, free energy & entropy and apply Nernst equation, water chemistry as well as explain concept of acid-base, metallurgy, Emf cell and corrosion.

BSC103.5: Collectively aim to equip students with a comprehensive understanding of the theoretical principles, practical methodologies, and diverse applications of various spectroscopic techniques.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
BSC	BSC 103	Chemistry-1	3	2	2	1	8	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e., Lecture (L) and Tutorial (T)and others),

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini projected.),

SL: Self-Learning,

C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback teachers ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Course Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks (PRA + ESA)**
			Class/ Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+ SA+CAT +AT)		
BSC	BSC 103	Chemistry-1	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
BSC	BSC 103-L	Chemistry-1	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion

BSC103.1: Apply VSEPR theory to predict the three-dimensional shapes of molecules.

Approximate Hours

Item	App X Hrs.
Cl	9
LI	6
SW	2
SL	1
Total	18

Session Outcomes (SOs)	LaboratoryInstruction (LI)	Class room Instruction(CI)	Self Learning(SL)
SO1.Describe the classification of different types of orbit orbitals SO1.2 Discuss the fundamental concept of wave function and probability distribution curve SO1.3 Explain and apply Atomic Spectroscopy: Energies of atomic orbital’s	LI1.1. Determination of specific density of given liquid LI.1.2. Determination of viscosity of given liquid LI.1.3 Paper chromatography,Thin layer Chromatography.	**Unit 1: Atomic and Molecular Structure & Periodic properties** **1.1.** Introduction of orbit, orbitals and electronic configuration **1.2.** Schrodinger wave equation and its derivation **1.3.** Hybridization and typesof Hybridization. Intermixing of orbitals	1. History of development of periodic table **2.** Electronegativity and its application

SO1.4 Apply concept of VSEPR in the determination of geometry of various molecules. SO1.5 Restate molecular energy level diagram of N2F2 and O2 molecules.		. **1.4.** VSEPR theory, bond pair and lone pair repulsion, **1.5.** Determination of geometry ofthe molecules **1.6.** Molecular orbital theory, **1.7.** Molecular energy level diagram and bond order for homo and hetero atomic molecules **1.8.** Periodicity of atomic size and ionization energy **1.9** Electron gain enthalpy and types of electron gain enthalpy	3.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Applications of molecular orbital theory for the determination of bond order and magnetic behavior.

b. Mini Project:

i. Hybridization and its application.

c. Other Activities (Specify):

i. Write an essay on different type of chemical bond.

BSC103.2: Describe the concept of symmetry, chirality and optical activity and synthesize chiral drug molecule.

Approximate Hours

Item	App X Hrs.
Cl	9
LI	6
SW	2
SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction(LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1understand the concept of representations of 3 dimensional structures SO2.2 explain structural isomers and stereoisomers SO2.3 describe symmetry, chirality and optical activity	LI.2.1.To Synthesize drug molecules and determine its percentage yieldLI.2.2.To determine the acidvalue or saponification value of oil/fat	**UNIT 2: Stereochemistry, Organic reactions and synthesis of a drug molecule** 2.1 Representations of 3 dimensional structures 2.2 Structural isomers and stereoisomers 2.3 Symmetry and chirality, optical activity and absolute configurations	1. Plane of polarized light 2. Types of symmetry

SO2.4 explain and identify different types ofreactions with mechanisms SO2.5 apply the concept of mechanisms to synthesize drug molecules	LI2.3.To determine partition coefficient of a organic substance between two immiscible liquids.	2.4 enantiomers, diastereomers 2.5 Isomerism in transitional metal compounds 2.6 Introduction to reactions involving substitution reaction 2.7 Addition, elimination, oxidation, reduction reaction 2.8 cyclization and ring openings 2.9 Synthesis of a commonly used drug molecule	

SW-2 Suggested Sessional Work (SW):

Assignments: Conformational Isomerism and conformational analysis

BSC-103.3: understand the concept of Intermolecular forces, Hydrogen bond, Transitionmetal complexes by applying this concept

Approximate Hours

Item	App X Hrs.
Cl	9
LI	6
SW	2
SL	1
Total	18

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Describe Ionic, dipolar, London, dispersion	LI3.1. Synthesis a inorganic metal complex	**Unit-3: Intermolecular forces and Transition metal complexes** **3.1.** Ionic, dipolar,	1. Coordination compounds IUPAC name and Werner

force, vander Waals interaction SO2.2explain Hydrogen bond and types of hydrogen bond SO2.3 Coordination compounds SO2.4 describe Metallig andbonding by VBT SO2.5 explain Metal ligand bonding by CFT	LI3.2. Determine the two acid and two basics radical LI.2.3. Determinationof chloride content of water	London dispersion force **3.2.** Vander Waals interactions **3.3.** Hydrogen bond, types of hydrogen bond. **3.4.** Coordination compounds **3.5.** Metal ligand bonding by VBT **3.6.** Metal ligand bonding by CFT **3.7.** The energy level diagrams for transition metal ions and their magnetic properties. **3.8.** The energy level diagrams for transition metal ions and their magnetic properties **3.9.** The energy level diagrams for transition metal ions and their magnetic properties	theory 2. The energy level diagrams for transition metal ions and their magnetic properties

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. VBT theory, CFT theory, The energy level diagrams for transition metal ions and theirmagnetic properties

b. Mini Project:

i. applications of transition metal complexes

BSC103.4 Predict the concept of thermodynamics, free energy & entropy and apply Nernst equation, water chemistry as well as explain concept of acid-base, metallurgy, Emf cell and corrosion.

Approximate Hours

Item	Appx. Hrs.
Cl	9
LI	6
SW	2
SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Restate concept of free energy, Free energy, Enthalpy Entropy and types of different thermodynamic system **SO4.2**Discuss the fundamental concept of cell representation standard EMF of cell **SO4.3** Explain and apply different types of concepts used in softening of water	LI.4.1. Determination of hardness of water LI.4.2. Determination of alkalinity ofwater LI.4.3. Chemical analysis of a salt.	**Unit 4: Use of free energy in chemical equilibrium** **4.1**Introductionenergy, Enthalpy, Entropy, system and surroundings **4.2** Cell notation of cell, Nernst equation and its application **4.3** Water chemistry, Hardness of water, Temporary and permanent hardness **4.4** Water softening methods **4.5** Introduction of	1- derivation of Nernst equation.

and purification of water **SO4.4** Understand and applyconcept of corrosionfor the development of green corrosion inhibitors **SO4.5** Understand different acid-base concepts, ionic and solubility product of salts		Corrosion, Mechanism of corrosion **4.6** Factors affecting rate of corrosion **4.7** Various acid-base concepts, Arrhenius concept, **4.8** Lewis acid-base concept, Bronsted Lowryconcept **4.9** Brief idea about ionic and solubility equilibria	

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Applications of green corrosion inhibitors

b. **Mini Project:**
   i. Analysis of water quality parameters.

c. **Other Activities (Specify):**
   i. Write an essay on acid-base concepts, ionic and solubility product of salts.

BSC103.5: Collectively aim to equip students with a comprehensive understanding of the theoretical principles, practical methodologies, and diverse applications of various spectroscopic techniques.

Approximate Hours

Item	Appx. Hrs.
Cl	9
LI	6
SW	2
SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self-Learning (SL)
SO5.1Understand Identification and classification of different types of EMR and vibrational modes in molecules. SO5.2 Understand the fundamental principles of vibrational and rotational spectroscopy, including the interaction of light with molecular vibrations, the concept of infrared (IR) SO5.3 Explain and apply Atomic Spectroscopy: Energies of atomic orbital's SO5.4 Understand and apply concept of NMR, Nuclear spin, nuclearresonance. SO5.5 Understand introduction of X-ray Diffraction determination crystallographic structure of materials.	LI.5.1. Verification of Beer- Lambert law LI5.2. Determination of absorption maximum of a given organic compound. LI.5.3. Determination of cell constant and conductance of solutions.	Unit 5: Spectroscopic techniques and applications 5.1 Introduction of spectroscopy, discovery, properties and types of electromagnetic radiation. 5.2 Classification of different types of vibrational modes in molecules (stretching, bending, torsional, etc.).IR activity. **5.3** Energies of atomic orbitals and electronic transition, frank Condon principle. **5.4** Introduction of NMR, 5.5. Nuclear spin, nuclear resonance 5.6 Principle and instrumentation of NMR **5.7.** Shielding and de shielding of magnetic nuclei. **5.8.** surface characterization techniques **5.9.** Diffraction and scattering	1. Applications Nuclear magnetic resonance and magnetic resonance imaging

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Applications Nuclear magnetic resonance and magnetic resonance imaging

b. Mini Project:

i. Fluorescence and its applications in medicine

c. Other Activities (Specify):

i. Write an essay on surface characterization techniques. Diffraction and scattering.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Instruction (LI)	Sessional Work (SW)	Self-Learning (SL)	Total hour (Cl+LI+SW+SI)
BSC103.1: Apply VSEPR theory to predict the three-dimensional shapes of molecules.	09	06	02	01	16
BSC103.2: Describe the concept of symmetry, chirality and optical activity and synthesize chiral drug molecule	09	06	02	01	18
BSC103.3: Explain and apply the concept of Intermolecular forces, Hydrogen bond, and transition metal complexes	09	06	02	01	16
BSC103.4: Predict the concept of thermodynamics, free energy & entropy and apply Nernst equation, water chemistry as well as explain concept of acid-base, metallurgy, Emf cell and corrosion.	09	06	02	01	16
BSC103.5: Collectively aim to equip students with a comprehensive understanding of the theoretical principles, practical methodologies, and diverse applications of various spectroscopic techniques.	09	06	02	01	14
Total Hours	45	30	10	05	90

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Atomic and Molecular Structure &Periodic properties	03	01	01	05
CO-2	Stereochemistry, Organic reactions and synthesis of a drug molecule	02	06	02	10
CO-3	Intermolecular forces and Transition metal complexes	03	07	05	15
CO-4	Use of free energy in chemical equilibrium	-	10	05	15
CO-5	Spectroscopic techniques and applications	03	02	-	05
Total		11	26	13	50

The end of semester assessment for Chemistry I will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers forabove tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to NCL, CSIR laboratories
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	A textbook of Chemistry-1	Shyamala Sundara	S. Chand	Edition 2008
2	A Textbook of Engineering Chemistry	Shashi Chawla |	Dhanpat Rai Prakashan	Edition 2020
3	A Textbook of Engineering Chemistry	PC Jain and Monika Jain	Dhanpat Rai Prakashan	Edition2018

Suggested Web Sources:

1. https://nptel.ac.in/course.html
2. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=5
3. https://swayam.gov.in/explorer?category=Chemistry

Mode of Delivery: Lecture, demonstration, E-tutoring, discussion, assignments, quizzes,case study, power point;

LMS/ICT Tools: Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point,Online Resources.

****

Curriculum Development Team

1. Dr. Samit Kumar , Associate professor Department of chemistry
2. Mrs. Nahid Usmani, Assistant professor Department of chemistry
3. Kanha Singh Tiwari, Assistant professor Department of chemistry

COs,POs and PSOs Mapping

Program Title: B.Tech. Electrical Engineering
Course Title: Chemistry- I
Course Code: BSC103

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO 1	**PO 2**	**PO3**	**PO 1**	**PO 2**	**PO6**	**PO 7**	**PO 8**	**PO9**	**PO 10**	**PO 11**	**PO12**	**PSO 1**	**PSO 2**
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Apply VSEPR theory to predict the three-dimensional shapes of molecules.	**3**	**1**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**2**	**2**	**3**
CO 2 Describe the concept of symmetry, chirality and optical activity and synthesize chiral drug molecule.	**2**	**1**	**2**	**2**	**1**	**2**	**3**	**2**	**1**	**1**	**2**	**2**	**2**	**3**
CO3 Explain and apply the concept of Intermolecular forces, Hydrogen bond, and transition metal complexes.	**2**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**3**
CO4: Predict the concept of thermodynamics, free energy & entropy and apply Nernst equation, water chemistry as well as explain concept of acid-base, metallurgy, Emf cell and corrosion.	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**1**	**2**	**3**	**3**	**3**
CO5 Collectively aim to equip students with a comprehensive understanding of the theoretical principles, practical methodologies, and diverse applications of various spectroscopic techniques	**2**	**-**	**-**	**1**	**1**	**3**	**3**	**3**	**1**	**1**	**2**	**2**	**3**	**3**

Legend:1–Low,2–Medium, 3–High

Course Curriculum Map:

POs &PSOs No.	Cos. No. &Titles	SOs No.	Laboratory instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO1,2,3,4,5, 6, 7,8,9,10,11,12 PSO 1,2	**CO1:** Apply VSEPR theory to predict the three-dimensional shapes of molecules.	SO1.1 SO1.2 SO1.3, SO1.4 SO1.5	LI.1.1, LI.1.2, LI.1.3	**Unit-1.0 Atomic and Molecular Structure & Periodic properties** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	1,2
PO1,2,3,4,5, 6, 7,8,9,10,11,12 PSO 1,2	**CO2:** Describe the concept of symmetry, chirality and optical activity and synthesize chiral drugmolecule.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LI.2.1, LI.2.2, LI.2.3	Unit-2 **Stereochemistry, Organic reactions and synthesis of a drug molecule** 2.1,2.2,2.3,2.4,2.5,2.6, 2.7, 2.8,2.9	1,2
PO1,2,3,4,5, 6, 7,8,9,10,11,12 PSO 1,2	**CO3** Explain and apply the concept of Intermolecular forces, Hydrogen bond, and transition metal complexes.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	LI.3.1, LI.3.2 LI.3.3	Unit-3 **Intermolecular forces and Transition metal complexes** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1,2
PO1,2,3,4,5, 6, 7,8,9,10,11,12 PSO 1,2	**CO 4** Predict the concept of thermodynamics, free energy & entropy and apply Nernst equation,water chemistry as well as explainconcept of acid-base, metallurgy, Emf cell and corrosion	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LI.4.1, LI.4.2, LI.4.3	Unit-4: **Use of free energy in** chemical **equilibrium** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9	1
PO1,2,3,4,5, 6, 7,8,9,10,11,12 PSO 1,2	**CO 5** Collectively aim to equip students with a comprehensive understanding of the theoretical principles, practical methodologies, and diverse applications of various spectroscopic techniques.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	LI.1.1, LI.1.2, LI.1.3	**Unit 5: Spectroscopic** techniques **and applications** 5.1,5.2,5.3,5.4,5.5,5.6,5.75.8,5.9	1

Semester-II

Course Code:	**BSC104**
Course Title :	**Mathematics -II**
Pre- requisite:	Objective of this course is to familiarize the prospective engineers with techniques in Ordinary and partial differential equations and Laplace transform. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.
Rationale:	The program aims to develop the tool of power series and Fourier series for learning advanced engineering mathematics

Course Outcome:

BSC104.1 Understand the importance of Laplace transform and elementary properties of Laplace transform

BSC104.2 To introduce effective mathematical tools for the solutions of ordinary differential equations and solutions with Bessel functions and Legendre functions

BSC104.3 Demonstrate an understanding of the Vector Calculus

BSC104.4 Define and recognize the method to solve Sequences and series

BSC104.5 Students will create the concept of a Partial Differential Equations

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
BSC	BSC104	Mathematics -II	4	0	1	1	6	4

Legend:
CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+ CT+SA +CAT +AT)		
BSC	BSC104	Mathematics-II	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

BSC104.1 Understand the importance of Laplace transforms and elementary properties of Laplace transform

Approximate Hours

Item	AppX Hrs
Cl	13
LI	0
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the concept ofLaplace transform of elementary functions **SO1.2** Understand the Laplace transform of derivatives **SO1.3** Understand the Inverse Laplace transform **SO1.4** Understand the Application of Laplace transform		**Unit-1.0** 1.1 Introduction of Laplace transform 1.2 Laplace transform of elementary functions 1.3 Linearity property 1.4 Properties of Laplace transform, 1.5 Laplace transform of derivatives 1.6 Laplace transform of Integral 1.7 Multiplication by t^n 1.8 Division by t 1.9 Inverse Laplace transform 1.10 First shifting theorem 1.11 Second shifting Property 1.12 Convolution theorem 1.13 Application of Laplace transform	**SL1.1** Change of scale property

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

1. Example on Properties of Laplace transform
2. Example on Laplace transform of derivatives
3. Example on Laplace transform of Integral
4. Example on Multiplication by t^n
5. Example on First shifting theorem

b. Mini Project:

i. Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

BSC104.2: To introduce effective mathematical tools for the solutions of ordinary differential equations and solutions with Bessel functions and Legendre functions

Approximate Hours

Item	AppX Hrs
Cl	11
LI	0
SW	1
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1Understand the concept Solving Second order linear differential,		**2.1** Linear differential Equation with constant coefficients	**SL2.1**Examples of Frobenius method

SO2.2 Understand the Solution by variation of parameters SO2.3 Understand the Power series solutions: SO2.4 Understand the Legendre's equations and Legendre polynomials		**2.2** Complimentary Function and Particular integral **Second order linear differential Equations with variable coefficients:** **2.3** Solution by Inspection Method **2.4** Solution by change of dependent variable **2.5** Solution by change of Independent variable **2.6** Solution by variation of parameters **2.7** Power series solutions(Frobenius method): **2.8** Series for Ordinary Point **2.9** Legendre's equations and **2.10** Bessel's equation and **2.11** Tutorial	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Example on Solution by variation of parameters
2. Example on Power series solutions:
3. Example on Legendre's equations and
4. Example on Legendre polynomials
5. Example on Frobenius method

b. Mini Project:

i. Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

BSC104.3 Demonstrate an understanding of the Vector Calculus

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 understand the scalar and vector point function SO3.2 Understand the Line integrals, Surface integrals, Volume integrals SO3.3 Understand the Gradient ,Curl, divergence SO3.4Understand the Gauss Divergence theorems, Stoke's theorems		3.1 Differentiation of vector 3.2 scalar and vector point function 3.3 Directional derivatives 3.4 Gradient 3.5 Curl 3.6 Divergence 3.7 Line integrals, 3.8 Surface integrals 3.9 Volume integrals 3.10 Green's theorems 3.11 Gauss Divergence theorems 3.12 Stoke's theorems	**SL.1**Examples on Stoke's theorems

SW-3 Suggested Sessional Work (SW):

a. Assignments:

1. Example on Directional derivatives
2. Example on Gradient
3. Example on Divergence
4. Example on Surface integrals
5. Stoke’s theorems

b. Mini Project:

i. Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

i. Quiz, Class Test.

BSC104.4 Define and recognize the method to solve Sequences and series

Approximate Hours

Item	AppX Hrs
Cl	13
LI	0
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand Convergence and Divergence of sequence SO4.2 Understand the Tests for convergence SO4.3Understand Fourier series SO4.4 understand and Calculation of limits		**4.1** Limits of sequence of numbers **4.2** Convergence and Divergence of sequence **4.3** Cauchy sequence **4.4** Calculation of limits **4.5** Infinite series **4.6** Tests for convergence **4.7** Rabbe test and logarithmic test **4.8** Comparison test **4.9** Fourier series **4.10** Even and odd function **4.11** Half range sine and cosine series **4.12** Half range cosine series **4.13** Parseval’s theorem.	**SL4.1**Some theorem on sequence

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**

1. Example on Cauchy sequence
2.Example on Tests for convergence
3.Example on Comparison test
4.Example on Fourier series
5.Example on Even and odd function

b. Mini Project:

i. Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

BSC104.5 Students will create the concept of a Partial Differential Equations

Approximate Hours

Item	AppX Hrs
Cl	11
LI	0
SW	1
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand the Solutions of first order linear PDE **SO5.2** Understand the Solution to homogenous and Non-homogenous linear PDE **SO5.3** Understand the First order PDE **SO5.4** Understand PDE of Second order by particular integral method		5.1 Definition of Partial Differential Equations 5.2 First order PDE 5.3 Solutions of first order linear PDE 5.4 Solution to homogenous PDE 5.5 Non-homogenous linear PDE 5.6 PDE of Second order by complimentary function and 5.7 PDE of Second order by particular integral method. 5.8 Lagrange's Linear equation, 5.9 Charpit's method 5.10 Separation of variable method for the solution of heat equations 5.11 wave equations	**SL.1** Problems on PDE

SW-3 Suggested Sessional Work (SW):

a. **Assignments**

1. Example on linear PDE
2. Example on Solution to homogenous PDE
3. Example on Lagrange's Linear equation,
4. Example on PDE of Second order by complimentary function and
5. Example on Charit's method

b. Mini Project:

i. Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
BSC104.1 Understand the importance of Laplace transform and elementary properties of Laplace transform	13	1	1	15
BSC104.2 To introduce effective mathematical tools for the solutions of ordinary differential equations and solutions with Bessel functions and Legendre functions	11	1	1	13
BSC104.3 Demonstrate an understanding of the Vector Calculus	12	1	1	14
BSC104.4 Define and recognize the method to solve Sequences and series	13	1	1	15
BSC104.5 Students will create the concept of a Partial Differential Equations	11	1	1	14
Total Hours	60	5	5	70

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	**U**	**A**	
CO-1	Understand the importance of Laplace transform and elementary properties of Laplace transform	03	01	01	05
CO-2	To introduce effective mathematical tools for the solutions of ordinary differential equations and solutions with Bessel functions and Legendre functions	02	06	02	10
CO-3	Demonstrate an understanding of the Vector Calculus	03	07	05	15
CO-4	Define and recognize the method to solve Sequences and series	-	10	05	15
CO-5	Students will create the concept of a Partial Differential Equations	03	02	-	05
Total		11	26	13	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Mathematics-II will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies

1. Improved Lecture
2. Tutorial
3. Presentation
4. Group Discussion
5. Online sources
6. Seminar
7. Works

Suggested Learning Resources:

a) Books :

S.No.	Title	Author	Publisher	Edition & Year
1	Engineering Mathematics-II	D.K, Jain	Shree Ram Prakashan.	7th Edition 2015-16
2	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	36th Edition, 2010
3	Engineering Mathematics-II	D.C.Agrawal	Shree Sai Prakashan	10th Edition 2018
4	Higher EngineeringMathematics	B.V.Ramana	Tata McGraw Hill	11th Reprint, 2010.

****

Curriculum Development Team

1. **Dr.Sudha Agrawal, HOD, Department of Mathematics.**
2. **Dr.Ekta Shrivastava , Assistant Professor, Department of Mathematics.**
3. **Mr.Neelkanth Napit, Assistant Professor, Department of Mathematics.**
4. **Mrs.Vandana Soni, Assistant Professor, Department of Mathematics.**
5. **Mr.Radhakrishna Shukla, Assistant Professor, Department of Mathematics.**
6. **Mr.Ghanhyam sen, Assistant Professor, Department of Mathematics.**
7. **Ms. Pushpa Kushwaha, Assistant Professor, Department of Mathematics.**
8. **Ms. Arpana Tripathi, Assistant Professor, Department of Mathematics.**

COs, POs and PSOs Mapping

Course Title: B. Tech. Electrical Engineering
Course Code: BSC104
Course Title: Mathematics-II

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1-Understand the importance of Laplace transform and elementary properties of Laplace transform	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO2- To introduce effective mathematical tools for the solutions of ordinary differential equations and solutions with Bessel functions and Legendre functions	3	3	3	3	2	2	1	3	2	2	2	3	3	2
CO3- Demonstrate an understanding of the Vector Calculus	3	2	3	2	2	1	2	2	2	2	2	3	3	2
CO4- Define and recognize the method to solve Sequences and series	3	3	2	2	2	2	2	3	2	2	2	2	2	3
CO5- Students will create the concept of a Partial Differential Equations	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO1-**Understand the importance of Laplace transform and elementary properties of Laplace transform	SO1.1 SO1.2 SO1.3 SO1.4		Unit-1.0 Laplace Transform1.1,1.2,1.3,1.4,1.5,1.6.1.7,1.8,1.9 ,1.10,1.11,1.12,1.13	SL1.1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO2-** To introduce effective mathematical tools for the solutions of ordinary differential equations and solutions with Bessel functions and Legendre functions	SO2.1 SO2.2 SO2.3 So2.4		Unit-2 Ordinary differential equations of higher orders:2.1, 2.2, 2.3, 2.4,2.5,2.6,2.7,2.8,2.9,2.10,2.11	SL2.1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO3-** Demonstrate an understanding of the Vector Calculus	SO3.1 SO3.2 SO3.3 SO3.4		Unit-3Vector Calculus 3.1, 3.2, 3.3, 3.4, 3.5 ,3.6,3.7,3.8,3.9,3.10,3.11,3.12	SL3.1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO4-** Define and recognize the method to solve Sequences and series	SO4.1 SO4.2 SO4.3 SO4.4		Unit-4 Sequences and series 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8,4.9,4.10,4.11,4.12,4.13	SL4.1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO5-** Students will create the concept of a Partial Differential Equations	SO5.1 SO5.2 SO5.3 SO5.4		Unit-5Partial Differential Equations5.1, 5.2, 5.3, 5.4, 5.5, 5.6 ,5.7,5.8,5.9,5.10,5.11	SL5.1

Semester – II

Course Code: **ESC104**

Course Title: **Programming for problem solving**

Pre- requisite: Basic computer skills, Mathematics, logical thinking, problem solving skills

Rationale: Programming allows us to create something from scratch and have a tangible impact on the world around us. By mastering this skill, we become active agents of change and pave the way for unique and revolutionary solutions. The aim of this course is to develop logical skills and basic technical skills so that students should be able to solve basic computing problems. The students should be able to learn the basic of any computer programming language.

Course Outcomes: After the completion of this subject, students will be able to

ESC104.1: Understand the basic concept of Programming languages, software, algorithm and flowchart.
ESC104.2: Acquire knowledge regarding the building blocks of programming language.
ESC104.3: Apply python for solving basic programming solutions.
ESC104.4: Create algorithms using learnt programming skills.
ESC104.5: Understand real world problems and developing computer solutions for those.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours per Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Engineering Science Course (ESC)	ESC104	Programming for problem solving	3	4	1	1	9	5

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others).

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)						
			Progressive Assessment (PRA)					End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 Assignments 3 marks Each (CA)	2 Class Test (best 2 out of 3) 10 marks Each (CT)	One Seminar (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+AT)		
ESC	ESC104	Programming for problem solving	15	20	10	5	50	50	100

Practical

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
ESC	ESC 104-L	Programming for problem solving	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

ESC104.1: Understand the basic concept of Programming languages, software, algorithm and flowchart**.**

Approximate Hours

Item	Appx. Hrs.
Cl	7
LI	12
SW	2
SL	1
Total	22

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1. Understand types of programming languages. **SO1.2.** Utilize OperatingSystem **SO1.3.** Compare compiler, linker, loader **SO1.4.** Create algorithm and flow charts for problem	**1.** Running instructions in Interactive interpreter and a Python Script. **2.** Write a program to purposefully raise Indentation Error and Correct it. **3.** Create Flow chart for an organization **4.** Create Flow chart for an education system **5.** Compare various operating systems	**Unit-1** **Introduction to Programming** **1.1** Evolution of languages: Machine languages, Assemblylanguages, High-level languages construction eras. **1.2** Software requirements for programming	1. Different types of programming languages examples. 2. Learn about various operating systems.

	6. Write five features of Notepad	**1.3** System software like operating system **1.4** compiler, linker, loader **1.5** Application programs like editor. **1.6** Algorithm specification of algorithm **1.7** . Flowcharts	

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   1. Create algorithms for some real-life problems.
   2. Create flowcharts for problems.

b. **Mini Project:**
   i. Flow diagram of working of a university.

c. **Other Activities (Specify):**
   NA

ESC104.2: Acquire knowledge regarding the building blocks of programming language.

Approximate Hours

Item	Appx. Hrs.
Cl	12
LI	12
SW	2
SL	1
Total	27

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1. To Understand the datatypes **SO2.2.** Identify Expressions **SO2.3.** Apply operators **SO2.4.** Use list, string tuples	**1.** Write a program to demonstrate basic data type in python. **2.** Write a program to compute distance between two points taking input from the user **3.** Write a program add.py that takes 2 numbers as command line arguments and prints its sum. **4.** Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . 1/10. **5.** Write a program using a for loop that loops over a sequence. What is sequence? **6.** Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero..	**Unit-2 Datatypes and Operators, Variables, Sequences and Iteration** 2.1. Data Types 2.2. Different types of Data types 2.3.Expressions, Precedence Rules 2.4. Operators 2.5. Types of Operators 2.6.Local Variables 2.7.Global Variables 2.8.List 2.9. String 2.10. Tuples 2.11. Sequence Mutations 2.12. Accumulation Patterns.	1. Operator precedence 2. Scope of variables

SW-2 Suggested Sessional Work(SW):

a. Assignments:

1. Compare List and Tuples.
2. String functions with example.

b. Mini Project:

Create a Calculator.

c. Other Activities(Specify):

NA

ESC104.3: Gain an understanding of the various types of Conditional Statements, Loops, Arrays and Strings.

Approximate Hours

Item	Appx. Hrs.
Cl	10
LI	12
SW	2
SL	1
Total	25

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1. To Understand the loop types **SO3.2.** Identify the looping Expressions **SO3.3.** Apply arrays **SO3.4.** Use of user defined datatype	**LI.3.1.** Write a Program for checking whether the given number is an even number or not. Using a for loop. **LI.3.2.** Write a program using a while loop that asks the user for a number, and **LI.3.3.** prints a countdown from that number to zero. **LI.3.4.** Write function to compute gcd, lcm of two numbers. **LI.3.5.** Write a program to implement Merge sort. **LI.3.6.** Write a program to implement Selection sort, Insertion sort	**Unit-3 : Conditional Statements, Loops, Arrays and Strings, User Defined Data Types** 3.1 If-else statement, 3.2 For loop, 3.3 While Loop, 3.4 Nested Iteration, 3.5 Concept and use of arrays 3.6 Declaration and usage of arrays, 3.7 , 2-dimensionalarrays, 3.8 Different types of user defined datatypes 3.9 Structre 3.10 3.10Union	1. Loops to access array elements 2.Member access in user defined data type .

SW-3 Suggested Sessional Work (SW):

a. Assignments:

a. Compare the looping statements
b. Use of user defined data type with example.

b. Mini Project:

Create a stopwatch.

ESC104.4: Familiarize with a concise overview of the Dictionaries and methods.

Approximate Hours

Item	Appx. Hrs.
Cl	10
LI	12
SW	2
SL	1
Total	25

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1. Understand the concepts of Dictionaries and Dictionary Accumulation **SO4.2.**Identify the Functions/Methods **SO4.3.**Apply functions **SO4.4.**Use of Functions/ Methods	**1.** Write a program to count the numbers of characters in the string and **2.** store them in a dictionary data structure. **3.**Write a program to use split and join methods in the string and **4.** trace a birthday of a person with a dictionary data structure. **5** Write a program for user define function. **6.** Write a program to demonstrate the use of Array.	**Unit-4 : Dictionaries and Dictionary Accumulation, Functions/Methods** 4.1 Dictionary Basics 4.2 Operations 4.3 Methods, accumulation. 4.4 Advantage of modularizing program into functions. 4.5 Function definition. 4.6 Function invocation. 4.7 Positional Parameter Passing 4.8 Passing arrays to functions 4.9 Recursion 4.10 Library Functions	1. Preparation of process Dictionary 2. A typical Positional Parameter Passing .

SW-4 Suggested Sessional Work (SW):

a. Assignments:

1. Write a program that reads a string from keyboard and prints the unique words
2. Use of user defined function with example.

b. Mini Project:

Map Two Lists into A Dictionary.

c. Other Activities(Specify):

NA.

ESC104.5: Comprehend the functions of different File Handling and Memory Management.

Approximate Hours

Item	Appx. Hrs.
Cl	6
LI	12
SW	2
SL	1
Total	21

Session Outcomes (SOs)	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning (SL)
SO5.1 Understanding the file handlingtask **SO5.2** know the functions of filehandling **SO5.3** Importance of .csv file **SO5.4** Use of Memory Management	**1.** Write a program to count frequency of characters in a given file. **2.**Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file? **3**Write a program to read data from a file. **4.** Write a program to write data into a file. **5.**Write a program to copy data from one file to another. **6.**Write a program for memory management	**Unit 5: File Handling and Memory Management** 5.1File Handling 5.2Memory Management 5.3Concepts of files and basic file operations. 5.4Writing Data to a .csv File. 5.5Reading Data to from a .csvFile. 5.6Memory ManagementOperations.	1. Role of file handling. 2. Working of .csv file

SW-5 Suggested Sessional Work (SW):

a. Assignments:
List the different file handling functions .

b. Mini Project:
Data base management of any fields by using file handling.

c. Other Activities(Specify):
NA.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	LI (Laboratory Instruction)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
ESC104.1: At the end of this chapter the student will know the basic concept of programming.	7	12	2	1	22
ESC104.2: At the end of this chapter the student will use Operators in programs.	12	12	2	1	27
ESC104.3: At the end of this chapter the student will describe the control flow statements.	10	12	2	1	25
ESC104.4: At the end of this chapter the student will make function and dictionary	10	12	2	1	25
ESC104.5: Comprehend the functions of .csv andfile handling functions.	6	12	2	1	21
Total Hours	45	60	10	5	120

Suggestion for End Semester Assessment

Suggested Specification Table(ForESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CT101.1	Understand the basic concept of Programming languages, software, algorithm and flowchart.	02	08	01	11
CT101.2	Acquire knowledge regarding the building blocks of programming language.	02	06	01	09
CT101.3	Apply python for solving basic programming solutions.	02	03	04	09
CT101.4	Create algorithm using learnt programming skills.	02	04	04	10
CT101.5	Understand real world problems and developing computer solutions for those.	03	05	03	11
Total		11	26	13	50

Legend: *R:Remember,* *U:Understand,* *A:Apply*

The end of semester assessment for Problem Solving and Programming will be held with written examination of 50 marks.

Suggested Learning Resources:

a. Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Programming for Problem Solving	R.S. Salaria, Khanna	Khanna Publishing House	2021, 4th Edition
2	Taming Python by Programming	Jeeva Jose	Khanna Publishing House	2019, 3rd Edition
3	Learning Python	Mark Lutz	O'Reilly Media	2013, 5th Edition

****

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Curriculum Development Team

1. **Dr. Akhilesh K. Waoo, HOD, Department of Computer Science and Engineering.**
2. **Dr. Pramod Singh, Assistant Professor, Department of Computer Science and Engineering.**
3. **Ms. Shruti Gupta, Assistant Professor, Department of Computer Science and Engineering.**
4. **Ms. Pragya Shrivastava, Assistant Professor, Department of Computer Science and Engineering.**
5. **Mr. Lokendra Gaur, Assistant Professor, Department of Computer Science and Engineering.**
6. **Mr. Vinay Kumar Dwivedi, Assistant Professor, Department of Computer Science and Engineering.**
7. **Ms. Pinki Sharma, Assistant Professor, Department of Computer Science and Engineering.**
8. **Ms. Pushpa Kushwaha, Assistant Professor, Department of Computer Science and Engineering.**

COs, POs and PSOs Mapping

Program: B. Tech. Electrical Engineering
Course Code: ESC104
Course Title: Programming for Problem Solving

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO 1: Understand the basic concept of Programming languages, software, algorithm and flowchart.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1	2
CO 2 : Acquire knowledge regarding the building blocks of programming language	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1	3
CO 3: Apply python for solving basic programming solutions.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2	2
CO 4: Create algorithms using learnt programming skills	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2	2
CO 5: Understand real world problems and developing computer solutions for those.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 1: Understand the basic concept of Programming languages, software, algorithm and flowchart.	SO1.1 SO1.2 SO1.3 SO1.4	1,2,3,4,5,6	Unit-1 Introduction to Programming 1.1,1.2,1.3,1.4,1.5,1.6,1.7	1,2
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2 : Acquire knowledge regarding the building blocks of programming language.	SO2.1 SO2.2 SO2.3 SO2.4	1,2,3,4,5,6	Unit-2 Datatypes and Operators, Variables, Sequences and Iteration 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7,2.8,2.9,2.10,2.11,2.12	1,2
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 3: Apply python for solving basic programming solutions. .	SO3.1 SO3.2 SO3.3 SO3.4	1,2,3,4,5,6	Unit-3 Conditional Statements, Loops, Arrays and Strings, User Defined Data Types 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10 ,	1,2
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: Create algorithms using learnt programming skills.	SO4.1 SO4.2 SO4.3 SO4.4	1,2,3,4,5,6	Unit-4 Dictionaries and Dictionary Accumulation, Functions/Methods: 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10 ,	1,2
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 5: Understand real world problems and developing computer solutions for those.	SO5.1 SO5.2 SO5.3 SO5.4	1,2,3,4,5,6	Unit-5 File Handling and Memory Management: 5.1,5.2,5.3,5.4,5.5,5.6	1,2

Semester-II

Course Code: **ESC-105**

Course Title: **Manufacturing Practice Workshop**

Pre- requisite: Basic knowledge of mathematical skill with some scientific temperament.

Rationale: It is a place of work for preparing variety of jobs/products by using different kinds of Instruments, hand tools and Machines. In order to prepare the products in workshop, the workshop is divided into many branches according to nature of work. Ex: 1. Fitting shop 2. Welding shop 3. Sheet metal shop 4. M/c Shop 5. Foundry & Forging shop etc

Course Outcomes:

ESC 105.1: Understand various production processes, selecting appropriate methods for different material, optimizing manufacturing efficiency and ensuring product quality.

ESC 105.2: Acquired proficiency in using hand tools, understanding different types of fits and tolerances, interpreting engineering drawing and precision measurement techniques.

ESC 105.3: Develop fundamental skills such as measuring, cutting and joining wood. Gain expertise in handling various carpentry tools and machinery.

ESC 105.4: Appreciate and access the use of casting processes in manufacturing and understand the Working of various casting processes.

ESC 105.5: Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Engineering Science Core (ESC)	ESC 105	Manufacturing Practice Workshop	1	4	1	1	7	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial(T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcomeof Learning.

Scheme of Assessment:

Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT +SA+CAT+AT)		
ESC	ESC105	Manufacturing Practice Workshop	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
ESC	ESC 105-L	Manufacturing Practice Workshop	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

ESC105.1: Understand various production processes, selecting appropriate methods for different material, optimizing manufacturing efficiencyand ensuring product quality.

Approximate Hours

Item	AppX Hrs
Cl	03
LI	12
SW	1
SL	1
Total	17

Session Outcome (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand various manufacturing processes, materialsand technologies. **SO1.2** Acquire knowledge in cost estimation resource management and sustainable manufacturing practices.	1.1 Safety aspects pertaining to common manufacturing practices. 1.2 Introduction of tools and machines used in each process. 1.3 Basic instructions and procedures for using lathe and drilling machine. 1.4 Drawing of a simple work piece for carrying out various lathe /drilling operations 1.5 Demonstration of different operations during actual performance of work. 1.6 Fire Safety Instructions during the work.	**Unit-1.0 Manufacturing Methods-casting, forming, machining, joining,advanced manufacturing methods, CNC machining, Additive manufacturing.** 1.1 Define manufacturing And various methods. 1.2 Introduction to casting, forming, machining, joining and advanced manufacturing methods. 1.3 Introduction to CNC Machine	1.Introduction n to additive manufactur ing.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Mechanical properties of engineering materials. Explain advanced manufacturing methods

ESC 105.2: Acquired proficiency in using hand tools, understanding different types of fits and tolerances, interpreting engineering drawing and precision measurement techniques.

Approximate Hours

tem	AppX Hrs
Cl	03
LI	12
SW	1
SL	1
Total	17

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Understand different cutting tools like hacksaw, chisels etc. SO2.2 acquires knowledge of various fitting and assembly techniques.	2.1 Safety instructions for using various fitting hand tools. 2.2 Tools Introduction 2.3 Instructions for using proper tools in the correct way 2.4 Drawing of a simple work piece for carrying out different fitting operations. 2.5 Demonstration of different inspection, checking and measuring methods used for proper fitting work. 2.6 Actual performance of a small simple job.	**Unit-2 Fitting operations & power tools** 2.1 Tools used in fitting shop 2.2 types of clamping tools, marking tools, cutting tools, striking tools. 2.3 Various operations performed on fitting shop	1. Types of drilling tools and threading tools.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Explain different striking tools with neat sketch
   ii. Explain different types of vices used in fitting shop.

ESC 105.3: Develop fundamental skills such as measuring, cutting and joining wood. Gain expertise in handling various carpentry tools and machinery **Approximate Hours**

Item	AppX Hrs
Cl	03
LI	12
SW	1
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 proficiency in measuring cutting and assembling wood. **SO3.2** acquire knowledge in using various tools like saws, drills and planes **SO3.3** understand joinery techniques, wood finishing and safety practices	3.1 Safety instructions for using various carpentry tools. 3.2 Carpentry tools introduction. 3.3 Instructions for using proper tools in the correct way 3.4 Drawing of a simple work piece for preparation of common carpentry joinery work. 3.5 Demonstration of different inspection , checking and measuring methods used for proper carpentry work. 3.6 Production of any one type of joints listed below- • Dovetail Joint/Corner Joint/Mortise and Tenon Joint etc.	**Unit-3 : Carpentry shop** 3.1 Introduction to carpentry shop 3.2 different methods of seasoning of timber 3.3 carpentry tools	1. Defects in timber 2. Conversion of wood

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**

i. Explain the different operation performed in wood working

ii. Sketch and describe the different joints made in carpentry shop.

iii. Explain the different types of wood working machines used in modern wood work.

b. **Mini Project:**

i. Production of a simple utility item using different carpentry tools and methods

ESC 105.4: Appreciate and access the use of casting processes in manufacturing and understand the Working of various casting processes.

Approximate Hours

Item	AppX Hrs
Cl	03
LI	12
SW	1
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 The production of cast metal component, quality control measures and adherence to manufacturing standards	4.1 Safety instructions for foundry shop, pattern making , mould preparation. 4.2 Foundry tools introduction. 4.3 Instructions for using proper tools in the correct way 4.4 Drawing of a simple work piece for preparation of a pattern. 4.5 Instructions for sand preparation, mould preparation, melting and casting properly in the safe manner. 4.6 Production of a simple casting.	**Unit-4 : Metal casting** 4.1 Introduction to foundry shop. 4.2 Pattern, Mould , Casting , pattern allowances , moulding sand . 4.3 Casting procedure , core , gating system.	1. Types of moulding sand.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Explain different defects in casting.
ii. Explain different casting terms like runner , riser , mould etc.

ESC 105.5: Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application**.**

Approximate Hours

Item	AppX Hrs
Cl	03
LI	12
SW	1
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self -Learning (SL)
SO5.1 Performing set up, adjustment of flame and gas pressure, and shutdown procedure for oxyacetylene welding and cutting equipment. **SO5.2** Aquire knowledge about setting up and shutting down SMAW equipment.	5.1 Safety instructions for welding shop. 5.2 Welding tools introduction for Electric Arc Welding process. 5.3 Instructions for using proper tools in the correct way. 5.4 Drawing of a simple welded joint viz. Square butt joint, T joint , Lap joint etc. 5.5 Demonstration of producing a square butt joint using MMAW process. 5.6 Actual production of a welded joint as described above.	**Unit 5: welding shop** 5.1 introduction to welding shop, 5.2 classification of welding process, gas welding and its equipments and techniques. 5.3 electric arc welding and brazing process	1. study of TIG and MIG welding process 2. study of thermit welding process

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Explain different defects in casting.
ii. Explain different casting terms like runner , riser , mould etc.

b. Mini Projects

Preparing lap joint using arc welding process

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Laboratory Instruction (LI)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
ESC 105.1: Understand various production processes, selecting appropriate methods for different material, optimizing manufacturing efficiency and ensuring product quality.	3	1	12	1	17
ESC 105.2: Acquired proficiency inusing hand tools , understanding different types of fits and tolerances,interpreting engineering drawing and precision measurement techniques.	3	1	12	1	17
ESC 105.3: Develop fundamental skills such as measuring, cutting and joining ood. Gain expertise in handling various carpentry tools and machinery.	3	1	12	1	17
ESC 105.4: Appreciate and access the use ofcasting processes in manufacturing and understand the working of various casting processes.	3	1	12	1	17
SC 105.5: Analyze and access theimportance of welding processes inmanufacturing and apply knowledge to select appropriate welding process based on the type of industrial application.	3	1	12	1	17
Total Hours	15	5	60	5	85

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Manufacturing Methods-casting, forming, machining, joining, advanced manufacturingmethods, CNC machining, Additive manufacturing	04	05	01	10
CO-2	fitting operations & power tools	05	04	01	10
CO-3	carpentry shop	-	05	05	10
CO-4	metal casting	04	04	02	10
CO-5	Welding shop	05	03	02	10
Total		18	21	11	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Manufacturing Practice Workshop will be held withwritten examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	lements of Workshop Technology	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K.	Media promoters and publishers rivate limited, Mumbai	ol. I 2008 and Vol. II 2010
2	Manufacturing Engineering and Technology	Kalpakjian S. And Steven S. Schmid	Pearson Education India	Edition, 2002
3	Manufacturing Technology	Rao P.N	Tata McGraw Hill House	Vol. I and Vol. II 2007
4	Processes and Materials of Manufacture	Roy A. Lindberg	rentice Hall ndia,	4^{th} edition, 1998
5	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna .			

****

Curriculum Development Team

1. **Mr. S.S. Parihar, Head of Deptt. Mech. Engg., AKS University**
2. **Mr. Alok Ranjan Tiwari , Assistant Professor, Dept. of Mechanichal Engg.**
3. **Mr Deepak Pandey , Assistant Professor , Dept. of Mechanichal Engg**
4. **Mr.,Keshav Pratap Singh, Assistant Professor , Dept. of Mechanichal Engg**
5. **Mr.Amar Soni , Assistant Professor , Dept of Mechanichal Engg**
6. **Mr K.P Tiwari , Assistant Professor , Dept. of Mechanichal Engg**
7. **Mr. Ketan Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
8. **Mr. K.C. Kori, Faculty, Assistant Professor , Dept. of Mechanichal Engg**
9. **Mr,Lokesh Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
10. **Mr. Ram Narayan Shukla, Assistant Professor , Dept. of Mechanichal Engg**
11. **Mr. Rishi Kumar Sharma, Assistant Professor , Dept. of Mechanichal Engg**
12. **Mr. Naveen Kumar Soni, Assistant Professor , Dept. of Mechanichal Engg**

Cos, POs and PSOs Mapping

Course Title: B. Tech. Electrical Engineering

Course Code: ESC105

Course Title: Manufacturing Practice Workshop

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1 : Understand various production processes, selecting appropriate methods for different material, optimizing manufacturing efficiency and ensuring product quality.	2	1	2	2	3	2	2	2	2	1	3	2	2	2
CO 2 : Acquired proficiency in using hand tools , understanding different types of fits and tolerances, interpreting engineering drawing and precision measurement techniques.	1	1	1	1	3	2	2	2	2	1	2	2	1	2
CO3 : Develop fundamental skills such as measuring , cutting and joining wood. Gain expertise in handling various carpentry tools and machinery.	2	2	1	1	3	1	2	2	2	1	1	2	1	2
CO 4: Appreciate and access the use of casting processes in manufacturing and understand the working of various casting processes.	2	2	2	1	3	2	2	2	2	1	2	2	1	2
CO 5: Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application.	2	1	1	1	1	3	2	2	2	1	2	2	1	2

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO-1: Understand various production processes, selecting appropriate methods for different material, optimizing manufacturing efficiency and ensuring product quality.	SO1.1 SO1.2	1.1, 1.2 1.3 1.4 1.5 1.6	Unit-1.0 Manufacturing Methods- casting ,forming ,machining, joining, advancedmanufacturing methods, CNC machining, Additive manufacturing 1.1,1.2,1.3	1
1PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	O 2 : Acquired proficiency in using hand tools , understanding different types of fits and tolerances, interpreting engineering drawing and precision measurement techniques	SO2.1 SO2.2	2.1, 2.2 2.3, 2.4 2.5 2.6	Unit-2 Fitting operations & power tools 2.1, 2.2, 2.3	1
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	O3 : Develop fundamental skills such as measuring , cutting and joining wood. Gain expertise in handling various carpentry tools and machinery.	SO3.1 SO3.2 SO3.3	3.1, 3.2 3.3, 3.4 3.5 3.6	Unit-3 : Carpentry shop 3.1, 3.2,3.3	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO 4: Appreciate and access the use of casting processes in manufacturing and understand the working of various casting processes.	SO4.1	4.1, 4.2 4.3, 4.4 4.5 4.6	Unit-4 : Metal casting 4.1, 4.2,4.3	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO 5: Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application.	SO5.1 SO5.2	5.1, 5.2 5.3 5.4 5.5 5.6	Unit 5: Welding Shop 5.1,5.2,5.3	1,2

Semester-II

Course Code: **HSMC01**

Course Title: **Communication Skills**

Pre-requisite: Students must have basic knowledge of English language.

Rationale: In order to compete in this fast-growing world, LSWR skills of the students should be well developed and enhanced. Besides, they must have effective communication skills as it plays a vital role in shaping individual's personality and career. It also boosts the confidence and prepares them to face the audience fearlessly.

Course Outcomes: After completion of the course:

HSMC01.1: Students will be able to speak confidently in public as all the topics chosen emphasis on improving speaking skills and developing self confidence amongst them.

HSMC01.2: Students will be able to interact properly with improved Leadership Skills, Problem Solving Skills, Social skills and Communication Skills. Students will also be able to understand the Importance of Team Work.

HSMC01.3: Students will be able to communicate effectively in Hindi and English languages without hindrances.

HSMC01.4: Students will be able to convey their messages accurately by understanding the significance of grammar as it plays a vital role in improving speaking and writing skills.

HSMC01.5: The Understanding of Indian Culture and English Language will be developed through the study of Dramas and Poems written by Indian Writers.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits(C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
HSMC	HSMC01	Communication Skills	3	0	1	1	5	3

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Legend: **CI**: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T)and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self-Learning,
C: Credits.

Note: SW &SL has to be planned and performed under the continuousguidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activityany one (CAT)	Class Attendance (AT)	Total Marks (CA+CT +SA+CAT+AT)		
HSMC	HSMC 01	Communication Skills	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

HSMC01.1: Students will be able to speak confidently in public as all the topics chosen emphasis on improving speaking skills and developing self confidence amongst them.

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1Students will be able to introduce themselves SO1.2Understand the concept of Oral Presentation SO1.3 Students will be able to dress and present effectively SO1.4 Understand the importance of Body Language SO1.5 Students will be able to influence mass through skit and dramas.		**Self-grooming, Basic Etiquettes and Presentation Skill** 1.1 Self-introduction 1.2 Practice Sessions 1.3 Oral Presentation 1.4 Characteristics of presentation. 1.5 Presentation topics (The importance of Education, The 1.6 importance of English in Today's World and Necessity of uniforms ina college) 1.7 Professional dressing and groomingetiquettes. 1.8 Body Language tips and techniques. 1.9 Role play sessions on following topics: Classroom interaction, Hospital Scene and Scene at Railwaystation, Performance by Students	1) Prepare a presentation on thegiven topics. 2) Prepare a play on the given topics.

HSMC01.2: Students will be able to interact properly with improved Leadership Skills, Problem Solving Skills, Social skills and Communication Skills. Students will also be able to understand the Importance of Team Work.

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO2.1 Understand the techniques of Group Discussion **SO2.2**Understand the concept of Debate **SO2.3** Students will be able to design professional resume and crack interview **SO2.4** Explain the concept of how to	.	UNIT 2 – Confidence building skills, InterviewSkills and Resume Writing 2.1 Group Discussion 2.2 Do's and Don'ts of GD 2.3 Group Discussion sessions on impact of Covid 19 on mental health, impact of social media on lives, pros andcons of technology 2.4 Difference between GD andDebate. 2.5 Debate. Do's and Don'ts of Debate 2.6 Debate topics on	1. Prepare debate on given topics 2. Prepare a Resume

ace in an interview.		Should the Use of Plastic Be Banned?, Should Parents Decide Which Career Their Children Will Pursue?, Is Artificial Intelligence Useful or Dangerous? 2.7 Interviews and their Kinds 2.8 Mock Interview Session 2.9 Resume Writing.	

HSMC01.3: Students will be able to communicate effectively in Hindi and English languages without hindrances.

Approximate Hours

Item	AppX Hrs
Cl	10
LI	0
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO3.1 Students will be able to organize and prepare speeches. **SO3.2** Students will be able to think and speak instantaneously. **SO3.3** To make them understand the inquiry procedure at public places. **SO3.4** To enable them to communicate effectively through phones.	.	**Unit-3 :Public Speaking Skills& Conversational Skills** 3.1 Speech 3.2 Types of Speech 3.3 Speech /Anchoring on (National Science Day, Valedictory Speech, Patriotic speech). 3.4 Performance in the class. 3.5 Extempore 3.6 Extempore Topics on (Pros and Cons of Online teaching, Environment Conservation and Education of a Girl Child) 3.7 Practice Session 3.8 Conversational Topics (Inquiry at bank, Airport, Station and Hospitals). 3.9 Telephonic Conversation (Describing about Your College Day to Your Parents from Hostel, Talking with Customer Care Executive of Any E-Commerce company). 3.10 Revision	1. Prepare a speech on the following topics. 2. Prepare on the following conversation al topics.

HSMC01.4: Students will be able to convey their messages accurately by understanding the significance of Grammer as it plays a vital role in improving speaking and writing skills.

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO4.1 Understanding about the use of Prepositions. **SO4.2**Students will be able to understand the usage of Tenses **SO4.3**Undesrtand the concept of Active and Passive Voice **SO4.4**To understand the usage of Modals		Unit-4 :Functional Grammar and VocabularyBuilding 4.1 Prepositions (Place, Time and Direction) 4.2 MCQ based Questions on Prepositions. 4.3 Gap filling using prepositions. 4.4 Tenses 4.5 Present Tense 4.6 Past Tense 4.7 Future Tense 4.8 Voice (Active and Passive) 4.9 Modals.	1. Prepare the structure of Tenses and Active Passive. 2. Prepare250 Vocabularies.

HSMC01.5: The Understanding of Indian Culture and English Language willbe developed through the study of Dramas and Poems written by Indian Writers.

Approximate Hours

Item	AppX Hrs
Cl	8
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Students will be able to understand the value of Indian Literature (R.K. Narayan) **SO5.2** Students will be able to understand the value of Indian Literature (Nissim Ezekiel) **SO5.3** Students will be able to understand the value of Indian Literature (Khushwant Singh) **SO5.4** Students will be able to understand the value of Indian Literature (Mulk Raj Anand) **SO5.5** Students will be able to understand thevalue of Indian Literature (Premchand)		**Unit 5-Indian Writing in English Hindi** 5.1 The Axe- R.K. Narayan 5.2 About the Author - R.K.Narayan 5.3 The Night of the Scorpion-Nissim Ezekiel 5.4 About the Poet - Nissim Ezekiel 5.5 The Portrait of a Lady – Khushwant Singh 5.6 About the author- KhushwantSingh 5.7 The Lost Child- Mulk RajAnand 5.8 The Shroud- Premchand	1. Prepare the summary of all the topics(The Axe, The Night of the Scorpion, The Portrait of a Lady, The Lost Child he Shroud).

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
HSMC01.1: Students will be able to speak confidently in public as all the topics chosenemphasis on improving speaking skills and developing self confidence amongst them.	9	1	1	11
HSMC01.2: Students will be able to interact properly with improved Leadership Skills, Problem Solving Skills, Social skills and Communication Skills. Students will also be able to understand the Importance of Team Work.	9	1	1	11
HSMC01.3: Students will be able to communicate effectively in Hindi and English languages without hindrances.	10	1	1	12
HSMC01.4Students will be able to convey their messages accurately by understanding the significance of grammar as it plays a vital role in improving speaking and writing skills.	9	1	1	11
HSMC01.5: The Understanding of Indian Culture and English Language willbe developed through the study of Dramas and Poems written by Indian Writers.	8	1	1	10
Total Hours	45	5	5	55

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Self-Grooming, Basic Etiquettes and Presentation.	03	01	01	05
CO-2	Confidence Building and Interview Skills.	02	06	02	10
CO-3	Public Speaking Skills and Conversational Skills	03	07	05	15
CO-4	Functional Grammar and Vocabulary Building	-	10	05	15
CO-5	Indian Writings in English and Hindi	03	02	-	05
Total		11	26	13	50

Legend: R: Remember, U: Understand, A:Apply

The end of semester assessment for Communication Skills will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Role-play
5. Presentations
6. Extempore
7. Speeches
8. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Communication Skills	Dr. Meenu Pandey	Nirali Praksahan.	Fourth Edition
2	A Practical Guide to English Grammar	K.P. Thakur	Bharti Bhawan Publishers & Distributors.	Third Edition
3	Living English Structure	W. Stannard Allen	Dorling Kindersley IndiaPvt. Ltd.	Fifth Edition,
4	Communication Skills for Engineers	Muralikrishna C.,Sunita Mishra	Pearson, NewDelhi.	Second edition(2010)
5.	Advanced Language Practice,	Michael Vince	Macmillan Education, Oxford	2003.
6.	English Conversation Practise	Grant Taylor	Tata McGraw Hill Education Private Limited.	Fifth Edition
7.	Six Weeks to Words of Power	Wilfred Funk	W.R. Goyal Publishers and Distributors.	Fourth Edition

****

Curriculum Development Team

1)Mr. Amarpreet Saluja, HOD Department of communication skill
2) Ms. Deepika Senani (AP), Department of communication skill
3) Dr. Shubhra Mishra (AP), Department of communication skill

Cos, Pos and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering

Course Code: HSMC01

Course Title: Communication English

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Students will be able to speak confidentlyin public as all the topics chosen emphasis on improving speaking skills and developing self confidence amongst them.	1	1	1	1	3	3	2	2	1	1	1	1	1	1
CO2: Students will be able to interact properlywith improved Leadership Skills, Problem Solving Skills, Social skills and Communication Skills. Students will also be able to understand the Importance of Team Work.	1	1	1	1	3	3	2	2	2	2	1	1	1	1
CO3: Students will be able to communicate effectively in Hindi and English languages without hindrances.	1	1	1	1	2	3	1	2	1	1	1	1	1	1
CO4Students will be able to convey their messages accurately by understanding the significanceof grammar as it plays a vital role in improving speaking and writing skills.	1	1	1	1	1	3	1	2	1	1	1	1	1	
CO5: The Understanding of Indian Culture and English Language will be developed through the study of Dramas andPoems written by Indian Writers.	1	1	1	1	1	3	1	2	1	1	1	1	1	1

Legend:1–Low,2–Medium,3–High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO1:** Students will be able tospeak confidentlyin public as all the topics chosen emphasison improving speaking skills and developing self confidence amongst them.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 Self-Grooming, BasicEtiquettes and Presentation. 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8, 1.9	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO2:** Students will be able to interact properlywith improvedLeadership Skills, Problem Solving Skills, Social skills and Communication Skills.Students will also be able to understand the Importance ofTeam Work.	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2 Confidence Building andInterview Skills. 2.1, 2.2, 2.3,2.4,2.5,2.6,2.7,2.8,2.9	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO**3: Students will be able tocommunicate effectively in Hindi and English languages without hindrances.	SO3.1 SO3.2 SO3.3 SO3.4		Unit-3 : Public Speaking Skills andConversational Skills 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8, 3.9,3.10	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO**4: Students will be able to convey their messages accurately by understanding the significance of grammar as it plays a vital role in improving speaking and writing skills.	SO4.1 SO4.2 SO4.3 SO4.3		Unit-4 : Functional Grammar and Vocabulary Building 4.1, 4.2,4.3,4.5,4.6,4.7,4.8,4.9	1,2

PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO5:** The Understanding of Indian Culture and English Language will be developed through the study of Dramas and Poems written by Indian Writers.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit 5: Indian Writings in English and Hindi 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	1

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-II

Course Code: **HSMC07**
Course Title: **Indian Knowledge System**
Pre- requisite: Creating awareness among the youths about the true history and past rich culture of India.

Rationale: India has very rich and versatile knowledge system and cultural heritage since antiquity.The Indian Knowledge systems was developed on life science, medical science,literature, drama, art, music, dance, astronomy, mathematics, architecture (Sthapatyaveda), chemistry, aeronautics etc, during ancient period. In this basic course,a special attention is given to the ancient and historical perspective of ideas occurrencein the ancient society, and implication to the concept of material world and religious, social and cultural beliefs. On the closer examination, religion, culture and science haveappeared epistemological very rigidly connected in the Indian Knowledge System. Thisland of Bharat Bhumi has provided invaluable knowledge stuff to the society and the world in all sphere of life.

Course Outcomes:

HSMC07.1: To understand the ancient civilization, Indian Knowledge Systems, Concept of Panch Mahabhuta, Origin of name Bharat Varsha, Ancient Rivers, Ancient Universities and ancient agriculture.

HSMC07.2: Students will have the ability to learn about ancient books, Religious places, basic concept of Indian dance, music and arts, and fundamental aspects of Sangeeta and Natyashashtra etc.

HSMC07.3: Student will be able to gain knowledge on Vedic Science, Astronomy, Astrovastu, Vedic Mathematics, Aeronautics, Metallurgy, Nakhatras, Panchang, Concept of Zero, Pi and point etc.

HSMC07.4: Understanding on ancient Engineering, Science and Technology, Town Planning, Temple architecture, Chemistry and Metallurgy, Metal manufacturing etc.

HSMC07.5: Student will able to understand about the Life, Nature and Health through basic concept of Ayurveda and Yoga, Traditional Medicinal Systems, Ethno medicine, Nature conservation, World Heritage Sites etc.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours CI+LI+SW+SL	
HSMC	HSMC07	Indian Knowledge System	2	0	1	1	4	2

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Legend:
CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Session Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Scheme of Assessment:

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
HSMC	HSMC07	Indian Knowledge System	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:
This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

HSMC07.1. To understand Indian Civilization and Indian Knowledge Systems

Approximate Hours

Item	AppX Hours
CI	6
LI	0
SW	2
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 1.1. Understand Overview of Indian Knowledge Systems (IKS) SO 1.2. Understand Classification of Ancient IKS texts SO 1.3. Understand Introduction to Panch Mahabhutas (Earth, Water, Fire, Sky and Air) SO 1.4. Understand Origin of the name Bharatvarsha: the Land of Natural Endowments SO 1.5. Understand Rivers of ancient India (The Ganga, Yamuna, Godawari, Saraswati, Narmada, Sindhu and Kaveri) SO 1.6. Understand Ancient Agriculture and ancient		**Unit-1. Indian Civilization and Indian Knowledge Systems** 1.1.Overview of Indian Knowledge Systems (IKS) 1.2 Classification of Ancient IKS texts 1.3 Introduction to Panch Mahabhutas (Earth, Water, Fire, Sky and Air) 1.4 Origin of the name Bharatvarsha: the Land of Natural Endowments 1.5 Rivers of ancient India (The Ganga, Yamuna, Godawari, Saraswati, Narmada, Sindhu and Kaveri) 1.6 Agriculture system in ancient India, Ancient Universities: Takshashila	Golden era of ancient India

Universities: Takshashila and Nalanda, Gurukul system		and Nalanda, Gurukul system	

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Concepts of Panch Mahabhuta, Classification of ancient texts, origin of ancient rivers
b. **Mini Project:**
   i. Ancient Universities: Takshashila and Nalanda,
c. **Other Activities (Specify):**

HSMC07.2: Students will have the ability to apply the knowledge gained about Indian Art, Literature and Religious Places

Approximate Hours

Item	AppX Hours
CI	6
LI	0
SW	2
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 2.1. Understand the Ancient Indian Books: Vedas, Puranas, Shastras, Upanishads, Mahakavyas (Ramayana & Mahabharata), Smrities, Samhitas SO 2.2. Understand the Religious places: Puries, Dhams, Jyotiralinga, Shaktipeeths, Kumbha Mela		**Unit-2. Indian Art, Literature and Religious Places** 2.1. Ancient Indian Books: Vedas, Puranas, Shastras, Upanishads, Mahakavyas (Ramayana & Mahabharata), Smrities, Samhitas 2.2. Religious places: Puries, Dhams,	**1.** Indian Art, Music and Dance

SO 2.3. Understand the Legendary places of Madhya Pradesh: Ujjain, Chitrakoot, Omkareshwar, Bharhut, Maihar SO 2.4. Understand the Basic concept of Indian Art, Music and Dance, Indian Musical Instruments SO 2.5. Understand the Fundamental aspects of Sangeeta and Natya shastra SO 2.6. Understand the different schools of music, dance and painting in different regions of India		Jyotiralinga, Shaktipeeths, Kumbha Mela 2.3. Legendary places of Madhya Pradesh: Ujjain, Chitrakoot, Omkareshwar, Bharhut, Maihar 2.4. Basic concept of Indian Art, Music and Dance, Indian Musical Instruments 2.5. Fundamental aspects of Sangeeta and Natya shastra 2.6. Different schools of music, dance and painting in different regions of India	

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Visit of Chitrakoot, Maihar and Bharhuta

b. **Mini Project:**
   i. Kumbh mela, Story of Ramayana and Mahabharata

c. **Other Activities (Specify):**

HSMC07.3: Student will be able to understand Ancient Science, Astronomy and Vedic Mathematics
Approximate Hours

Item	AppX Hours
CI	6
LI	0
SW	2
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO 3.1. Understand Vedic Cosmology SO 3.2. Understand the Astronomy, Astrovastu, Vedang Jyotish, Nakshatras, Navagraha, Rashis, Vastushastra and their related plants SO 3.3. Understand the Time and Calendar, Panchang SO 3.4. Understand the Concept of Zero, Point, Pi -number system, Pythagoras SO 3.5. Understand the Vedic Mathematics, Vimana-Aeronautics, Basic idea of planetary model of Aryabhatta SO 3.6. Understand the Varanamala of Hindi language based on classification of sounds on the basis of their origin, Basic purpose of science of Vyakarana		**Unit-3. Ancient Science, Astronomy, Mathematics** 3.1. Vedic Cosmology 3.2. Astronomy, Astrovastu, Vedang Jyotish, Nakshatras, Navagraha, Rashis, Vastushastra and their related plants 3.3. Time and Calendar, Panchang 3.4. Concept of Zero, Point, Pi -number system, Pythagoras 3.5. Vedic Mathematics, Vimana-Aeronautics, Basic idea of planetary model of Aryabhatta 3.6. Varanamala of Hindi language based on classification of sounds on the basis of their origin, Basic purpose of science of Vyakarana.	1. Ancient Science, Astronomy and Vedic Mathematics

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Varanamala of Hindi language based on classification of sounds on the basis of their origin

b. Mini Project:

1. Nakshatras, Navagraha and their related plants

c. Other Activities (Specify):

HSMC07.4: Understand the Engineering, Technology and Architecture
Approximate Hours

Item	AppX Hours
CI	6
LI	0
SW	2
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 4.1. Understand the Engineering Science and Technology in Vedic and Post Vedic Era SO 4.2. Understand the Town and Home planning, Sthapatyaveda SO 4.3. Understand the Chemistry and Metallurgy as gleaned from archeological artifacts SO 4.4. Understand the Chemistry of Dyes, Pigments used in Paintings, Fabrics, Potteries and Glass SO 4.5. Understand the Temple Architecture: Khajuraho, Sanchi Stupa, Chonsath Yogini temple SO 4.6. Understand the Mining and manufacture in India of Iron, Copper, Gold from ancient times		**Unit-4. Engineering, Technology and Architecture** 4.1. Engineering Science and Technology in Vedic and Post Vedic Era 4.2. Town and Homeplanning, Sthapatyaveda 4.3. Chemistry and Metallurgy as gleaned from archeological artifacts 4.4 Chemistry of Dyes, Pigments used in Paintings, Fabrics, Potteries and Glass 4.5. Temple Architecture: Khajuraho, Sanchi Stupa, Chonsath Yogini temple 4.6. Mining and manufacture in India of Iron, Copper, Gold from ancient times	1. Ancient Science, Astronomy and Vedic Mathematics

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Varanamala of Hindi language based on classification of sounds on the basis of their origin
b. **Mini Project:**
   i. Nakshatras, Navagraha and their related plants
c. **Other Activities (Specify):**

HSMC07.5: Understand about the Life, Nature and Health

Approximate Hours

Item	AppX Hours
CI	6
LI	0
SW	2
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 5.1. Understand the Fundamentals of Ayurveda (Charaka & Shushruta) and Yogic Science (Patanjali), Ritucharya and Dinacharya SO 5.2. Understand the Traditional system of Indian medicines (Ayurveda, Siddha, Unani and Homoeopathy) SO 5.3. Understand Fundamentals of Ethnobotany and Ethnomedicines of India		**Unit-5. Life, Nature and Health** 5.1. Fundamentals of Ayurveda (Charaka & Shushruta) and Yogic Science (Patanjali), Ritucharya and Dinacharya 5.2. Traditional system of Indian medicines (Ayurveda, Siddha, Unani and Homoeopathy) Fundamentals of	1. Concept of Ayurveda and Yoga 2. Traditional system of Indian medicines 3. Ethnobotany and Ethnomedicines of India

SO 5.4. Understand the Nature Conservation in Indian ancient texts SO 5.5. Understand the Introduction to Plant Science in Vrikshayurveda SO 5.6. Understand the World Heritage Sites of Madhya Pradesh: Bhimbetka, Sanchi, Khajuraho		Ethnobotany and Ethnomedicines of India 5.3.Nature Conservation in Indian ancient texts 5.5 Introduction to Plant Science in Vrikshayurveda 5.6.World Heritage Sites of Madhya Pradesh: Bhimbetka, Sanchi, Khajuraho	4. World Heritage Sites

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Visit to world Heritage Site Khajuraho

b. **Mini Project:**
   i. Ritucharya and Dincharya, Ethnomedicinal plants

c. **Other Activities (Specify):**

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
HSMC07. 1: To understand Indian Civilization and Indian Knowledge Systems	6	2	1	9
HSMC07. 2: Students will have the ability to apply the knowledge gained about Indian Art, Literature and Religious Places	6	2	1	9
HSMC07. 3: Student will be able to understand the Ancient Science, Astronomy and Vedic Mathematics	6	2	1	9
HSMC07. 4: Understand the Engineering, Technology and Architecture	6	2	1	9
HSMC07. 5: Understand about the Life, Nature and Health	6	2	1	9
Total	30	10	5	45

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	Indian Civilization and Indian Knowledge Systems	2	5	1	8
CO 2	Indian Art, Literature and Religious Places	2	6	2	8
CO 3	Ancient Science, Astronomy and Vedic Mathematics	2	6	5	13
CO 4	Engineering, Technology and Architecture	2	4	4	10
CO 5	Life, Nature and Health	2	5	2	9
Total		10	26	14	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for **Indian Knowledge Systems** will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course teacher for above tasks. Teacher can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to Religious places, World Heritage Sites
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:
(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	An Introduction of Indian Knowledge Systems: Concept and Applications	Mahadevan, B.; Bhat V. R. and Pavana, Nagendra R. N.	Prentice Hall of India.	2022
2	Indian Knowledge Systems: Vol. I and II.	Kapoor, Kapil and Singh, A. K.	D.K. Print World Ltd	2005
3	Science of Ancient Hindus: Unlocking Nature in Pursuit of Salvation	Kumar, Alok	Create pace Independent Publishing	2014
4	A History of Agriculture in India	Randhava, M.S.	ICAR, New Delhi	1980
5	Panch Mahabhuta,	Yogcharya, Jnan Dev	Yog Satsang Ashram	2021
6	The Indian Rivers	Singh, Dhruv Sen	Springer	2018
7	The Wonder That Was India	Basam, Arthue Llewllyn	Sidgwick & Jackson	1954
8	Ancient Cities, Sacred Skies: Cosmic Geometries and City Planning in Ancient India	Malville, J. MacKim & Gujaral, Lalit M.	IGNCA & Aryan Books International, New Delhi	2000
9	The Natya Shastra of Bharat Muni	Jha, Narendra	Innovative Imprint, Delhi	2023
10	Astronomy in India: AHistorical Perspective	Padmanabhan, Thanu	Indian National Science Academy, New Delhi & Springer (India).	2010
11	History of Astronomy in India 2nd Ed.	Sen, S.N. and Shukla, K.S.	INSA New Delhi	2001
12	History of Indian Astronomy AHandbook	Ramasubramanian, K.; Sule, Aniket and Vahia, Mayank	Science and Heritage Initiative, I.I.T. Mumbai and Tata Institute of Fundamental Research, Mumbai	2016
13	Indian Mathematics and Astronomy: Some Landmarks	Rao, Balachandra S.	Jnana Deep Publications, Bangalore, 3rd Edition	. 2004

14	Vedic Mathematics and Science in Vedas	Rao, Balachandra S.	Navakarnataka Publications, Bengaluru	2019
15	A History of Hindu Chemistry	Ray, Acharya Prafulla Chandra	Repbl Shaibya Prakashan Bibhag, Centenary Edition, Kolkata	1902
16	Early Indian Architecture: Cities and City Gates	Coomeraswamy, Anand	Munciram Manoharlal Publishers	2002
17	Theory and Practices of Temple Architecture in Medieval India: Bhojas samrangasutradhar and the Bhojpur Line Drawings	Hardy, Adams	Dev Publishers & Distributors.	2015
18	Indian Science and Technology in Eighteenth Century	Dharmpal	Academy of Gandhian Studies, Hyderabad.	1971
19	Science in India: A Historical Perspective	Subbarayappa, B.V.	Rupa New Delhi	2013
20	Fine Arts & Technical Sciences in Ancient India with special reference to Someswvara's Manasollasa	Mishra, Shiv Shankar	Krishnadas Academy, Varanasi	1982
21	Fundamental Principles ofAyurveda, Volume One	Lad, Vasant D.	The Ayurvedic Press, Alboquerque, New Mexico.	2002
22	Charak Samhita, Chaukhamba	Pandey, Kashinath and Chaturvedi Gorakhnath	Vidya Bhawan, Varanasi	
23	Ayurveda: The Science of Self-Healing	Lad, Vasant D.	Lotus Press: Santa Fe	1984
24	Ayurveda: Life, Health and Longevit	Svoboda, Robert E	Penguin: London	1992
25	Plants in the Indian Puranas	Sensarma, P.	Naya Prokash, Calcutta	1989
26	Indian Cultural Heritage Perspective for Tourism	Singh, L. K.	Gyan Publishing House, Delhi	2008
27	Glimpses of Indian Ethnobotany	Jain, S.K.	Oxford & IBH Publishing Company	1981
28	Manual of Ethnobotany	Jain, S.K.	Scientific Publishers, Jodhpur	2010

****

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Curriculum Development Team:

1. **Er. Anant Kumar Soni, Hon'ble Pro-Chancellor and Chairman, AKS University, Satna (M.P.).**
2. **Prof. B.A. Chopade, Hon'ble Vice Chancellor, AKS University, Satna (M.P.).**
3. **Prof. G.C. Mishra, Director, IQAC,AKS University, Satna (M.P.).**
4. **Prof. R.L.S. Sikarwar, Director, Centre for Traditional Knowledge Research & Application,AKS University, Satna (M.P.).**
5. **Prof. Kamlesh Chaure, HOD, Department of Biotechnology,AKS University, Satna (M.P.).**
6. **Dr. Akhilesh Waoo, HoD, Department of Computer Science,AKS University, Satna (M.P.).**
7. **Dr. Shailendra Yadav, HoD, Department of Chemistry, AKS University, Satna (M.P.).**
8. **Dr. Kaushik Mukherji, HoD, Department of Management, AKS University, Satna (M.P.).**
9. **Dr. Neeraj Verma, PG Coordinator, Faculty of Agriculture Science and Technology, AKS University, Satna (M.P.)**
10. **Dr. Dilip Kumar Tiwari, HoD, Department of Yoga, AKS University, Satna (M.P.).**
11. **Shri Mirza Shamiullah Beg, Department of Arts,AKS University, Satna (M.P.).**
12. **Shri Vivek Shrivastava, Examination, AKS University, Satna (M.P.).**
13. **Shri Manish Agrawal, Department of Mining, AKS University, Satna (M.P.).**

Cos, POs and PSOs Mapping

Programme Title: B.Tech. Electrical Engineering
Course Code: HSMC07
Course Title: INDIAN KNOWLEDGE SYSTEM

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Teamwork	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: To understand Indian Civilization and Indian Knowledge Systems	3	3	3	3	2	1	1	2	2	3	1	2	2	3
CO2: Students will have the ability to apply the knowledge gained about Indian Art, Literature and Religious Places	3	3	2	3	1	2	1	2	1	2	2	2	3	2
CO3: Student will be able to understand the Ancient Science, Astronomy and Vedic Mathematics	3	3	2	1	1	2	2	2	1	3	2	3	3	2
CO4: Understand the Engineering, Technology and Architecture	3	2	3	2	3	2	1	3	2	2	2	2	3	3
CO5: Understand about the Life, Nature and Health	3	2	3	1	2	1	2	3	1	2	2	2	3	3

Legend:1–Low,2–Medium, 3–High

Course Curriculum Map

POs &PSOsNo.	COsNo. &Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1, 2	**CO1:** To understand Indian Civilization and Indian Knowledge Systems	SO1.1, SO1.2 SO1.3, SO1.4 SO1.5, SO1.6		**Unit-1:** Indian Civilization and Indian Knowledge Systems 1.1, 1.2, 1.3, 1.4, 1.5, 1.6	1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1, 2	**CO2:** Students will have the ability to apply the knowledge gained about Indian Art, Literature and Religious Places	SO2.1, SO2.2 SO2.3 SO2.4 SO2.5 SO2.6		**Unit-2**: Indian Art, Literature and Religious Places 2.1,2.2,2.3,2.4,2.5,2.6	1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1, 2	**CO3:** Student will be able to understand the Ancient Science, Astronomy and Vedic Mathematics	SO3.1, SO3.2 SO3.3 SO3.4 SO3.5 SO3.6		**Unit-3 :** Ancient Science, Astronomy and Vedic Mathematics 3.1, 3.2, 3.3, 3.4, 3.5, 3.6	1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1, 2	**CO4:** Understand the Engineering, Technology and Architecture	SO4.1, SO4.2 SO4.3, SO4.4 SO4.5, SO4.6		**Unit-4:S** Engineering, Technology and Architecture 4.1, 4.2, 4.3, 4.4, 4.5, 4.6	1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1, 2	**CO5:** Understand about the Life, Nature and Health	SO5.1, SO5.2 SO5.3, SO5.4 SO5.5, SO5.6		**Unit 5:** Life, Nature and Health 5.1, 5.2, 5.3, 5.4, 5.5, 5.6	1,2,3,4

Semester-II

Course Code: **HSMC09**

Course Title : **Sports And Yoga**

Pre- requisite: Student should have basic knowledge of Sports And Yoga

Rationale: Students of Yoga should have a legal understanding of Yoga and its original text Yoga. At the same time, they should also have adequate knowledge Yoga practices in which they should have knowledge of its basic principles and elements.

Course Outcomes:

HSMC09.1: A make the students understand the importance of Introduction of Yoga**.**
HSMC09.2: To make the students understand the importance of Fundamentals of Yoga.
HSMC09.3 To expose the students to a variety of physical and yogic activities aimedat stimulating their continued inquiry about Yoga, physical education, health and fitness.
HSMC09.4 To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize risk of injury.
HSMC09.5 To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits(C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
HSMC	HSMC 09	Sports and Yoga	2	0	0	0	2	NC

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop,field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Scheme of Assessment

Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)						
			Progressive Assessment (PRA)					End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 Assignments 3 marks Each (CA)	2 Class Test (best 2 out of 3) 10 marks Each (CT)	One Seminar (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ AT)		
HSMC	HSMC09	Sports and Yoga	15	20	10	5	50	50	100

Course-Curriculum Detailing:
This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

HSMC09.1: A make the students understand the importance of Introduction of Yoga**.**

Approximate Hours

Item	AppX Hrs
Cl	06
LI	0
SW	0
SL	3
Total	09

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Student will ableto Understand the Meaning & Importance of Yoga **SO1.2** Student will ableto Describe the Elements of Yoga, astang yoga **SO1.3** Student will ableto Describe Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas **SO1.4** Student will ableto Understand the Concept of Yoga for concentration &related Asanas **SO1.5** Student will ableto Understand the Concept of Relaxation Techniques for improving concentration - Yog-nidra	.	**Unit-1. Introduction of Yoga** – 1.1 Meaning & Importance of Yoga 1.2 Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas 1.3 Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Shashankasana) 1.4 Relaxation Techniques for improving concentration - Yog-nidra 1.5 Relaxation Techniques for improving concentration - Yog-nidra 1.6 Relaxation Techniques for improving concentration - Yog-nidra	1. Meaning & Importance of Yoga 2- Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas 3- Relaxation Techniques for improving concentration - Yog-nidra

HSMC09.2: To make the students understand the importance of Fundamentals of Yoga.

Approximate Hours

Item	AppX Hrs
Cl	06
LI	0
SW	0
SL	2
Total	06

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Student will able to Understand Fundamentals of Yoga **SO2.2**Student will able to Understand the Effect of yoga on the functioning of Various Body Systems	.	**Unit-2. Fundamentals of Yoga** 2.1 Purpose of yoga, definition of yoga, need and use of yoga for students. 2.2 Effect of yoga on the functioning of Various Body Systems. 2.3 Effect of yoga on the functioning of Various Body Systems 2.4 Circulatory System, 2.5 Respiratory System, 2.6Neuro- System, Muscular System etc.	1. Effect of yoga on the functioning of Various Body Systems 2. Fundamentals of Yoga

HSMC09.3 To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.

Approximate Hours

Item	AppX Hrs
Cl	06
LI	0
SW	0
SL	2
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Student will able to Understand Meaning & Importance Physical Fitness, Wellness & Lifestyle **SO3.2**Student will able to Understand the Components of Physical fitness **SO3.3** Student will able to Describe **SO3.4** Student will able to Understand of Health related fitness **SO3.5** Student will able to Understand of Preventing Health **SO3.6** Student will able to Describe Concept of Positive Life	.	**Unit-3. Physical Fitness, Wellness & Lifestyle** 3.1 Meaning & Importance of Physical Fitness & Wellness 3.2 Components of Physical fitness 3.3 Components of Health related fitness 3.4 Components of wellness 3.5 Preventing Health Threats through Lifestyle Change 3.6 Concept of Positive Lifestyle	1. Physical Fitness 2. Wellness & Lifestyle

HSMC09.4 To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize risk of injury.

Approximate Hours

Item	AppX Hrs
Cl	06
LI	0
SW	0
SL	1
Total	7

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Student will able to Understand Asanas as preventive measures **SO4.2**Student will able to Understand the Hypertension, Obesity, Back Pain, Diabetes, Asthema,	.	**Unit-4. Yoga & Lifestyle** 4. 1 Asanas as preventive measures. 4.2 Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana. 4.3 Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana. 4.4 Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana. 4.5 Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana.	1. Asanas as preventive measures

		4.6 Asthema: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.	

HSMC09.5 To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health

Approximate Hours

Item	AppX Hrs
Cl	06
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Student will able to Understand the Meaning and Concept of Postures **SO5.2**Student will able to Understand the Causes of Bad Posture **SO5.3** Student will able to describe Concept & advantages of Correct Posture	.	**Unit-5. Postures** 5.1 Meaning and Concept of Postures. 5.2 Causes of Bad Posture. 5.3 Advantages & disadvantages of weight training. 5.4 Concept & advantages of Correct Posture. 5.5 Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; 5.6 Lordosis, Kyphosis, Bow Legs and Scoliosis.	1. Meaning and Concept of Postures

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Yoga & Lifestyle

ii. Physical Fitness, Wellness & Lifestyle

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
HSMC09.1: To make the students understand the importance of Introduction of Yoga	6	0	3	9
HSMC09.2: To make the students understand of Fundamentals of Yoga	06	0	2	8
HSMC09.3: To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.	06	0	2	8
HSMC09.4: To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize risk of injury and Yoga & Lifestyle	06	0	1	7
HSMC09.5 To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health **&Postures**	06	1	1	8
Total Hours	30	1	9	40

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Introduction of Yoga**	10	10	00	20
CO-2	**Fundamentals of Yoga**	10	10	00	20
CO-3	**Physical Fitness, Wellness & Lifestyle**	05	05	00	20
CO-4	**Yoga & Lifestyle**	05	05	00	20
CO-5	**Postures**	05	05	00	20
Total		25	25	00	100

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Sports and yoga will be held with writtenexamination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) *Books:*

S. No.	Title	Author	Publisher	Edition &Year
1	Modern Trends and Physical Education	Prof. Ajmer Singh	Sports Publication	third
2	Light On Yoga	B.K.S. Iyengar	Kindle Edition	Fourth
3	Health and Physical Education	Dr. A. K. Shrivastava, Dr. N.K. Gaur	B. R. International Publishers	Fifth

****

Curriculum Development Team:

1. **Dr. Dileep Tiwari, Associate professor, Department of yoga, AKS University**
2. **Dr. Ganesh Prasad Gupta, Assistant professor, Department of yoga, AKS University**

COs, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: HSMC09
Course Title: Sports and Yoga

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: To make the students understand the importance of of Yoga	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**
CO2: To make the students understand the Fundamentals of Yoga	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**
CO3: To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.	**1**	**2**	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**2**	**1**	**2**	**1**	**1**
CO 4: To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize risk of injury and Yoga & Lifestyle	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**
CO5: To develop among students an appreciation of physical activity as a lifetime pursuit and a	**1**	**2**	**1**	**1**	**2**	**1**	**3**	**1**	**2**	**1**	**2**	**2**	**1**	**1**

means to better health &Postures.													

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8,9,10, 11,12 PSO 1,2	CO1 : To make the students understand the importance of Yoga	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 **Introduction of Yoga** 1.1,1.2,1.3,1.4,1.5,1.6	1,2,3
PO:1,2,3,4,5,6,7,8,9,10, 11,12 PSO 1,2	CO 2 : To make the students understand the Fundamentals of Yoga	SO2.1 SO2.2		Unit-2 **Fundamentals of Yoga** 2.1, 2.2, 2.3, 2.4,2.5,2.6	1,2
PO:1,2,3,4,5,6,7,8,9,10, 11,12 PSO 1,2	CO3: To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5 SO3.6		Unit-3: **Physical Fitness, Wellness & Lifestyle** 3.1, 3.2, 3.3, 3.4, 3.5 ,3.6	1,2
PO:1,2,3,4,5,6,7,8,9,10, 11,12 PSO 1,2	CO 4: To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize risk of injury and Yoga & Lifestyle	SO4.1 SO4.2		Unit-4: **Yoga & Lifestyle** 4.1, 4.2, 4.3, 4.4, 4.5, 4.6	1
PO:1,2,3,4,5,6,7,8,9,10, 11,12 PSO 1,2	CO5: To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health &Postures.	SO5.1 SO5.2 SO5.3		Unit-5: **Postures** Equations5.1, 5.2, 5.3, 5.4, 5.5, 5.6	1

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-III

Course Code:	**EE201**
Course Title :	**Electrical Circuit Analysis**
Pre- requisite:	Student should have basic knowledge of Electricity, Electrical Circuits, Basic Electrical Laws, Solution of differential equations, Laplace Transform
Rationale:	This course is designed to improve the student’s knowledge in network analysis besides the basic topics. It includes advanced topics in network analysis, network parameters, filter networks and network synthesis concepts. This course would help students to understand more advanced concepts in the analysis of complex networks

Course Outcomes: After the completion of this course the students will be able to

EE201.1: Apply different network theorems to analyze given network to evaluate different electrical parameters such as voltage, current, power etc.

EE201.2: Understand and apply the procedure of solving 1st and 2nd order differential equation to find the time response of given RL, RC and RLC networks.

EE201.3: Understand and learn the properties of Single phase and three phase AC circuits

EE201.4: Understand Laplace Transform and its significance in Network analysis.

EE201.5: Analyze two port networks using different network parameters such as Z, Y, Hybrid and ABCD Parameters.

Scheme of Studies:

Course Category	**Course Code**	**Course Title**	**Scheme of studies(Hours/Week)**					**Total Credits (C)**
			Cl	**LI**	**SW**	**SL**	**Total Study Hours (CI+LI+SW+SL)**	
Program Core (PCC)	EE 201	Electrical Circuit Analysis	4	2	1	1	7	5

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others).

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self Learning,

C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/ Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
PCC	EE 201	Electrical Circuit Analysis	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
PCC	EE201-L	Electrical Circuit Analysis	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE201.1: Apply different network theorems to analyze given network to evaluate different electrical parameters such as voltage, current, power etc.

Approximate Hours

Item	Approx. Hrs.
CI	12
LI	14
SW	2
SL	1
Total	29

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
the students will be able to **SO1.1** Understanding of different network theorems and their solution process **SO1.2** Solve different network problems using different network theorems **SO1.3** To understand the significance of network theorems.	1. Verification of Kirchhoff's current law 2. Verification of Kirchhoff's Voltage law 3. To verify the superposition theorem 4. To verify Thevenin's theorem 5. To verify Norton's theorem 6. To verify the maximum power transfer Theorem 7. To verify the Reciprocity Theorem applicable to D.C. circuit.	**Unit-1 Network Theorems** 1.1 Kirchhoff's Law 1.2 Node & Mesh Analysis-I 1.3 Node & Mesh Analysis-II 1.4 Thevenin's theorem 1.5 Norton' s theorem 1.6 Super-position theorem-I 1.7 Super-position theorem-II 1.8 maximum power transfer theorem 1.9 Reciprocity theorem 1.10 Millman's theorem 1.11 compensation theorem 1.12 Tellegen's theorem	1. Nodal and Mesh Analysis 2. Series and Parallel Equivalent Resistance calculation 3. Voltage Divider and Current Divider Rule

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Solution procedure of different network theorems
   ii. Numerical Problems based on different network theorems

EE201.2: Understand and apply the procedure of solving 1st and 2nd order differential equation to find the time response of given RL, RC and RLC networks.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Approximate Hours

Item	Approx. Hrs.
CI	12
LI	0
SW	2
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
the students will be ableto **SO2.1** Understand the concept of steady state and transientstate response. **SO2.2** Solve Based on Calculation of Time response of RL, RCand RLC networks. **SO2.3** Study forced andfree response ofgiven network.		**Unit-2 Solution of First and Second order networks** 2.1 steady state and transient state response 2.2 initial and final conditions in network elements-I 2.3 initial and final conditions in network elements-II 2.4 Solution of first and second order differential equations 2.5 Solution of first and second order differential equations for R-L circuit-I. 2.6 Solution of first and second order differential equations for R-L circuit-II 2.7 Solution of first and second order differential equations for R-C circuit-I. 2.8 Solution of first and second order differential equations for R-C circuit-II. 2.9 Solution of first and second order differential equations for R-L-C circuit-I. 2.10 Solution of first and second order differential equations for R-L-C circuit-II. 2.11 forced and free response, 2.12 Time constants.	1. Procedure of solving of differential equation. 2. Practice of Numerical problems.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**

i. Numerical Assignments Based on Calculation of Time response of RL, RC and RLC networks.

EE201.3: Understand and learn the properties of Single phase and three phase AC circuits

Approximate Hours

Item	Approx. Hrs.
CI	12
LI	6
SW	1
SL	1
Total	20

Session Outcomes (SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self-Learning (SL)
the students will be able to **SO3.1** Understand the concept of phasor, phasor diagrams, impedances and admittances **SO3.2** Analyze Single And 3 Phase AC Circuits. **SO3.3** Understand and Apply Dot Convention in circuit analysis.	**1.** To observe the characteristics ofRL RC and. RLC circuits. **2.** Study of 3 phasestar connection. **3.** Study of 3 phasedelta connection.	**Unit-3 : Sinusoidal steadystate analysis** 3.1 Representation of sinefunction as rotating phasor, 3.2 phasor diagrams, 3.3 impedances andadmittances, 3.4 Single phase AC circuits:RL, RC and RLC circuits, 3.5 Effective or RMS values,average power and complex power. 3.6 Three-phase circuits: Star Connection, 3.7 Delta connection, 3.8 3.9 3 phase 3 wire system and3 phase 4 wire system, 3.10 Mutual coupled circuits, 3.11 Dot Convention incoupled circuits-I. 3.12 Dot Convention incoupled circuits-II	1. Self and mutual inductance.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**

i. Numerical Problems Single and 3 phase AC circuits.

ii. Numerical Problems based on dot convention.

EE201.4: Understand Laplace Transform and its significance in Network analysis.

Approximate Hours

Item	Approx. Hrs.
Cl	8
LI	4
SW	2
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self-Learning (SL)
the students will be able to **SO4.1** Understand Laplace Transform and its properties. **SO4.2** Apply Laplace Transform to analyze electrical circuits **SO4.3** Understand the concept of poles and zeros and its significance. **SO4.4** Stability analysis on the basis of Pole-Zero plots.	**1.** To form the Transfer function of given system using MATLAB **2.** To Draw pole-zero plot of given system using MATLAB	**Unit-4 : Electrical Circuit Analysis UsingLaplace Transforms** **4.1** Laplace Transform,Properties of Laplace Transform, **4.2** Analysis of electrical circuits using Laplace Transform for standard inputs, **4.3** Inverse Laplacetransform, **4.4** Transformed Network with initialconditions. **4.5** Transfer function representation. **4.6** Poles and Zeros. Pole-Zero plots,Stability **4.7** Analysis of systemusing pole-Zero plot. **4.8** Stability analysis ofsystem using pole-Zero plot.	1. Practice of Numerical problems basedupon Laplace Transform and Inverse Laplace Transform. 2. Practice of Numerical problems based upon Poles, Zeros and Pole-Zero Plot

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Numerical Problems based upon Laplace Transform and Inverse Laplace Transform.

ii. Numerical problems based on upon Poles, Zeros and Pole-Zero Plot

EE201.5: Analyze two port networks using different network parameters such as Z, Y, Hybrid and ABCD Parameters.

Approximate Hours

Item	Approx. Hrs.
Cl	11
LI	6
SW	2
SL	1
Total	20

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
the students will be able to **SO5.1** Understand two port networks and their Properties. **SO5.2** Evaluate different network parameters for given network. **SO5.3** Understand the interconnection of two port networks and Relationship between their network Parameters	**1.** To calculate Z and Y parameters of given two port networks. **2.** To calculate Hybrid parameters of given two port network. **3.** Demonstration n of different interconnection of two port networks.	**Unit 5: Two Port Network and Network Functions** 5.1 Two Port Networks, terminal pairs, 5.2 two port variables, 5.3 Network Functions, 5.4 Network Parameters: 5.5 impedance parameters, 5.6 admittance parameters, 5.7 transmission parameters 5.8 hybrid parameters, 5.9 inter connections of twoport networks-I 5.10 inter connections of twoport networks-II 5.11 Relationship Between parameters	1. Relationship between different network Parameters. 2. Series and Parallel Connection. 3. Practice of numerical problems.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Numerical Problem based on Network Functions and Network Parameters.
   ii. Numerical Problem based on interconnection of two port networks

b. **Mini Project:**
   Draw the chart of Two Port Network Interconnection.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Instruction	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE01.1: Apply different network theorems to analyze given network to evaluate different electrical parameters such as voltage, current, power etc.	12	14	2	1	29
EE01.2: Understand and apply the procedure of solving 1st and 2nd order differential equation to find the time response of given RL, RC and RLC networks.	12	0	2	1	11
EE01.3: Understand and learn the properties of Single phase and three phase AC circuits	12	6	1	1	17
EE01.4: Understand Laplace Transform and its significance in Network analysis.	8	4	2	1	15
EE01.5: Analyze two port networks using different network parameters such as Z, Y, Hybrid and ABCD Parameters.	11	6	2	1	17
Total Hours	55	30	9	5	99

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Network Theorems	02	03	05	10
CO-2	Solution of First and Second order networks	02	05	03	10
CO-3	Sinusoidal steady state analysis	02	02	06	10
CO-4	Electrical Circuit Analysis Using Laplace Transforms	02	03	05	10
CO-5	Two Port Network and Network Functions	02	04	04	10
Total		10	17	23	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Process calculation will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Design Demonstration
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, WhatApp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Electric Circuit Analysis	K. S. Suresh Kumar	Pearson Publications	2013
2	Network Analysis	Van Valkenburg M.E	Prentice Hall India	2014
3	Circuit Theory	A. Chakrabarti	Dhanpat Rai & Co.	Eighth, 2023
4	Network Analysis and Synthesis	C.L Wadhwa	New Age International Publishers	2023
5	An Introduction to Circuit analysis: A System Approach	Donald E. Scott	McGraw Hil	2022
6.	Network Analysis	N.C. Jagan and C. Lakshminarayana	B.S. Publications	2008
7	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. Dr. Rama Shukla, HOD, Department of Electrical Engineering.
2. Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.
3. Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.
4. Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.
5. Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.
6. Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.
7. Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.
8. Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.
9. Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering

PCos,POs and PSOs Mapping

Course Title: B. Tech. Electrical Engineering
Course Code: EE 201
Course Title: Electrical Circuit Analysis

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical & Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Apply different network theorems to analyze given network to evaluate different electrical parameters such as voltage, current, power etc.	3	3	2	3	3	2	1	2	3	2	2	3	3	2
CO 2: Understand and apply the procedure of solving 1st and 2nd order differential equation to find the time response of given RL, RC and RLC networks.	3	3	3	2	2	2	1	2	1	2	2	2	2	2
CO3: Understand and learn the properties of Single phase and three phase AC circuits	3	3	2	2	3	1	2	2	1	2	2	3	2	2
CO 4: Understand Laplace Transform and its significance in Network analysis.	3	3	2	2	2	1	1	3	2	2	2	2	3	3
CO 5: Analyze two port networks using different network parameters such as Z, Y, Hybrid and ABCD Parameters.	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO1: Apply different network theorems to analyze given network to evaluate different electrical parameters such as voltage, current, power etc.	SO1.1 SO1.2 SO1.3	1, 2, 3,4,5,6,7	**Unit-1 Network Theorems** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8, 1.9,1.10,1.11,1.12	1,2,3
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO 2: Understand and apply the procedure of solving 1st and 2nd order differential equation to find the time response of given RL, RC and RLC networks.	SO2.1 SO2.2 SO2.3	0	**Unit-2 Solution of First and Second order networks** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9.2.10.2.11.2.12	1,2
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO3: Understand and learn the properties of Single phase and three phase AC circuits	SO3.1 SO3.2 SO3.3	1, 2,3	**Unit-3 : Sinusoidal steady state analysis** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9, 3.10,3.11,3.12	1
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO 4: Understand Laplace Transform and its significance in Network analysis.	SO4.1 SO4.2 SO4.3 SO4.4	1,2	**Unit-4 : Electrical Circuit Analysis Using Laplace Transforms** 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8	1,2
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO 5: Analyze two port networks using different network parameters such as Z, Y, Hybrid and ABCD Parameters.	SO5.1 SO5.2 SO5.3	1, 2,3	**Unit 5: Two Port Network and Network Functions** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9 ,5.10,5.11	1,2,3

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-III

Course Code:	**EE202**
Course Title:	**ANALOG ELECTRONICS**
Pre- requisite:	Student should have knowledge of fundamental principles of analog electronics.
Rationale:	In current scenario the diode, transistors, op-amp are extensively used in various electronic circuits. Such systems are required to design and maintain by engineer. Therefore, the goal of this course is for students to become competent to understand design and maintenance of such type of systems.

Course Outcomes: After the completion of this course the students will be able to

EE 202.1: Understanding the fundamental of diode, its characteristics and its various types.
EE 202.2: Understanding the various applications of diode.
EE 202.3: Design and analysis of bipolar junction transistor, its various configurations and applications.
EE 202.4: Design and analysis of junction field effect transistor and metal oxide semiconductor field effect transistor and its various configurations.
EE 202.5: Design and analysis of op-amp, its characteristics and various applications.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	EE 202	Analog Electronics	3	2	1	1	7	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Couse Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment**	**Total Marks**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	**(ESA)**	(PRA+ESA)
PCC	EE202	ANALOG ELECTRONICS	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	CourseTitle	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment**	**Total Marks**
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)	**(ESA)**	(PRA + ESA)
PCC	EE202-L	ANALO G ELECTR ONICS	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE 202.1: Understanding the fundamental of diode, its characteristics and its various types.

Approximate Hours

Item	Approx Hrs.
Cl	9
LI	6
SW	1
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the fundamental of PN junction diode, its working and applications. **SO1.2** Understand the fundamental of Zener diode, its working and applications. **SO1.3** Understand the fundamental of reactor diode, its working and applications. **SO1.4** Understand the fundamental of photo diode, its working and applications.	1. Plot VI characteristics of PN junction diode. 2. Plot VI characteristics of Zener diode. 3. Plot VI characteristics of photo diode	**Unit-1: Diode** 1.1 Introduction 1.2 PN Junction theory 1.3 Working of diode and its VI characteristics 1.4 Zener diode introduction 1.5 Working, VI characteristics and applications 1.6 Varactor diode introduction 1.7 Working, VI characteristics and applications 1.8 Photo diode introduction 1.9 Working, VI characteristics and applications	3. Fundamental of electronics 4. Semiconductor theory

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Classify the different types of electronic materials.
2. Discuss the property of semiconductor materials.

EE 202.2: Understanding the various applications of diode.

Approximate Hours

Item	Approx Hrs
Cl	8
LI	4
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Understanding application of diode as rectifier. **SO2.2** Understanding working of various types of clipper circuits and its applications. **SO2.2** Understanding working of various types of clamper circuits and its applications.	1. Plot the input and output waveform of half wave rectifier. 2. Plot the input and output waveform of bridge rectifier.	**Unit-2: Applications of diode** 2.1 Rectifier (introduction) 2.2 Half wave rectifier 2.3 Full wave rectifier using diode 2.4 Bridge rectifier 2.5 Clipper circuit 2.6 Types of clipper circuits and its applications. 2.7 Clamping circuit 2.8 Types of clamper circuits and its applications.	1. Working of diode. 2. Concept of series and parallel circuits.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. How diode works as rectifier.
ii. Explain working of various types of clipping circuits.
iii. Explain working of various types of clamping circuits.

EE 202.3: Design and analysis of bipolar junction transistor, its various configurations and applications.

Approximate Hours

Item	Approx Hrs
Cl	9
LI	6
SW	1
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self-Learning (SL)
SO3.1 Understand the working of NPN and PNP transistor. **SO3.2** Understand the working of CB configuration of transistor. **SO3.3** Understand the working of CE configuration of transistor. **SO3.4** Understand the working of CC configuration of transistor. **SO3.5** Understand how transistor works as a switch. **SO3.6** Understand how transistor works as an amplifier.	1. Plot input and output characteristics of CB configuration of transistor. 2. Plot input and output characteristics of CE configuration of transistor. 3. Plot input and output characteristics of CC configuration of transistor.	**Unit-3: Bipolar Junction Transistor Circuits** 2.1 Basic Structure 2.2 Types, mode of biasing 2.3 Working of NPN transistor 2.4 Working of PNP transistor 2.5 Configurations ofBJT. 2.6 Current gain of CB,CE and CC configuration. 2.7 Relation between α,β and γ 2.8 BJT as switch 2.9 BJT as amplifier	1. Properties of N type and P type semiconductor.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

- **i.** Explain how transistor works as an amplifier.
- **ii.** Explain how transistor works as a switch.

EE 202.4: Design and analysis of junction field effect transistor and metal oxide semiconductor field effect transistor and its various configurations.

Approximate Hours

Item	Approx Hrs
Cl	8
LI	6
SW	1
SL	1
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand the working of JFET. **SO4.2** Understand the working of depletion type MOSFET. **SO4.3** Understand the working of enhancement type MOSFET.	1. Plot drain and transfer characteristic of JFET. 2. Plot drain and transfer characteristic of depletion type MOSFET. 3. Plot drain and transfer characteristic of enhancement type MOSFET.	**Unit-4: Field Effect Transistor Circuits** 4.1 Introduction of FET. 4.2 Structure of JFET 4.3 Working of N channel JFET 4.4 Working of P channel JFET 4.5 Drain and transfer characteristics of JFET 4.6 Structure of MOSFET 4.7 Working of deletion type MOSFET and its characteristics 4.8 MOSFET as an amplifier	1. Difference between of BJT and FET.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Explain working of N channel JFET.
ii. Explain working of depletion type MOSFET.
iii. Explain working of enhancement type MOSFET.

EE 202.5: Design and analysis of op-amp, its characteristics and various applications.

Approximate Hours

Item	Approx Hrs
Cl	11
LI	8
SW	1
SL	1
Total	21

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand working of op- amp and its various applicati ons.	**1.** Working of inverting and non-inverting op amp. **2.** Inverting op amp as summing amplifier. **3.** Non inverting op amp as summing amplifier. **4.** Op-amp as difference amplifier.	**Unit 5: OP AMP and its applications** 5.1 Introduction of op amp. 5.2 Inverting amplifier. 5.3 Non inverting amplifier. 5.4 Application of op amp (summing amplifier) 5.5 Application of op amp (subtractor circuit) 5.6 Application of op amp (Integrator and differentiator circuit) 5.7 Application of op amp (Logarithmic amplifier) 5.8 Application of op amp (Anti logarithmic amplifier) 5.9 Application of op amp (voltage to Current converter). 5.10 Application of op amp (current to voltage converter). 5.11 Application of op amp in oscillatorcircuits.	1. Basic mathematical formulas.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

Calculate the gain of inverting and non-inverting op amp.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE 202.1: Understanding the fundamental of diode, its characteristics and its various types.	9	6	1	1	17
EE0 202.2: Understanding the various applications of diode.	8	4	1	1	14
EE 202.3: Design and analysis of bipolar junction transistor, its various configurations and applications.	9	6	1	1	17
EE 202.4: Design and analysis of junction field effect transistor and metal oxide semiconductor field effect transistor and its various configurations.	8	6	1	1	16
EE 202.5: Design and analysis of op-amp, its characteristics and various applications.	11	8	1	1	21
Total Hours	45	30	5	5	85

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Diode	04	03	01	8
CO-2	Applications of diode	06	03	02	11
CO-3	Bipolar Junction Transistor Circuits	04	03	01	8
CO-4	Field Effect Transistor Circuits	05	04	02	11
CO-5	OP AMP and its applications	04	04	04	12

Total	23	17	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Process calculation will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Design Demonstration
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Integrated Electronics	Millman and Halkias	Mc Graw Hill	Second Edition
2	Electronics Devices and Circuits	R. Boylested and L. Nashelsky	Prentice Hall India	Tenth Edition
3	Electronics Devices and Circuits	Millman and Halkias	TMH Edition	Fouth Edition 2015
4	Analog Electronics	Malcolm Goodge	TMH Edition	2019
5	ElectronicsPrinciples	Malvino	TMH Edition	2020
6	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni,Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE202
Course Title: ANALOG ELECTRONIC CIRCUITS

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	roblem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Understanding the fundamental of diode, its characteristics and its various types.	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO 2: Understanding the various applications of diode.	3	3	3	3	2	2	1	3	2	2	2	3	3	2
CO3: Design and analysis of bipolar junction transistor, its various configurations and applications.	3	2	3	2	2	1	2	2	2	2	2	3	3	2
CO 4: Design and analysis of junction field effect transistor and metal oxide semiconductor field effect transistor and its various configurations.	3	3	2	2	2	2	2	3	2	2	2	2	2	3
CO 5: Design and analysis of op-amp, its characteristics and various applications.	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	CO1: Understanding the fundamentalof diode, its characteristics and its various types.	SO1.1 SO1.2 SO1.3 SO1.4	1 , 2 , 3	**UNIT-1: Diode** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	1,2
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	CO 2: Understanding the variousapplications of diode.	SO2.1 SO2.2 SO2.3	1 , 2	**UNIT-2**: **Applications of diode** 2.1, 2.2, 2.3, 2.4, 2.5,2.6,2.7,2.8	1,2
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	CO3: Design and analysis of bipolar junction transistor, its various configurations and applications.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5 SO3.6	1 , 2 , 3	**Unit-3: Bipolar Junction Transistor Circuits** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	CO 4: Design and analysis of junctionfield effect transistor and metal oxide semiconductor field effect transistor and its various configurations.	SO4.1 SO4.2 SO4.3	1 , 2 , 3	**UNIT-4: Field Effect Transistor Circuits** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	1
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	CO 5: Design and analysis of op-amp, its characteristics and various applications.	SO5.1	1 , 2 , 3 , 4	**UNIT-5: OPAMP and its applications** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11	1

Semester-III

Course Code:	**EE 203**
Course Title :	**Electrical Machine-1**
Pre-requisite:	Students should have basic knowledge of electrostatics & electromagnetic, Physics, and Mathematics.
Rationale:	A process of introducing formal knowledge of electrical machine principles, construction, and working of various transformers and D.C. machines with various concepts of magnetic fields and circuits.

Course Outcomes: After the completion of this course the students will be able to

EE 203.1: Understand the concepts of magnetic circuits.
EE 203.2: Understand the phenomenon of electromagnetic force and torque
EE 203.3: Understand the operation of DC machines.
EE 203.4: Analyze the differences in operation of different dc machine configurations.
EE 203.5: Analyze single phase and three phase transformers circuits.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	EE 203	Electrical Machine-1	3	2	1	1	7	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field, or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project, etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL have to be planned and performed under the continuous guidance and feedback of the teacher to ensure the outcome of Learning.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Scheme of Assessment:
Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA + ESA)
PCC	EE 203	Electrical Machine-1	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	CourseTitle	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
PCC	EE 203	Electrical Machine-1	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE 203.1: Understand the concepts of magnetic circuits.

Approximate Hours

Item	AppX Hrs
Cl	08
LI	02
SW	02
SL	01
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Attain the basic knowledge about flux, flux density, and magnetic field intensity. **SO1.2** Understand the concept of reluctance and electro-motive force in magnetic circuits. **SO1.3** Understand and derive the laws of magnetic circuits. **SO1.4** Understand the Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air. **SO1.5** Understand the influence of highly permeable materials on the magnetic flux lines.	1. Study of different laws of magnetic circuit.	**Unit-1: Magnetic fields and magnetic circuits.** 1.1 Flux 1.2 Flux Density 1.3 Magnetic Field Intensity 1.4 Reluctance 1.5 Electro-Motive Force 1.6 Laws of Magnetic Circuit. 1.7 Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air. 1.8 Influence of highly permeable materials on the magnetic flux lines	1. Understand the various concepts of the Magnetic fields and magnetic circuits.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

i. Write down all the concepts of magnetic circuits with numerical.

b. **Mini Project:**

Learn different laws of magnetic circuit.

EE 203.2: Understand the phenomenon of electromagnetic force and torque

Approximate Hours

Item	AppX Hrs
Cl	07
LI	04
SW	02
SL	01
Total	14

Session Outcomes (SOs)	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self- Learning (SL)
SO2.1 To Understandthe B-H curve. **SO2.2** To understand the different typesof magnetic circuits. **SO2.3** Determine the energy stored in magnetic circuit. **SO2.4** To understand theconcept of force and torque. **SO2.5** To Understand theworking of different devices.	**1.** Study B-H curveof magnetic material. **2.** Study of different equipment usedin magnetic circuit.	**Unit-2 Electromagneticforce and torque.** 2.1 B-H curve of magnetic materials. 2.2 flux-linkage vs current characteristic of magnetic circuits. 2.3 linear and nonlinear magnetic circuits. 2.4 energy stored in the magnetic circuit. 2.5 force as a partial derivative of stored energy with respect to position of a movingelement. 2.6 torque as a partialderivative of stored energy with respect to angular position of a rotating element. 2.7 galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency.	1. Learn and gain knowledge of Electromagn etic force and torque.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Numerical Problems on flux linkage.
   ii. Numerical Problems on energy stored.
   iii. Write Down the Principles and Workings of force and torque.

b. **Mini Project:**
   i. Draft different types of apparatus.

EE 203.3: Understand the operation of DC machines.

Approximate Hours

Item	AppX Hrs
Cl	09
LI	02
SW	01
SL	01
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 To Understand the Basic Construction. **SO3.2** To understand the various parts of magnetic structure.	1. Study the constructional details of different parts of DC machine.	**Unit-3 DC Machines** 3.1 Construction 3.2 magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core. 3.3 visualization of magnetic field produced by the field winding	1. Learn and gain knowledge of DC Machine.

SO3.3 To understand the distribution of flux at different parts. **SO3.4** To understand the different equations. **SO3.5** To understand the armature reaction and commutator action.		excitation with armature winding open. 3.4 air gap flux density distribution, flux per pole, induced EMF in an armature coil. 3.5 Armature winding and commutation - Elementary armature coil and Commutator, lap and wave windings, construction of Commutator, linear commutation 3.6 Derivation of back EMF equation 3.7 Armature MMF wave, Armature reaction 3.8 Derivation of torque equation 3.9 Air gap flux density distribution with armature reaction.	

SW-2 Suggested Sessional Work (SW):

a. Assignments:
- Numerical Problems on EMF and Torque Equations.
- Numerical Problems of Performance Characteristics.
- Write Down the Principles and Workings of the DC Machine.

b. Mini Project:
  a. Draft the DC machine Construction.

EE 203.4: Analyze the differences in operation of different dc machine configurations.

Approximate Hours

Item	AppX Hrs
Cl	09
LI	12
SW	01
SL	01
Total	23

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 To derive the equation for generation and motoring. **SO4.2** To Understand the Various field excitations. **SO4.3** To Understand the open circuit characteristics of separately excited DC generator. **SO4.4** To Understand the back EMF with armature reaction. **SO4.5** To Analyze the phenomenon of voltage build up. **SO4.6** To understand the no load and on load characteristics with speed control methods. **SO4.7** To understand the losses and test performed on DC machine.	1. Obtain magnetic characteristics of DC shunt generator. 2. Obtain load characteristics of DC shunt generator. 3. Obtain load characteristics of DC series generator. 4. Obtain Load Characteristics of DC series motor. 5. To perform speed control methods dc motor. 6. To perform Back-to-Back test on DC machine.	**Unit-4: D.C. Machines – motoring and generation** 4.1 Armature circuit equation for motoring and generation 4.2 Types of field excitations - separately excited, shunt and series. 4.3 Open circuit characteristic of separately excited DC generator. 4.4 back EMF with armature reaction 4.5 voltage build-up in a shunt generator 4.6 Critical field resistance and critical speed. 4.7 V-I characteristics and torque-speed characteristics of separately excited shunt and series motors. 4.8 Speed control through armature voltage. 4.9 Losses, load testing and back-to-back testing of DC machines.	1. To ensure all the concepts of DC Motor should be learned.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Numerical Problems on Back EMF and Torque Equation.
   ii. Numerical Problems on Speed Control Methods.

EE 203.5: Analyze single phase and three phase transformers circuits.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	10
SW	01
SL	01
Total	24

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 Evaluation of Single-Phase Transformer- Construction, working, phasor diagram, efficiency, voltage regulation and losses. **SO5.2** To Understand Testing of Transformers **SO5.3** To Study the Construction and Working of Auto-Transformer	1. Study the Constructional details of transformer. 2. To perform open circuit test on single-phase transformer. 3. To perform short circuit test on single-phase transformer.	**Unit-5: Transformers.** 5.1 Principle 5.2 construction and operation of single-phase transformers. 5.3 equivalent circuit, phasor diagram 5.4 voltage regulation, losses and efficiency 5.5 Testing - open circuit and short circuit tests, polarity test	1. Make Well-Organized Notes on of All Concepts of Transformers.

SO5.4 To Understand the Construction of a Three-Phase Transformer. **SO5.6** To Understand the Different Types of Connections and their Applications. **SO5.7** To Study the Parallel Operation of Transformers. **SO5.8** To Understand the Excitation phenomenon and harmonics in transformers with B-H curve. **SO5.9** To Study the Three Winding Transformers and transformer cooling.	4. To perform stumper's test or back-to-back test on single-phase transformer. 5. Study and working of Auto Transformer	5.6 back-to-back test, separation of hysteresis and eddy current losses 5.7 Three-phase transformer – construction, types of connection and their comparative features 5.8 Parallel operation of single-phase and three-phase transformers. 5.9 Autotransformers - construction, principle, applications and comparison with two winding transformer. 5.10 Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current 5.11 Phase conversion - Scott connection, three-phase to six-phase conversion 5.12 Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers, Cooling of transformers.	

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Numerical Problems on Transformer Equation and O.C. & S.C. Test.

b. Mini Project:

ii. Evaluate the Phasor Diagram of the Transformer at different Loads.

Brief of Hours Suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE 203.1: Understand the concepts of Principles of different Magnetic fields and magnetic circuits.	08	02	2	1	13
EE 203.2: Understand the Concept of electromagnetic torque and force.	07	04	2	1	14
EE 203.3: Understand the Construction and working of dc machines with their starting and speed control methods.	09	02	1	1	13
EE 203.4: Understand the construction and working of dc motor with various test performed on dc machine.	09	12	1	1	23
EE 203.5: To Study the Transformers.	12	10	1	1	24
Total Hours	**45**	**30**	**07**	**5**	**87**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Magnetic fields and magnetic circuits	03	01	01	05
CO-2	Electromagnetic torque and force	01	02	02	05
CO-3	DC Machines	02	07	06	15
CO-4	DC Machine – generation and motoring	03	07	05	15
CO-5	Transformers	03	03	04	10
Total		12	20	18	50

Legend: R: Remember, U: Understand, A: Apply

The end-of-semester assessment for Process calculation will be held with the written examination of 50 marks.

Note. Detailed Assessment rubrics need to be prepared by the course-wise teachers for the above tasks. Teachers can also design different tasks as per requirement, for end-semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture

2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to the electrical power plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, WhatsApp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Electrical Machines	I.J. Nagrath & D.P. Kothari	Tata McGraw-Hill	Fourth-2018
2	Electrical Machines	Husain Ashfaq	Dhanpat Rai & Sons	Third-2016
3	Electrical Machinery	P.S. Bimbhra	Khanna Publisher	Seventh-2011
4	Electric Machinery	A.E. Fitzgerald, C. Kingsley Jr, and Umans	McGraw-Hill	Sixth-2002
5	Electric Machine and Transformers	Irving L., Kosow	Prentice Hall of India	Second-1991
6	The Performance and Design of AC machines	M.G. Say	Pitman & Sons	First-2005
7	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni,Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE203
Course Title: ELECTRIC MACHINE 1

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering Knowledge	Problem Solving	Design Skills	Laboratory Skills	Teamwork	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: Understand the concepts of magnetic circuits.	3	2	3	2	2	2	1	1	2	1	1	2	2	2
CO 2: Understand the phenomenon of electromagnetic force and torque	1	2	3	2	1	2	1	1	2	1	1	3	3	2
CO3: Understand the operation of DC machines.	3	3	2	1	1	2	2	2	1	1	2	3	1	2
CO 4: Analyze the differences in the operation of different DC machine configurations.	3	2	2	2	3	2	1	3	2	1	2	2	3	3
CO 5: Analyze single-phase and three-phase transformer circuits.	3	2	3	1	1	3	2	3	1	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2, 3, 4	CO-1: Understand the concepts of magnetic circuits.	SO1.1,SO1.2,SO1.3 SO1.4, SO1.5	1	**Unit-1: Magnetic fields and magnetic circuits.** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	1
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2, 3, 4	CO-2: Understand the phenomenon of electromagnetic force and torque	SO2.1, SO2.2, SO2.3 SO2.4, SO2.5	1, 2	**Unit-2**: **Electromagnetic force and torque.** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7	1
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2, 3, 4	CO-3: Understand the operation of DC machines.	SO3.1,SO3.2 SO3.3, SO3.4 SO3.5	1	**Unit-3: DC Machines** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2, 3, 4	CO-4: Analyze the differences in the operation of different DC machine configurations.	SO4.1,SO4.2, SO4.3SO4.4, SO4.5, SO4.6 SO4.7	1, 2, 3,4,5,6	**Unit-4: D.C. Machines – motoring and generation** 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9	1
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2, 3, 4	CO-5: Analyze single-phase and three-phase transformer circuits.	SO5.SO5.2SO5.3 SO5.4SO5.5 SO5.6 SO5.7 SO5.8 SO5.9	1, 2, 3,4,5	**Unit 5: Transformers** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10, 5.11, 5.12	1

Semester-III

Course Code: **BSC 206**

Course Title : **Mathematics III**

Pre- requisite: Students should review the fundamentals of calculus, linear algebra, and differential equations, and matrix operations

Rationale: The program aims to develop advanced problem-solving and analytical skills and prepares students for careers in academia, research, industry, or other sectors that require advanced mathematical expertise.

Course Outcome :

BSC 206.1 By the end of the course students are expected to have deep understanding in complex analysis with a focus on Cauchy-Riemann equations, analytic functions, harmonic functions, and conformal mappings.

BSC 206.2 By the end of the course students are expected to understand the concept of a contour integralin the complex plane, concept of zeros of analytic functions and behavior of functions near essential singularities.

BSC 206.3 The course provide a comprehensive overview of the skills and understanding that students are expected to gain from a course in elementary probability theory and random variables.

BSC 206.4 The course provide a comprehensive overview of the skills and understanding that students are expected to gain from a course covering measures of central tendency and measures of dispersion**.**

BSC 206.5- The course provide a comprehensive overview of the skills and understanding that students are expected to gain from a course covering correlation and regression, rank correlation, curve fitting, and various tests of significance.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
BSC	BSC 206	Mathematics III	4	0	1	1	6	4

Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self-Learning,
C: Credits.
Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	**Course Code**	**Course Title**	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks (PRA+ ESA)**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT +SA +CAT+ AT)		
BSC	BSC 206	Mathematics III	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

BSC206.1: By the end of the course students are expected to have deep understanding in complex analysis with a focus on Cauchy-Riemann equations, analytic functions, harmonic functions, and conformal mappings

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Understand and state the Cauchy-Riemann equations for a complex-valued function **SO1.2** Determine the real and imaginary parts of a complex function and check for analyticity using the Cauchy-Riemann equations **SO1.3** Identify and define analytic functions in the complex plane **SO1.5** Understand the concept of Represent functions as Taylor and Laurent series; classify singularities and poles; find residues and evaluate complex integrals using the residue theorem.	-	**Unit-1.0** **Complex Variable** : 1.1Definition of Analytic function 1.2 Cauchy-Riemann equations in Cartesian form and polar form 1.3 Questions of Analytic function based on Cartesian form 1.4 Questions of Analytic function based on polar form 1.5 Harmonic function and orthogonal functions 1.6 Conjugate Method for construction of an analytic function 1.7 Milne's method for construction of an analytic function 1.8 Totorial- 1 1.9 Conformal mappings, 1.10 questions of Conformal mappings 1.11 Mobius transformations 1.12 properties of Mobius transformations	1 Apply the Cauchy-Riemann equations to verify the analyticity of a given function. 2 Explore the properties of trigonometric functions in the context of complex analysis 3 Define logarithmic functions and explore their behavior in the complex plane

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. write the application of complex function.
ii. Properties of Complex Variable.
iii. Write all formula of complete unit.

b. Other Activities (Specify):
Quiz, Class Test.

BSC206.2: By the end of the course students are expected to understand the concept of a contour integral in the complex plane, concept of zeros of analytic functions and behavior of functions near essential singularities.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understand the concept of a contour integral in the complex plane. **SO2.2** Evaluate contour integrals using parametrization and integration techniques.		**Unit-2.0** **Complex Variable (Integration).** 2.1 Cauchy's integral formula for analytic function	**1** Apply contour integrals to evaluate complex integrals. **2** Compute Taylor series expansions for given functions

SO2.3 Apply contour integrals to evaluate complex integrals. **SO2.4** State and understand the Cauchy Integral formula for analytic functions **SO2.5** Apply the Cauchy Integral formula to calculate values of analytic functions		2.2 Questions of Cauchy's integral formula for simple poles. 2.3 2Questions of Cauchy's integral formula for order poles. 2.4 Residues of an analytic function 2.5 Questions of Residues for simple poles 2.6 5 Questions of Residues for order poles 2.7 Residue theorem and based questions 2.8 Poles and singularities of analytic function 2.9 Zeros of analytic function 2.10 questions of Singularity. 2.11 tutorial 1 2.12 tutorial 2	**3** Define residues of complex functions and understand their significance

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. write a short notes on singularities.

ii. Define poles and zeros with example.

b. Mini Project:

Oral presentation, Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

BSC202.3: The course provide a comprehensive overview of the skills and understanding that students are expected to gain from a course in elementary probability theory and random variables

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Understand the fundamental concepts of probability theory **SO3.2** Develop an appreciation for the role of probability in modeling uncertainty and randomness **SO3.3** Define probability using a mathematical framework **SO3.4** Understand probability axioms and laws governing probability measures **SO3.5** Classify events as mutually exclusive, exhaustive, dependent, or independent		**Unit-3.0 Probability and Random Variable** 3.1 definition of probability 3.2 Mathematical definition of probability 3.3 Various types of events 3.4 Additive law of probability 3.5 Multiplicative law of probability 3.6 Compound probability 3.7 Conditional probability 3.8 Bays rule of probability 3.9 Discrete random variable 3.10 Continuous random variable 3.11 Binomial distribution 3.12 Poisson distribution	**1.** Analyze compound probability involving multiple events **2.** Define and understand conditional probability **3.** Define and understand the concept of a random variable

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Define probability using a mathematical framework.
ii. write the application of probability in daily life.

b. Mini Project:

Oral presentation, Power Point Presentation.

BSC202.4: Students will compute the expression of permutation groups by using permutation multiplication.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Define arithmetic mean and understand its significance **SO4.2** Compute the arithmetic mean for both grouped and ungrouped data **SO4.3** Apply different methods (direct method, assumed mean method) for calculating the arithmetic mean. **SO4.4** Understand the properties of the arithmetic mean, including its sensitivity to extreme values **SO4.5** Define the median and understand its interpretation		**Unit-4.0** **Measures of Central Tendency** 4.1 methods of calculating Arithmetic mean 4.2 methods of calculating median 4.3 properties of mean and median 4.4 numericals of mean for different data 4.5 4 numericals of median for different data 4.6 methods of calculating mode 4.8 relation based question of mean median and mode 4.9 Measures of dispersion	**1** Define mode and recognize its applications **2** Understand the concept of unimodal, bimodal, and multimodal distributions **3** Explore the relationships and patterns among the mean, median, and mode

		4.10 Range 4.11 quartile deviation 4.12 standard deviation and its properties	

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. write the application of mean median and mode .

ii. Explain mean with real life example.

b. Other Activities (Specify):

Quiz, Class Test.

BSC202.5: The course provide a comprehensive overview of the skills and understanding that students are expected to gain from a course covering correlation and regression, rank correlation, curve fitting, and various tests of significance.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Define correlation and understand its significance in statistical analysis. **SO5.2** Recognize the types of relationships between variables (positive, negative, or none) based on correlation **SO5.3**		**Unit-5.0** **5.1** Defination of Correlation **5.2** formula of correlation coefficient **5.3** Questions of correlation coefficient **5.4** Defination of regrattion **5.5** question of line of regrattion **5.6** rank correlation	**1** Define regression analysis and understand its purpose in modeling relationships between variables **2** Apply the method of least squares to fit straight lines, second-degree

Calculate and interpret Pearson's correlation coefficient. **SO5.4** Define and calculate rank correlation coefficients **SO5.5** Understand the use of rank correlation in cases where variables may not have a linear relationship		5.7 fitting of a straight line 5.7 fitting of a second degree parabola 5.8 fitting of different curves 5.9 Tutorial-1 5.10 Test of significance for large sample 5.11 Test of significance for small sample 5.12 Tutorial-2	parabolas, and more general curves to datasets **3** Test the difference between two proportions

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
CO1-202.1 By the end of the course students are expected to have deep understanding in complex analysis with a focus on Cauchy-Riemann equations, analytic functions, harmonic functions, and conformal mappings.	12	1	1	14
CO1-202.2 By the end of the course students are expected to understand the concept of a contour integral in the complex plane, concept of zeros of analytic functions and behavior of functions near essential singularities.	12	1	1	14
CO1-202.3 The course provide a comprehensive overview of the skills and understanding that students are expected to gain from a course in elementary probability theory and random variables.	12	1	1	14
CO1-202.4 The course provide a comprehensive overview of the skills and understanding that students are expected to gain from a course covering measures of central tendency and measures of dispersion	12	1	1	14
CO1-202.5 The course provide a comprehensive overview of the skills and understanding that students are	12	1	1	14

expected to gain from a course covering correlation and regression, rank correlation, curve fitting, and various tests of significance.				
Total Hours	**60**	**5**	**5**	**70**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Complex Variable – Differentiation	03	01	01	05
CO-2	Complex Variable – Integration	02	05	01	08
CO-3	Probability and Random Variable	03	05	05	13
CO-4	Measures of Central Tendency and Measures of Dispersion	02	08	05	15
CO-5	Statistics	03	04	02	05
Total		**13**	**23**	**14**	**50**

Legend: R: Remember, U: Understand, A: Apply

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies

1. Improved Lecture
2. Tutorial
3. Presentation
4. Group Discussion
5. Online sources
6. Seminar
7. Workshop

Suggested Learning Resources:

a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Engineering Mathematics-III	D. K. Jain. Engineering	Shree Ram Prakashan.	1st edition, 2018
2				
3	Engineering Mathematics-III	D.C.Agrawal	S Chand Prakashan.	2022
4	Introduction to Engineering Engineering Mathematics-III	H.K.Dass Sonendra Gupta	Dhanpat Rai Publishing	2nd edition, 2014

****

Curriculum Development Team

1. **Dr.Sudha Agrawal, HOD, Department of Mathematics.**
2. **Dr.Ekta Shrivastava , Assistant Professor, Department of Mathematics.**
3. **Mr.Neelkanth Napit, Assistant Professor, Department of Mathematics.**
4. **Mrs.Vandana Soni, Assistant Professor, Department of Mathematics.**
5. **Mr.Radhakrishna Shukla, Assistant Professor, Department of Mathematics.**
6. **Mr.Ghanhyam sen, Assistant Professor, Department of Mathematics.**
7. **Ms. Pushpa Kushwaha, Assistant Professor, Department of Mathematics.**
8. **Ms. Arpana Tripathi, Assistant Professor, Department of Mathematics.**

COs,POs and PSOs Mapping

Course Title: B. Tech. Electrical Engineering
Course Code: BSC 206
Course Title: MATHEMATICS-III

Course Outcome	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1**:** Understand the importance of algebraic properties with regard to working within various number systems.	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**2**	**2**	**2**	**3**
CO2: Students will determine whether a given binary operation on the given set gives a group structure by applying the axioms.	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**3**	**2**	**2**	**2**	**3**	**3**	**2**
CO3:Students will be able to describe all elements in a cyclic subgroup by using generators.	**3**	**2**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**
CO4-Students will compute the expression of permutation groups by using permutation multiplication.	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**
CO5- Students will create the concept of a group action to real life problems such as Counting.	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**3**

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO1-By the end of the course students are expected to have deep understanding in complex analysis with a focus on Cauchy-Riemann equations, analytic functions, harmonic functions, and conformal mappings	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1 **Complex Variable (Differentiation)** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11,1.12	1,2,3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO2-By the end of the course students are expected to understand the concept of a contour integral in the complex plane, concept of zeros of analytic functions and behavior of functions near essential singularities	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-2 **Complex Variable – (Integration)** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9,2.10 2.11,2.12	1,2,3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO3-The course provide a comprehensive overview of the skills and understanding that students are expected to gain from a course in elementary probability theory and random variables.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-3 **Probability and Random** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,3.11,3.12	1,2,3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2,	CO4-The course provide a comprehensive overview of the skills and understanding that students are expected to gain from a course covering measures of central tendency and measures of dispersion	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-4 **Measures of Central Tendency and Measures of Dispersion** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10,4.11,4.12	1,2,3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2,	CO5-202. The course provide a comprehensive overview of the skills and understanding that students are expected to gain from a course covering correlation and regression, rank correlation, curve fitting, and various tests of significance	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-5 **Statistics** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11,5.12	1,2,3

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-III

Course Code: **ESC 207**

Course Title: **Engineering Mechanics**

Pre- requisite: Student should have basic knowledge of mathematics and Physics up to higher secondary level.

Rationale: As a bridge between theory and application, engineering mechanics is used to formulate new ideas and theories, discover and interpret phenomena and develop experimental and computational tools.

Course Outcomes:

ESC 207.1: Understanding of term Mechanics and its classification.
ESC 207.2: Understanding Resolution and composition of force acting on the rigid body.
ESC 207.3: Compute the resultant of force for different system of force and study of different laws related to different force system.
ESC 207.4: compute the different types of load acting on different types of beam.
ESC 207.5: Compute the centroid, second moment of area, center of gravity, moment of inertia and mass moment of inertia.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits(C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	ESC 207	Engineering Mechanics	3	2	1	1	7	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop,field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Course Code	Course Title	Scheme of Assessment(Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	ClassTest 2 (2 best out of 3) 10 markseach (CT)	Seminar one (SA)	Class Activityany one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
ESC	ESC 207	Engineering Mechanics	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	CourseTitle	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
ESC	ESC 207-L	Engineering Mechanics	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

ESC 207.1: Understanding of term Mechanics and its classification.

Approximate Hours

Item	AppX Hrs
Cl	9
LI	4
SW	2
SL	2
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Understanding of basic knowledge of term Mechanics. SO1.2 Understanding how objects move when forces are applied to them. Newton's laws lay the foundation for comprehending how forces interact with objects to cause motion. SO1.3 Describing motion without considering its causes. This includes concepts like velocity, acceleration, displacement, and time. SO1.4 Understanding the causes of motion, mainly through the study of forces. This involves concepts like friction, tension, gravitational forces, and how they affect objects.	1.1 Introduction to laboratory 1.2 Introduction to Tools and Equipments	**Unit-1.0 Introduction to Mechanics** 1.1 Introduction of term mechanics 1.2 classification of mechanics 1.3 static and dynamics 1.4 classification of dynamics 1.5 kinetic and kinematic 1.6 fundamental laws of mechanics 1.7 Gravitational law 1.8 Newton Laws 1.9 Numerical	**4.** Numerical problem related to classification of mechanics **5.** Numerical problem related to basic laws

SW-1 Suggested Sessional Work (SW):

a. Assignments:
   i. Explain Newton 2nd law of motion and its application
   ii. Write the definition of basic term related to static and dynamic

ESC 207.2: Resolution and composition of force acting on the rigid body..

Approximate Hours

Item	AppX Hrs
Cl	8
LI	12
SW	0
SL	1
Total	21

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Ability to break down a single force into its horizontal and vertical components. This involves understanding trigonometric concepts like sine and cosine functions to determine the components of a force along different axes. SO2.2 Ability to determine the resultant of multiple forces acting on an object. This includes finding the net force and direction when multiple	**2.1** Introduction to Laws of forces **2.2** Verification of Parallelogram law of forces **2.3** Verification of Triangle law of forces **2.4** Verification of Polygon law of forces **2.5** Introduction to Lami's theorem **2.6** To verify the lami's theorem	**Unit-2.0 Resolution and Composition of Forces** 2.1 Forces and its type, Pressure and Stress 2.2 Concept of free body diagram 2.3 Characteristics and Effects of a Force, System of Forces, Resolution of a Force 2.4 Composition of Forces, Resultant / Equilibrant Force, Law of Parallelogram of Forces, 2.5 Law of Triangle of Forces, Polygon Law of	1. Numericals of resolution of forces 2. Numerical problem of Law of Parallelogram of Forces

forces are applied simultaneously. SO2.3 Applying these concepts to real-world scenarios, such as analyzing the forces acting on structures, machines, or systems. This could involve calculating the forces involved in bridges, buildings, or mechanical devices SO2.4 Understanding how to add multiple vectors together using the Polygon Law. This involves arranging vectors head-to-tail to form a closed polygon, where the resultant vector is the vector closing the polygon from the starting point to the end point.		Forces, Lami's Theorem 2.6 Equilibrium of a Body Under Two / Three/More Than Three Forces 2.7. Law of Superposition of Forces. 2.8 Practice class	

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Derivation of lamis theorem and its numerical problem
   ii. Derivation of Parallelogram and its numerical

ESC 207.3: Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.

Approximate Hours

Item	AppX Hrs
Cl	8
LI	4
SW	2
SL	2
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Calculating the resultant force by summing up all the individual forces acting on an object. The resultant force represents the net effect of all forces combined. SO3.2 Identifying the point where the resultant force is applied on the object or structure. This may involve finding the moment or torque caused by the forces and locating the resultant force's line of action. SO3.3 Checking whether the system of forces is in equilibrium. If the resultant force is zero, the system is in equilibrium; otherwise, the object or structure will experience acceleration or movement in the direction of the resultant force.	3.1 Introduction to moment and couple 3.2 To verify the principle of moment using by bell crank lever	**Unit-3.0 System of forces** 3.1 Introduction of system of forces, Moment of a force 3.2 Varignon'sTheorem 3.3 Resultant of Parallel Forces, Moment of a Couple 3.4 Resolution of Force into a Couple 3.5 Resultant of Coplanar, Non Con-Current Forces 3.6 Numericals on Moment and Couple 3.7 Numericals on system of forces 3.8 Practice class	1. Explanation of nature of moment and its types 2. Numericals on resultant force

SW-3 Suggested Sessional Work (SW):
a. Assignments:

i. Classify system of forces.
ii. Explain the concept of couple

ESC 207.4: Compute the different types of load acting on different types of beam.
Approximate Hours

Item	AppX Hrs
Cl	10
LI	4
SW	2
SL	2
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Calculating the forces and moments at support points. This includes determining the vertical and horizontal reactions, as well as any moments generated at these locations due to applied loads. SO4.2 Supported at both ends and can carry loads between the supports. They experience maximum bending moment at the center and zero shear at the ends.	4.1 Introduction to Trusses 4.2 To calculate the forces in members of simple roof truss and find the percentage error between the observed and calculated values	Unit-4.0 **Beams and Trusses** 4.1 define beam and its type 4.2 Simply Supported Beam, Overhanging Beam, Cantilever Beam 4.3 Simply Supported Beam, Overhanging Beam, Cantilever Beam 4.4 concept of load, Load on the Beam or Frame 4.5 Load on the Beam or Frame, Calculation of support reaction and its type 4.6 Support reaction calculation in cantilever beam 4.7 Support reaction calculation in simple supported beam, Concept of truss	1. Numerical problem of support reaction calculation in cantilever beam and simply supported beam. 2. Numerical problem of truss analysis by joint method.

SO4.3 Fixed at one end and free at the other. They carry loads at the free end and experience maximum shear at the fixed end. SO 4.4 Assemblies of beams connected by joints, commonly used in bridges and roofs. They rely on the framework of triangles to distributeloads efficiently.		4.8 Analysis of truss by analytical method (Joint method) 4.9 Analysis of truss by analytical method (Section method) 4.10 Practice class	

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Classify Beams and Load acting on it.
ii. Explain types of truss.

ESC 207.5: Compute the centroid, second moment of area, center of gravity, moment of inertia and mass moment of inertia.

Approximate Hours

Item	AppX Hrs
Cl	10
LI	6
SW	1
SL	2
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Determining the point where the entire weight of an object or system appears to act. SO5.2 Quantifying an object's resistance to rotational motion around a specific axis.	5.1 Introduction to Moment of inertia 5.2 To determine the moment of inertia of a flywheel about its own axis of rotation 5.3 Viva practice	**Unit-5.0 Center of gravity and moment of inertia** 5.1 Concept of Centroid, Centre of Gravity. 5.2 Difference between Centroid, Centre of Gravity 5.3 Centroid of Trianle, I section, angle section and channel section 5.4 Theorems of Moment of Inertia 5.5 Radius of Gyration 5.6 Polar Moment of Inertia of Standard Sections 5.7 Moment of Inertia of Composite Section, Principal Moment of Inertia 5.8 Concept of mass moment of inertia 5.9 Mass moment of inertia of basic solid figures. 5.10 Practice class	1. Numerical problem related to center of gravity 2. Numerical of MI of T section 3. Numerical of I section.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Find the CG and MI of Circle, semicircle and Rectangle and Triangle.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Lecture (LI)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+LI+SW+SI)
ESC 207.1: Understanding of termMechanics and its classification	9	4	2	2	17
ESC 207.2: Understanding Resolution and composition of force acting on therigid body.	8	12	0	1	21
ESC 207.3: Compute the resultant offorce or different system of force and study ofdifferent laws related to different force System.	8	4	2	2	16
ESC 207.4: compute the different typesof load acting on a different types of beam.	10	4	2	2	18
ESC 207.5: Compute the centroid, second moment of area, center of gravity,moment of inertia and mass moment of inertia	10	6	1	2	19
Total Hours	45	30	7	9	91

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**1:** Understanding of term Mechanics and its classification	03	01	01	05
CO-2	**2:** Understanding Resolution and composition of force acting on the rigid body.	02	06	02	10
CO-3	**3:** Compute the resultant of force for different system of force and study of different laws related to Different force system.	03	07	05	15
CO-4	**4:** compute the different types of load acting on different types of beam.	0	10	05	15
CO-5	**5:** Compute the centroid, second moment of area, center of gravity, moment of inertia and mass moment of inertia	03	02	0	05
Total		11	26	13	50

Legend: **R: Remember,** **U: Understand,** **A: Apply**

The end of semester assessment for Engineering Graphics & Design will be held withwritten examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Facebook, Twitter, WhatApp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Engineering Mechanics	Dr.R.K bansal	Laxmi Publicatio n(p) ltd.	4rth and 2016
2	Engineering mechanics	R.K Rajpoot	Laxmi Publication(p) ltd.	3^{rd} and 2016
3	Engineering Mechanics: Statics & Dynamics	Russell C. Hibbeler	Pearson	14th Edition, 2015
4	*Engineering Mechanics*	*Timoshenko, and Young*	TMH	5^{th} 2017
5	Training Manual			
6	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna .			

****

Curriculum Development Team

1. **Mr. S.S. Parihar, Head of Deptt. Mech. Engg., AKS University**
2. **Mr. Alok Ranjan Tiwari , Assistant Professor, Dept. of Mechanichal Engg.**
3. **Mr Deepak Pandey , Assistant Professor , Dept. of Mechanichal Engg**
4. **Mr.,Keshav Pratap Singh, Assistant Professor , Dept. of Mechanichal Engg**
5. **Mr.Amar Soni , Assistant Professor , Dept of Mechanichal Engg**
6. **Mr K.P Tiwari , Assistant Professor , Dept. of Mechanichal Engg**
7. **Mr. Ketan Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
8. **Mr. K.C. Kori, Faculty, Assistant Professor , Dept. of Mechanichal Engg**
9. **Mr,Lokesh Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
10. **Mr. Ram Narayan Shukla, Assistant Professor , Dept. of Mechanichal Engg**
11. **Mr. Rishi Kumar Sharma, Assistant Professor , Dept. of Mechanichal Engg**
12. **Mr. Naveen Kumar Soni, Assistant Professor , Dept. of Mechanichal Engg**

COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: ESC 207
Course Title: Engineering Mechanics

Course Outcome	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: Understanding of term Mechanics and its classification	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO2: Understanding Resolution and composition of force acting on the rigid body.	3	3	2	3	1	2	1	3	2	2	2	3	3	2
CO3: Compute the resultant of force for different system of force and study of different laws related to Different force system.	3	2	3	2	2	1	2	2	2	2	2	3	3	2
CO4: compute the different types of load acting on a different types of beam.	3	3	3	2	2	2	1	3	2	2	2	2	2	3
CO5: Compute the centroid, second moment of area, center of gravity, moment of inertia and mass moment of inertia	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO1: Understanding of term Mechanics and its classification	SO1.1 SO1.2 SO1.3 SO1.4	1,2	**Unit-1.0 Introduction to Mechanics** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO2: Understanding Resolution and composition of force acting on the rigid body.	SO2.1 SO2.2 SO2.3 SO2.4	1, 2, 3, 4, 5, 6	**Unit-2.0 Resolution and Composition of Forces** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO3: Compute the resultant of force for different system of force and study of different laws related to Different force system.	SO 3.1 SO 3.2 SO 3.3	1,2	**Unit-3.0 System of forces** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2,	CO4: compute the different types of load acting on a different types of beam.	SO4.1 SO4.2 SO4.3 SO4.4	1,2	Unit-4.0 **Beams and Trusses** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2,	CO5: Compute the centroid, second moment of area, center of gravity, moment of inertia and mass moment of inertia	SO5.1 SO5.2	1,2,3	**Unit-5.0 Center of gravity and moment of inertia** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10	1,2,3

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester III

Course Code: **HSMC10**

Course Title: **Universal Human Values**

Pre-requisite: Creating awareness among the students on a holistic perspective about life.

Rationale: The purpose is to help develop a holistic perspective about life. A self-reflective methodology of teaching is adopted. It opens the space for the student to explore his/her role (value) in all aspects of living – as an individual, as a member of a family, as a part of the society and as an unit in nature. Through this process of self-exploration, students are able to discover the values intrinsic in them.

Course Outcomes:

HSMC10.1 To understanding Value Education

HSMC10.2 Students will have the ability to learn about Harmony in the Human Being.

HSMC10.3 Student will be able to gain knowledge on Harmony in the Family and Society.

HSMC10.4 Understanding Harmony in the Nature/Existence.

HSMC10.5 Student will able to understand about Implications of Holistic Understanding- A Look at Professional Ethics.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Hours (CI+LI+SW+SL)	
HSMC	HSMC10	Universal Human Values	3	0	0	1	4	0

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self-Learning,
C: Credits.

Note: Proposed examination scheme (Marking) as per the recommendation of University Grant Commission (UGC) for Under Graduate Courses in Fundamentals of Universal Human Values 2022-23 onwards SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ESA)
			Class/Home Assignment 5 number 3 marks each (HA)	Class Test 2 (2 best out of 3)10 marks each (CT)	Seminar one(TSN)	Class Activity any one (TCA)	Class Attendance (TA)	Total Mark (HA+CT+TSN+TCA+		
HSMC	HSMC 10	Universal Human Value	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

HSMC10.1: To understanding Value Education

Approximate Hours

Item	Appx.Hrs
CI	9
LI	0
SW	0
SL	2
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	SelfLearning (SL)
SO1.1. Understand Self- exploration as the Process for Value Education **SO 1.2**. Understand Continuous Happiness and Prosperity – the Basic Human Aspirations **SO 1.3.** Understand Right Understanding **SO1.4.** Understand Relationship and Physical Facility **SO 1.5.** Understand Happiness and		**Unit -1Understanding Value Education** 1.1 Self-exploration as the Process for Value Education 1.2 Continuous Happiness and Prosperity – the Basic Human Aspirations 1.3 Recognizing and articulating fundamental human values 1.4 Right Understanding 1.5 Relationship and Physical Facility 1.6 Happiness and Prosperity – Current Scenario 1.7 Method to Fulfill the Basic Human Aspirations	**SL.1** Human values to become a good man SL2. Identify Core Human Values

Prosperity – Current Scenario		1.8 Connect values education to community service 1.9 Understanding of values through various assessment methods	

SW-1SuggestedSessionalWork (SW):

a. Assignments:
   i. Continuous Happiness and Prosperity–the Basic Human Aspirations

b. Mini Project:
   i. Relationship and Physical Facility

c. Other Activities(Specify):

.i. Quiz, Class Test.

HSMC10.2: Students will have the ability to apply the gained knowledge on Harmony in the Human Being

Approximate Hours

Item	Appx Hrs
CI	9
LI	0
SW	0
SL	2
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1. Understanding Human being as the Co-existence of the Self and the Body **SO2.2.**Understand the Distinguishing between the Needs of the Self and Body **SO 2.3.**Understand the Body as an Instrument of the Self **SO 2.4.**Understanding Harmony in the Self **SO 2.5**. Understanding Harmony of the Self with the Body		**Unit-2: Harmony in the Human Being** 2.1 Module-II Harmony in the Human Being 2.2 Human being as the Co- existence of the Self and the Body 2.3 Distinguishing between the Needs of the Self and Body 2.4 Body as an Instrument of the Self 2.5 Harmony in the Self 2.6 Harmony of the Self with the Body 2.7 Programme to ensure self- regulation and Health 2.8 Explore techniques for improving concentration and mental clarity 2.9 Discuss the impact of positive emotions and strategies	**SL.1** Harmony in and among human being **SL.2** Mindfulness and Self-Awareness

SW-2 Suggested Sessional Work (SW):

Assignments:

Harmony in the self

Mini Project:

Body an instrument

Other Activities (Specify):

Quiz, Class Test.

HSMC10.3: Learn the basic concepts of dual nature of matter and wave packet and apply them to analyze various relevant phenomenon and to solve related numerical problem

Approximate Hours

Item	Appx.Hrs
CI	09
LI	0
SW	0
SL	2
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1. Understand Harmony in the Family – the Basic Unit of Human Interaction **SO3.2.** Understand the Values in Human-to-Human Relationship	-	**Unit-3: Harmony in the Family and Society** 3.1 Harmony in the Family – the Basic Unit of Human Interaction 3.2 Values in Human-to-Human Relationship 3.3 'Trust' – the	**SL.1** Harmony in the society **SL.2** Reflect on Social Responsibilities

SO3.3. Understand the 'Trust' – the Foundational Value in Relationship **SO3.4.** Understand the 'Respect' – as the Right Evaluation **SO3.5.** Understanding Harmony in the Society		3.4 Foundational Value in Relationship 3.5 'Respect' – as the Right Evaluation 3.6 Understanding Harmony in the Society 3.7 Vision for the Universal Human Order 3.8 Role of Empathy and Understanding 3.9 Conflict Resolution Skills	

SW-2SuggestedSessionalWork (SW):

a. Assignments:

1. Respect the right evaluation

b. Mini Project:

1. Trust is the fundamental value of relationships

c. Other Activities (Specify):

Quiz, Class Test.

HSMC10.4: Student will be able to understand Harmony in the Nature/Existence

Approximate Hours

Item	Appx.Hrs
CI	9
LI	0
SW	0
SL	2
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1. Understanding Harmony in the Nature, Interconnectedness **SO4.2.** Understand self-regulation and Mutual Fulfillment among 4 orders of Nature **SO 4.3**. Understand the Exploring Four Orders of Nature **SO 4.4**. Understand the Realizing Existence as Co-existence at All Levels **SO 4.5**. Understand the holistic Perceptions of Harmony in Existence		**Unit-4: Harmony in the Nature/Existence** 4.1 Harmony in the Nature, Interconnectedness 4.2 Self-regulation and Mutual Fulfillment among 4 orders of Nature 4.3 Exploring Four Orders of Nature 4.4 Realizing Existence as Co-existence at All Levels 4.5 The holistic Perceptions of Harmony in Existence 4.6 The Exploring Co-Existence in Existence 4.7 Introduce environmental ethics principles 4.8 Study different ecosystems 4.9 Address the challenges posed by climate change and human activities on natural harmony	**SL.1** Harmony in the nature **SL.2** Study Ecological Principles.

SW-4 SW-2SuggestedSessionalWork (SW):

a. **Assignments:**
   i. Harmony in nature
b. **Mini Project:**
   i. Exploring4 orders of nature
c. **Other Activities (Specify):**
   Quiz, Class Test.

HSMC10.5: Students will have the ability to apply the gained knowledge in Implications of Holistic Understanding- A Look at Professional Ethics.

Approximate Hours

Item	Appx. Hrs
CI	9
LI	0
SW	0
SL	2
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1. Understand Natural acceptance of Human Values **SO5.2** Understand Definitiveness of (Ethical) Human Conduct		**Unit 5 Implications of Holistic Understanding- A Look at Professional Ethics** 5.1 Introduce the concept of professional ethics 5.2 Natural acceptance of Human Values	**SL.1** Holistic understanding of human values **SL.2** Read case studies and real-life

SO5.3. Understand A Basis for Humanistic Education **SO5.4.** Understand the Humanistic Constitution and Universal Human Order **SO 5.5.** Understand Competence in Professional Ethics		5.3 Definitiveness of (Ethical) Human Conduct 5.4 A Basis for Humanistic Education 5.5 Humanistic Constitution and Universal Human Order 5.6 Competence in Professional Ethics 5.7 Strategies for Transition towards value based Life and Profession 5.8 Explore major ethical theories 5.9 Analyze case studies to illustrate ethical decision-making using different frameworks	examples from various profession

SW-5 Suggested Sessional Work(SW):

a. **Assignments:**
   i. Human conduct
b. **Mini Project:**
   i. Humanistic constitution
c. **Other Activities (Specify):**
   Quiz, Class Test.
   i. Humanistic constitution

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (SL)	Total hour (CI+SW+SL)
HSMC10.1 To understanding Value Education	09	0	0	2	11
HSMC10.2 Students will have the ability to learn about Harmony in the Human Being.	09	0	0	2	11
HSMC10.3 Student will be able to gain knowledge on Harmony in the Family and Society.	09	0	0	2	11
HSMC10.4 Understanding Harmony in the Nature/Existence.	09	0	0	2	11
HSMC10.5: Student will able to understand about Implications of Holistic Understanding- A Look at Professional Ethics.	09	0	0	2	11
Total Hours	45	0	0	10	55

Suggestion for End Semester Assessment

Suggested Specification Table (ForESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Understanding Value Education	02	04	05	11

CO-2	Harmony in the Human Being	03	07	04	14
CO-3	Harmony in the Family and Society	02	06	02	10
CO-4	Harmony in the Nature/Existence	03	03	02	08
CO-5	Implications of Holistic Understanding- A Look at Professional Ethics	03	02	02	07
Total		13	22	15	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Universal Human Values will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)
8. Brainstorming
9. Seminar
10. Workshop

Suggested Learning Resources:

(a) **Books**:

S. No.	Title	Author	Publisher	Edition Year
1	JeevanVidya:EkParichaya	A Nagaraj	JeevanVidyaPrakashan, Amarkantak	1998
2	HumanValues	A.N.Tripath	NewAgeIntl. Publishers,New Delhi,	2004
3	UniversalHumanValues		AICTE	2021
4	HumanValuesand ProfessionalEthics	R.R.Gaur,R Sangal andG P Bagaria	ExcelBookPublisher	2009
5	Vyavaharvadï.Samajshastra	A Nagaraj	Jeevan VidyaPrakashan, Amar kantak	1999
6	ManavaVyavaharaDarsana	A Nagaraj	Jeevan VidyaPrakashan, Amarkantak	2003
7	Foundationsof Ethics and Management,	BP Banerjee	ExcelBook	2005
8	FundamentalsofEthicsfor Scientists&Engineers	EGSeebauer& RobertL.Berry	OxfordUniversity Press.	2000
9	Engineering Ethichs (includingHumanValues)	MGovindrajran,S Natrajan and V.S. SenthilKumar	Eastern Economy Edition,PrenticeHall ofIndiaLtd.	-

****

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Curriculum Development Team:

1. **Er. Anant Kumar Soni, Hon'ble Pro-Chancellor and Chairman, AKS University, Satna (M.P.).**
2. **Prof. B.A. Chopade, Hon'ble Vice Chancellor, AKS University, Satna (M.P.).**
3. **Prof. G.C. Mishra, Director, IQAC,AKS University, Satna (M.P.).**
4. **Prof. R.L.S. Sikarwar, Director, Centre for Traditional Knowledge Research & Application,AKS University, Satna (M.P.).**
5. **Prof. Kamlesh Chaure, HOD, Department of Biotechnology,AKS University, Satna (M.P.).**
6. **Dr. Akhilesh Waoo, HoD, Department of Computer Science,AKS University, Satna (M.P.).**
7. **Dr. Shailendra Yadav, HoD, Department of Chemistry, AKS University, Satna (M.P.).**
8. **Dr. Kaushik Mukherji, HoD, Department of Management, AKS University, Satna (M.P.).**
9. **Dr. Neeraj Verma, PG Coordinator, Faculty of Agriculture Science and Technology, AKS University, Satna (M.P.)**
10. **Dr. Dilip Kumar Tiwari, HoD, Department of Yoga, AKS University, Satna (M.P.).**
11. **Shri Mirza Shamiullah Beg, Department of Arts,AKS University, Satna (M.P.).**
12. **Shri Vivek Shrivastava, Examination, AKS University, Satna (M.P.).**
13. **Shri Manish Agrawal, Department of Mining, AKS University, Satna (M.P.).**

COs, Pos and PSOs Mapping

Program Title: B.Tech. (Electrical Engineering)
Course Code: HSMC10
Course Title: Universal Human Values

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	The ability to apply technical & engineering knowledge for production	Ability to understand the day to plant operational problems of cement	Ability to understand the latest cement manufacturing technology	Ability to use the research based innovative knowledge for sustainable
HSMC10.1 To understanding Value Education	2	2	3	2	1	1	1	3	2	1	1	2	2	2	2	2
HSMC10.2 Students will have the ability to learn about Harmony in the Human Being	2	2	1	3	1	2	1	3	2	2	2	2	2	2	2	2
HSMC10.3 Student will be able to gain knowledge on Harmony in the Family and Society.	2	1	2	1	1	2	2	3	2	1	2	3	2	2	2	2
HSMC10.4 Understanding Harmony in the Nature/Existence.	1	1	1	2	1	2	1	3	2	1	2	2	2	2	3	3
HSMC10.5: Student will able to understand about Implications of Holistic Understanding- A Look at Professional Ethics.	1	1	1	1	1	2	2	3	1	2	2	2	3	2	3	2

Legend:1–Low,2–Medium,3–High

Course Curriculum Map:

Pos &PSOs No.	Cos No. & Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	**HSMC10.1** To understanding Value Education	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**Unit-1: Understanding Value Education** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	1,2
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	**HSMC 10.2** Students will have the ability to learn about Harmony in the Human Being	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		**Unit-2: Harmony in the Huma Being** 2.1,2.2,2.3,2.4,2.5,2.6,2.7, 2.8,2.9	1,2
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	**HSMC10.3** Student will be able to gain knowledge on Harmony in the Family and Society.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		**Unit-3: Harmony in the Family and Society** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1,2
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	**HSMC10.4** Understanding Harmony in the Nature/Existence.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		**Unit-4: Harmony in th Nature/Existence Implications of Holistic** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9	1,2
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	**HSMC10.5** Student will able to understand about Implications of Holistic Understanding- A Look at Professional Ethics.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		**Unit 5: Understanding- A Look at Professional Ethics** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8, 5.9	1,2

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-IV

Course Code:	**EE204**
Course Title:	**DIGITAL ELECTRONICS**
Pre- requisite:	Student should have knowledge of fundamental of digital electronic systems.
Rationale:	In current scenario we are extensively using various digital electronic circuits in various applications. Such systems are required to design and maintain by engineer. Therefore, the goal of this course is for students to become competent to understand design and maintenance of such type of systems.

Course Outcomes:

EE204.1: Understand the deign process of digital hardware, use Boolean algebra to minimize the logical expressions and optimize the implementation of logical functions.
EE204.2: Design and analysis of combinational logic circuits.
EE204.3: Design and analysis of sequential logic circuits.
EE204.4: Understand the process of Analog to Digital conversion and Digital to Analog conversion.

EE 302.5: Understand the fundamental of Semiconductor memories and Programmable logic devices.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	EE204	DIGITAL ELECTRONICS	3	2	1	1	7	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Couse Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks (PRA+ ESA)**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
PCC	EE204	DIGITAL ELECTRONICS	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
PCC	EE204-L	DIGITAL ELECTRONICS	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE204.1: Understanding the fundamental of diode, its characteristics and its various types.

Approximate Hours

Item	Approx Hrs
Cl	9
LI	4
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the number system and conversion of various types of number systems. **SO1.2** Understand the Boolean expression minimization technique.	1. Verification of all the logic gates. 2. Implementation of NAND & NOR as Universal gate.	**Unit-1: Fundamental of digital systems and logic families** 1.1 Digital signals 1.2 Number System 1.3 Code conversion 1.4 Two's complements 1.5 Addition and Subtraction of signed and unsigned numbers 1.6 Boolean algebra and Demorgan's theorem 1.7 SOP & POS forms 1.8 Optimized implementation of logic functions using K-Map 1.9 Logic gates and networks	1. Fundamental of digital electronics

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Discuss the different types of logic gates.

EE204.2: Understanding the various applications of diode.

Approximate Hours

Item	Approx. Hrs
Cl	10
LI	10
SW	1
SL	1
Total	22

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Understanding the working of adder circuits. **SO2.2** Understanding the working of subtractor circuits. **SO2.3** Understanding the working of multiplexer and Demultiplexer circuits. **SO2.1** Understanding the working of encoder and decoder circuits.	1. Design of combinational circuit for the half adder 2. Design of combinational circuit for the Full adder 3. Design of combinational circuit for the half subtractor 4. Design of combinational circuit for the full subtractor 5. Multiplexer / Demultiplexer based Boolean function	**Unit-2: Combinational circuits** 2.1 Half Adder 2.2 Full Adder 2.3 Half Subtractor 2.4 Full Subtractor 2.5 Multiplexers 2.6 Demultiplexers 2.7 Parity Checkers and Generators 2.8 Decoders 2.9 Encoders 2.10 CD adder	1. Logic gates

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**

   i. How will you classify the different types of logic circuits?

EE204.3: Design and analysis of bipolar junction transistor, its various configurations and applications.

Approximate Hours

Item	Approx Hrs
Cl	9
LI	8
SW	1
SL	1
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Understand the difference between latch and flip flop. **SO3.2** Understand the SR latch. **SO3.3** Understand the working of SR flip flop. **SO3.4** Understand the working of D flip flop. **SO3.5** Understand working of JK flip flop. **SO3.6** Understand working of registers. **SO3.7** Understand working of counters.	1. Verify the truth table of SR flip flop. 2. Verify the truth table of D flip flop. 3. Verify the truth table of JK flip flop. 4. Verify the truth table of T flip flop.	**Unit-3: Sequential circuits** 3.1 Basic Latch 3.2 Gated SR Latch 3.3 Gated D Latch 3.4 Master-Slave edge triggered flip-flops 3.5 JK Flip-flop 3.6 Race around condition 3.7 T Flip-flop 3.8 Registers 3.9 Counters	1. Methods of triggering.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**

i. Explain race around condition in flip flop.

EE204.4: Design and analysis of junction field effect transistor and metal oxide semiconductor field effect transistor and its various configurations.

Approximate Hours

Item	Approx Hrs
Cl	9
LI	4
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand the working of D/A converters. **SO4.2** Understand the working of A/D converters.	1. Design various D-A convertors 2. Design various A-D convertors	**Unit-4: A/D & D/A Converters** 4.1 Introduction 4.2 accuracy, resolution and precision 4.3 D/A converter 4.4 variable resistor network 4.5 R-2R ladder 4.6 sample and hold circuit 4.7 quantization and encoding 4.8 A/D converter, dual slope method 4.9 Successive approximation method.	1. Basics of analog and digital signals.

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Discuss various applications of A/D and D/A converters.

EE204.5: Design and analysis of op-amp, its characteristics and various applications.

Approximate Hours

Item	Approx. Hrs.
Cl	7
LI	4
SW	1
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand the different types of semiconductor memories. **SO5.2**Understand structure of PAL **SO5.3** Understand structure of PLA **SO5.4** Understand structure of CPLD **SO5.5** Understand structure of FPGA	1. Studyof PLAs 2. Studyof FPGA	**Unit 5: Semiconductor memories and Programmable logic devices** 5.1 Introduction of semiconductor memories 5.2 RAM and its types 5.3 ROM and its types 5.4 General structure of a Programmable Array Logic (PAL) 5.5 Programmable Logic Arrays (PLAs) 5.6 Structure of CPLD 5.7 Structure of FPGA	1. Basic of semiconductor

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**

How will you classify different types of semiconductor memories?

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE204.1: Understand the deign process of digital hardware, use Boolean algebra to minimize the logical expressions and optimize the implementation of logical functions.	9	4	1	1	15
EE204.2: Design and analysis of combinational logic circuits.	10	10	1	1	22
EE204.3: Design and analysis of sequential logic circuits.	9	8	1	1	19
EE204.4: Understand the process of Analog to Digital conversion and Digital to Analog conversion.	9	4	1	1	15
EE204.5: Understand the fundamental of Semiconductor memories and Programmable logic devices.	7	4	1	1	13
Total Hours	44	30	5	5	84

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Fundamental of digital systems and logic families	04	03	01	8
CO-2	Combinational circuits	06	03	02	11
CO-3	Sequential circuits	04	03	01	8
CO-4	A/D & D/A Converters	05	04	02	11
CO-5	Semiconductor memories and Programmable logic devices	04	04	04	12
Total		23	17	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Process calculation will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Design Demonstration
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Digital logic and Computer design	M. M. Mano	Pearson Education India	2016
2	Fundamentals of Digital Circuits	A. Kumar	Prentice Hall India	2016
3	Modern Digital Electronics	R. P. Jain	McGraw Hill Education	2009
4	Fundamental of Digital Circuits	A. Anand Kumar	PHI	4th edition, 2018
5	Foundation of Digital Electronics & Logic Design	A. K. Singh	New Age Int. Publishers	
6	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni,Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE204
Course Title: DIGITAL ELECTRONICS

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Understand the design process of digital hardware, use Boolean algebra to minimize the logical expressions and optimize the implementation of logical functions.	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO 2: Design and analysis of combinational logic circuits.	3	3	3	3	2	2	1	3	2	2	2	3	3	2
CO3: Design and analysis of sequential logic circuits.	3	2	3	2	2	1	2	2	2	1	2	3	3	2
CO 4: Understand the process of Analog to Digital conversion and Digital to Analog conversion.	3	3	2	2	2	2	2	3	2	2	2	2	2	3
CO 5: Understand the fundamental of Semiconductor memories and Programmable logic devices.	3	3	3	3	2	3	1	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO1: Understand the deign process of digital hardware, use Boolean algebra to minimize the logical expressions and optimize the implementation of logical functions.	SO1.1 SO1.2	1,2	**UNIT-1: Fundamental of digital systems and logic families** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	1
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO 2: Design and analysis of combinational logic circuits.	SO2.1 SO2.2 SO2.3 SO2.4	1,2,3,4,5	**UNIT-2**: **Combinational circuits** 2.1, 2.2, 2.3, 2.4, 2.5,2.6,2.7,2.8,2.9,2.10	1
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO3: Design and analysis of sequential logic circuits.	SO3.1,SO3.2 SO3.3, SO3.4 SO3.5, SO3.6 SO3.7	1,2,3,4	**Unit-3: Sequential circuits** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO 4: Understand the process of Analog to Digital conversion and Digital to Analog conversion.	SO4.1SO4.2	1,2	**UNIT-4: A/D & D/A Converters** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10	1
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO 5: Understand the fundamental of Semiconductor memories and Programmable logic devices.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	1,2	**UNIT-5: Semiconductor memories and Programmable logic devices** 5.1,5.2,5.3,5.4,5.5,5.6,5.7	1

Semester-IV

Course Code: **EE205**

Course Title : **Electrical Machine – II**

Pre- requisite: Students should have basic knowledge of Basic Laws of Electro-magnetic Circuit with brief information of various electrical quantities.

Rationale: A process of introducing formal knowledge of electrical machine principles, construction, and working of various AC machines with various concepts of magnetic fields and circuits.

Course Outcomes:

EE205.1: Understand the constructional and working details of AC machine winding.
EE205.2: Understand the concept of pulsating magnetic fields.
EE205.3: Understand the concepts of rotating magnetic fields.
EE205.4: Understand the operation of ac machines.
EE205.5: Analyze performance characteristics of ac machines.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	EE205	ELECTRICAL MACHINE – II	3	2	1	1	7	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PCC	EE205	ELECTRICAL MACHINE – II	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
PCC	EE205-L	ELECTRICAL MACHINE – II	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE205.1: Understand the constructional and working details of AC machine winding.

Approximate Hours

Item	AppX Hrs
Cl	09
LI	2
SW	1
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction(LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the arrangement of windings in various parts. **SO1.2** Understand the concept of different types of coils. **SO1.3** Understand the concept of 3D visualization of winding types. **SO1.4** Understand the construction of sinusoidal distributed winding. **SO1.5** Understand the distributed winding factors.	1. Study the constructional details and performance characteristics of AC machine winding.	**Unit-1: Fundamentals of AC machine windings** 1.1 Physical arrangement of windings in stator and cylindrical rotor. 1.2 Slots for windings. 1.3 Single-turn coil - active portion and overhang. 1.4 Full-pitch coils. 1.5 Concentrated winding, Distributed winding. 1.6 Winding axis. 1.7 3D visualization of the above winding types. 1.8 Air-gap MMF distribution with fixed current through winding-concentrated and distributed. 1.9 Sinusoidaly distributed winding, Winding distribution factor.	1. Various concepts of windings.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Make tabulation list of different types of windings.

a. **Mini Project:**
   i. Draw the table of Factors affecting the windings.

EE205.2: Understand the concept of pulsating magnetic fields

Approximate Hours

Item	AppX Hrs
Cl	07
LI	2
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 To Understand the different magnetic field types. **SO2.2** To apply the shifting of winding angles. **SO2.3** To understand the revolving magnetic field.	**1.** Study of two field revolving theory.	**Unit-2 Pulsating and revolving magnetic fields.** 2.1 Constant magnetic field. 2.2 Pulsating magnetic field - alternating current in windings with spatial displacement. 2.3 Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings. 2.4 Windings spatially shifted by 90 degrees. 2.5 Addition of pulsating magnetic fields. 2.6 Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents). 2.7 Revolving magnetic field.	1. Remember the Concepts of pulsating and revolving magnetic fields.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Write down the difference between concentrated and distributed windings.

ii. Draw the chart of operation revolving magnetic field.

Other Activities (Specify):

Review the operations at different angles.

EE205.3: Understand the concepts of rotating magnetic fields.

Approximate Hours

Item	AppX Hrs
Cl	9
LI	8
SW	1
SL	1
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 To Understand the Construction and types. **SO3.2** To Understand various concepts related to torque. **SO3.3** To Draw equivalent circuit, phasor diagram and review of losses and efficiency. **SO3.4** To Understand the methods of starting and speed control. **SO3.5** To Understand the concept of self-start and doubly fed induction machine.	1. Study the constructional details of three-phase Induction machine. 2. Obtain the performance characteristics at different loads for three-phase Induction Machine. 3. Study different type of starters of three-phase Induction Machine. 4. Study different types of methods of speed control of three-phase Induction Motor.	**Unit-3 : Induction Machine** 3.1 Construction 3.2 Types (squirrel cage and slip-ring). Torque Slip Characteristics. 3.3 Starting and Maximum Torque. 3.4 Equivalent circuit, Phasor Diagram, Losses and Efficiency 3.5 Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, Stator Voltage and Frequency). 3.6 Methods of starting, braking and speed control for induction motors. 3.7 Generator operation. 3.8 Self-excitation. 3.9 Doubly-Fed Induction Machines.	1. Basic principle of Induction Machine.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

- i. Numerical Problems on Slip of Induction Machine.
- ii. Numerical Problems on Speed Control Methods.

EE205.4: Understand the operation of ac machines.

Approximate Hours

Item	AppX Hrs
Cl	05
LI	6
SW	1
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Evaluation of Constructional Features. **SO4.2** Understanding the Double Field Revolving Theory. **SO4.3** Determination of different Parameters. **SO4.4** Understand the concepts related to split-phase I.M.	1. To study the construction and working of single-phase Induction Machine. 2. To obtain Torque-Slip Characteristics of single-phase Induction Motor. 3. To perform No-load and Blocked-Rotor test on single-phase Induction Motor and calculation of its efficiency.	**Unit-4 : Single-phase induction motors** 4.1 Constructional features. 4.2 Double revolving field theory. 4.3 Equivalent circuit 4.4 Determination of parameters. 4.5 Split-phase starting methods and applications.	1. Gain the knowledge about single-phase Induction Machines.

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Numerical Problems on single-phase Induction Machine.

Mini Project:
   i. Draw a chart of different single-phase machines.

EE205.5: Analyze performance characteristics of ac machines.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	12
SW	2
SL	1
Total	27

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand the constructional features. **SO5.2** Understand the Operating functions. **SO5.3** Evaluation of V-Curves.	1. To study the Constructional details of Synchronous Machine. 2. To calculate voltage regulation of three-phase Alternator, without disconnecting the load (EMF/Synchronous Impedance Method). 3. To study the effect of Resistive and Inductive Load of same load current on three-phase Alternator	**Unit 5: Synchronous Machines** 5.1 Constructional features. 5.2 Cylindrical rotor synchronous machine - generated EMF. 5.3 Equivalent circuit and phasor diagram. 5.4 Armature reaction 5.5 Synchronous impedance 5.6 Voltage regulation	1. Remember the Concepts of Synchronous Machines.

SO5.4 Understanding the two reaction theory. **SO5.5** Understand the Parallel Operation.	(Demagnetizing Effect of Armature Reaction). 4. To obtain load characteristics of three-phase Synchronous Motor. 5. To Obtain V-Curve and Inverted V-Curve of Synchronous Motor. 6. Application of Synchronous Motor as a Condensor.	5.7 Operating characteristics of synchronous machines 5.8 V-curves 5.9 Salient pole machine - two reaction theory 5.10 Analysis of phasor diagram 5.11 Power angle characteristics 5.12 Parallel operation of alternators - synchronization and load division.	

SW-5 Suggested Sessional Work (SW):

a. Assignments:

Numerical Problem based on Synchronous Generator.

i. Numerical Problem based on Synchronous Motor.

b. Mini Project:

Draw the chart of different single phase synchronous machines.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE205.1: Understand the concepts of Fundamentals of AC machine windings.	9	2	1	1	13
EE205.2: Understand the Concepts of Pulsating and revolving magnetic fields.	7	2	1	1	11
EE205.3: Understand the Concepts of Induction Machine.	9	8	1	1	19
EE205.4: Understand the concept of Single-phase Induction Motor.	5	6	1	1	13
EE205.5: Understand the Concepts of Synchronous Machines.	12	12	2	1	27
Total Hours	42	30	6	5	83

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Fundamentals of AC machine windings	03	02	02	07
CO-2	Pulsating and revolving magnetic fields	02	01	02	05
CO-3	Induction Machine	02	07	06	15
CO-4	Single-phase Induction Motors	03	03	03	09
CO-5	Synchronous Machines	04	05	05	14
Total		14	18	18	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Electrical Machine-II will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Electric Machinery	A. E. Fitzgerald and C. Kingsley	McGraw Hill Education	2013
2	Performance and design of AC machines.	M. G. Say	CBS Publishers	2012
3	Electrical Machinery	P. S. Bimbhra	Khanna Publishers	2011
4	Electric Machines	I. J. Nagrath and D. P. Kothari	McGraw-Hill Education	2010
5	Alternating current machines	A. S. Langsdorf	McGraw-Hill Education	1984
6	Principles of Electric Machines and Power Electronics	P. C. Sen	John Wiley & Sons	2007
7	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni,Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE205
Course Title: ELECTRIC MACHINE 2

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering Knowledge	Problem Solving	Design Skills	Laboratory Skills	Team Work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
EE205.1: Understand the constructional and working details of AC machine winding.	3	3	2	2	3	2	1	1	2	1	1	2	2	2
EE205.2: Understand the concept of pulsating magnetic fields.	2	3	3	2	1	2	1	1	1	1	2	2	2	2
EE205.3: Understand the concepts of rotating magnetic fields.	3	3	2	1	1	2	2	2	1	1	2	3	1	2
EE205.4: Understand the operation of ac machines.	3	2	2	2	3	2	1	3	2	1	2	2	3	3
EE205.5: Analyze performance characteristics of ac machines.	2	3	3	1	1	3	2	3	1	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7 ,8,9,10,11,12 PSO 1,2, 3, 4	CO-1: Understand the constructional and working details of AC machine winding.	SO1, SO1.2 SO1.3, SO1.4 SO1.5	1	**Unit-1: Fundamentals of AC machine windings** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	1
PO:1,2,3,4,5,6,7 ,8,9,10,11,12 PSO 1,2, 3, 4	CO-2: Understand the concept of pulsating magnetic fields.	SO2.1, SO2.2 SO2.3	1	**Unit-2**: **Pulsating and revolving magnetic fields.** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7	1
PO:1,2,3,4,5,6,7 ,8,9,10,11,12 PSO 1,2, 3, 4	CO-3: Understand the concepts of rotating magnetic fields.	SO3.1, SO3.2 SO3.3, SO3.4 SO3.5	1, 2, 3,4	**Unit-3 : Induction Machine** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1
PO:1,2,3,4,5,6,7 ,8,9,10,11,12 PSO 1,2, 3, 4	CO-4: Understand the operation of ac machines.	SO4.1SO4.2 SO4.3SO4.4	1, 2, 3	**Unit-4 : Single-phase induction motors** 4.1, 4.2,4.3,4.4,4.5	1
PO:1,2,3,4,5,6,7 ,8,9,10,11,12 PSO 1,2, 3, 4	CO-5: Analyze performance characteristics of ac machines.	SO5.1SO5.2 SO5.3 SO5.4SO5.5	1, 2, 3,4,5,6	**Unit 5: Synchronous Machines.** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10, 5.11, 5.12	1

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-IV

Course Code: **EE206**

Course Title : **POWER ELECTRONICS**

Pre- requisite: Student should have basic knowledge of basic electronics, Physics and Mathematics.

Rationale: To deliver power that supports a variety of needs, there exists a branch of electrical engineering called power electronics; this branch basically deals with the processing of high voltages and currents. All the areas, from space applications to household electronic equipment, need a steady and dependable electric power with the desired conditions or specifications. Power supply in one form is transformed into another form by processing the energy using controlled mechanisms supplying regulated and controlled power and power semiconductor switches..

Course Outcomes: On successful completion of the course, the student will be able to:

EE206.1: To gain knowledge of various applications of semiconductor switches by understanding their static and dynamic characteristics.

EE206.2: To understand the performance characteristics of controlled AC-DC converters for R, RL & RLE loads.

EE206.3: To gain knowledge on basic DC-DC converters and their operation under continuous and discontinuous mode of conduction for RLE loads

EE206.4: To identify and formulate the requirements for four quadrants operation of DC motor.

EE206.5: To differentiate and understand the significance of various commutation circuits and their consequence on device stress. To understand the principle of DC-AC conversion and the different topology for three phase to three phase and single phase to single phase DC-AC conversion.

Scheme of Studies

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	EE206	POWER ELECTRONICS	**3**	**2**	**1**	**1**	**7**	**4**

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Couse Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks (PRA+ ESA)**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PCC	EE206	Power Electronics	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
PCC	EE206-L	Power Electronics	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion

EE206.1: Understand the concepts of High power Switches and effective application and Limitation.

Approximate Hours

Item	AppX Hrs
Cl	10
LI	16
SW	2
SL	1
Total	29

Session Outcomes (SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self- Learning (SL)
SO1.1 Concept of high power switch **SO1.2** recognize fault situation **SO1.3** Switches use according toload **SO1.4** understand the characteristicsof Thyristor family	**1.** To perform PN junction diode characteristics andto plot the forward andreverse bias characteristics of PN junction diode. **2.** To perform voltage stabilization characteristicof Zener diode "With builtin resistance load"(ME 5420). **3.** To study of SCR characteristics apparatus(ME 5340). **4.** To study of protection circuit of SCR. dv/dt, di/dt, over voltage andover current. **5.** To study of SCR commutation technique(ME 793). **6.** To study of phase controlusing Triac (ME 794). **7.** To perform characteristicsof Thyristor family devices. **8.** study of triac characteristics apparatus(ME 5520)	**Unit-1: Thyristor family** 1.1 Thyristor family 1.2 Two transistor analogy, brief idea of construction of SCR, Static characteristics ofSCR, 1.3 Condition of turn on &off 1.4 different commutation techniques (Class A,B,C,D,E, & F Commutation) 1.5 firing of SCR, 1.6. SCR rating 1.7 protection of SCR 1.8 heating, cooling &mounting of SCR 1.9 series operation of SCR 1.10 parallel operation of SCR	1. Fundamentalof Electronics

SW-1 Suggested sessional Work (SW)

a. Assignments

i. Making poster for all high power Switches

ii. Numerical problem related to above topic

EE206.2: Learn AC to DC Converter Using High power Switches

Approximate Hours

Item	AppX Hrs
Cl	10
LI	6
SW	2
SL	1
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Concept of simple rectifier **SO2.2** Analysis controlling of DC Power **SO2.3** Effect of load in o/p voltage **SO2.4** understand the waveform according to load	**1.** Single Phase Half Wave Controlled Converter **2.** Single Phase Half Controlled Bridge Converter. **3.** Single Phase Fully Controlled Bridge Converter	**Unit-2** 2.1. Operation and analysis of single phase (Half wave) 2.2. Operation and analysis of single phase (Full Wave) and 2.3. Three Phase uncontrolled rectifier circuit with resistive load 2.4. Three Phase uncontrolled rectifier circuit inductive load (continuous) FW small and RLE loads. 2.5. Three Phase controlled rectifier circuit with resistive, 2.6. Three Phase controlled rectifier circuit inductive load (non continuous conduction) FW small & very large inductive loads) and RLE loads. 2.7. Three Phase controlled rectifier circuit inductive load (non continuous conduction) 2.8. Estimation of average load voltage and load current for above rectifier circuits active and reactive power input. 2.9. Effect of free wheeling diode and source inductance on performance of these rectifier circuits . 2.10. Comparison of mid point & Bridge rectifier circuits, Semi converter	1) Network Analysis 2) Fourier transform

SW-2 Suggested sessional Work (SW)

a. **assingments**
   i. Project related to Half wave and full Wave Rectifier
   ii. Numerical problem related to above topic

EE206.3: Learn DC To AC Converter Using High power Switches

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Concept of simple Inverter **SO3.2** Analysis controlling of DC Power **SO3.3** Analysis the application of Inverter according to output **SO3.4** Understand the waveform according to load		Unit-3 3.1) Series inverter 3.2) parallel inverter, 3.3) Voltage source inverter 3.4) current source inverter, 3.5) Single phase and 3.6) three phase bridge inverter, Self-cumulated inverters 3.7) Mc- Murray & MC Murray bed ford inverters, 3.8)Voltage control of single phase inverters 3.9) three phase bridge inverters, Harmonics & their reduction techniques	1.property of Active and passive device

SW-3 Suggested sessional Work (SW)

a. **assignments**
   i. Make a project Based on application of Inverter
   ii. Numerical problem related to above topic

EE206.4: Learn DC To DC Converter Using High power Switches
Approximate Hours

Item	AppX Hrs
Cl	8
LI	4
SW	2
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Concept of Chopper **SO4.2** Analysis controlling of DC Power **SO4.3** DC motor input control **SO4.4** Understand the waveform according to load	1. To perform Morgan's chopper (ME 808). 2. To perform John's chopper (ME 807).	**Unit-4** 4.1) Principle of chopper operation 4.2) Various control strategies in chopper, 4.3) Step up choppers 4.4) step down choppers, 4.5) chopper configuration (Type A,B, C,D, & E), 4.6) Steady state analysis of chopper circuits, Current & voltage commutation of chopper circuits 4.7) Jones chopper 4.8) Morgens chopper	**Self-Learning(SL)** 1)DC Motor

SW-4 Suggested sessional Work (SW)

a. **assignments**
   i. Make a project Based on application of Chopper
   ii. Numerical problem related to above topic

EE206.5: Learn DC To DC Converter Using High Power Switches

Approximate Hours

Item	AppX Hrs
Cl	8
LI	4
SW	2
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 synthesizing the output waveform from segments of the AC supply **SO5.2** Analysis controlling of RMS value of voltage and current in various application **SO5.3** AC motor input control **SO5.4** Understand the reducing the	1. To perform electronic speed control of D.C. motor(ME 800). 2. To perform chopper circuit using power MOSFET (ME 813).	**Unit-5** 5.1) Single phase (mid point & bridge configuration) and 5.2) three phase cyclo convertor configuration and 5.3) operating principles. 5.4) AC voltage controllers (using SCRs & Traics) single phase full wave controller with R and RL load, 5.5) Estimation of RMS load voltage, RMS load current and input power factor, three phase AC	**Self-Learning(SL)** 1) All Parameter of AC Circuit

voltage available at the output terminals without changing the polarity.		voltage controller (Without analysis) 5.6) Dual converter Switched mode voltage regulator 5.7) Buck regulators, Boost regulators 5.8) Buck & Boostregulators, Cuk regulators.	

SW-4 Suggested sessional Work (SW)

a. **assignments**
   i. Design a project Based on application
   ii. Numerical problem related to above topic

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE206.1: To understand and develop the firing circuit requirement for different power semiconductor devices used as switches.	10	16	2	1	29
EE206.2: To understand the concepts of different types of AC-DC, DC-DC& DC-AC controlled converters for Industrial applications	10	6	2	1	19
EE206.3: To analyze the effect of controlled and uncontrolled converters in Power system and their mitigation.	9	0	2	1	12
EE206.4: To design and develop the commutation circuits for semi-controlled power semiconductor devices.	8	4	2	1	15
EE206.5: Learn DC To DC Converter Using High power Switches	8	4	2	1	15
Total	45	30	10	5	90

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Thyristor family	02	03	05	10
CO-2	Phase Control Rectifier	02	04	04	10
CO-3	Inverter	02	02	06	10
CO-4	Chopper	03	07	05	15
CO-5	Cycloconverter, Voltage Controller	01	02	02	05
Total		10	18	22	50

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Design Demonstration
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Power electronics,	Dr.P.S Bimbra	Khanna pubishers	2013
2	Introduction to Modern Power Electronics	A.M. Trzynadlowski	Wiley-Interscience	2014
3	. Power Electronics Principles and Applications	J.M. Jacob, Delmar	Thomson Learning	Eighth, 2023
4	. Power Electronics: Converters, Applications and Design	C.L Wadhwa	N. Mohan, T.M. Undeland and W.P. Robbins	1995.
5	Elements of Power Electronics System Approach	P.T. Krein	Oxford University Press	1998

****

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE206
Course Title: Power electronics

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: To gain knowledge of various application of semiconductor switches by understanding their static and dynamic characteristics.	3	3	2	3	3	2	1	2	3	2	2	3	3	2
CO2: To understand the performance characteristics of controlled AC-DC converters for R, RL & RLE loads.	3	3	3	3	2	2	1	2	1	2	2	2	2	2
CO3: To gain knowledge on basic DC-DC converters and their operation under continuous /discontinuous mode of conduction for RLE loads	3	3	2	2	3	1	2	2	1	2	2	3	2	2
CO4: To identify and formulate the requirements for four quadrant operation of DC motor.	3	3	2	2	2	1	1	3	2	2	2	2	3	3
CO5: To differentiate and understand the significance of various commutation circuits and their	3	3	3	3	2	3	2	3	2	2	2	2	3	3

consequence on device stress and understand the principle of DC-AC conversion and the different topology for three phase to three phase and single phase to single phase DC-AC conversion														

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7 ,8,9,10,11,12 PSO 1,2	**CO1:** To gain knowledge of various application of semiconductor switches by understanding their static and dynamic characteristics.	SO1.1 SO1.2 SO1.3	1, 2, 3,4,5,6,7,8	**Unit-1** Thyristor family 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8, 1.9,1.10	1
PO:1,2,3,4,5,6,7 ,8,9,10,11,12 PSO 1,2	**CO2**: To understand the performance characteristics of controlled AC-DC converters for R, RL & RLE loads.	SO2.1 SO2.2 SO2.3	1,2,3	**Unit-2 Phase controlled rectifier** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7,2.8,2.9,2.10	1,2
PO:1,2,3,4,5,6,7 ,8,9,10,11,12 PSO 1,2	**CO3:** To gain knowledge on basic DC-DC converters and their operation under continuous /discontinuous mode of conduction for RLE loads	SO3.1 SO3.2 SO3.3		**Unit-3 : Inverter** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1
PO:1,2,3,4,5,6,7 ,8,9,10,11,12 PSO 1,2	**CO4:** To identify and formulate the requirements for four quadrant operation of DC motor.	SO4.1 SO4.2 SO4.3 SO4.4	1,2	**Unit-4 : Chopper** 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8	1

PO:1,2,3,4,5,6,7 ,8,9,10,11,12 PSO 1,2	**CO5:** To differentiate and understand the significance of various commutation circuits and their consequence on device stress CO6: To understand the principle of DC-AC conversion and the different topology for three phase to three phase and single phase to single phase DC-AC conversion	SO5.1 SO5.2 SO5.3	1, 2	**Unit 5: voltage controller, Cycloconverter** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	1

Semester-IV

Course Code:	**EE207**
Course Title :	**Signals and Systems**
Pre- requisite:	Student should have basic knowledge of Engineering mathematics, Engineering physics and Electronic Devices
Rationale:	This course aims to introduce the basic concepts of signals and systems its properties and analyzing the concepts of continuous time and discrete time systems. with the transformation techniques

Course Outcomes:

EE207.1: Understanding the concept and properties of different types of Signals and Systems
EE207.2: Understanding the behavior of continuous and discrete time LTI systems
EE207.3: Analyzing the different signals and systems using Fourier series and Fourier transform.
EE207.4: Understanding the significance of signals and system using Laplace transform and Z- transform
EE207.5: Analyzing the signals by applying Sampling and Reconstruction theorems, applications of signals and systems.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	EE207	Signals and Systems	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks (PRA+ ESA)**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PCC	EE207	Signals and Systems	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE207.1: Understanding of the concept and properties of different types of Signals and Systems

Approximate Hours

Item	Approx Hrs
Cl	07
LI	0
SW	1
SL	1
Total	09

Session Outcomes (SOs)	Lab Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the concept of signals and its types **SO1.2** Understand the characteristics of systems and its types **SO1.3** Understand the significance of different properties of signals and systems	.	**Unit-1: Signal and system properties** 1.1 Definition of signal and signal properties 1.2 periodicity, absolute integrability, determinism and stochastic character 1.3 the unit step, the unit impulse, the sinusoid, the complex exponential 1.4 Continuous and discrete time signals, continuous and discrete amplitude signal 1.5 Definition of systems and systems properties 1.6 linearity: additivity and homogeneity, shift invariance 1.7 Causality, stability .realizability. Examples	1. Mathematical accepts of different signals 2. Types of different signals and their representation

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

i. Theoretical Assignments of different types of Signals and Systems.

ii. Numerical Problems Related to properties of signal and system.

EE207.2 Understanding of behavior of continuous and discrete time LTI systems

Approximate Hours

Item	Approx Hrs
Cl	09
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understanding of LTI systems. **SO2.2** Analyzing the different Responses **SO2.3** Understand the different characteristics of LTI system		**Unit-2 Behavior of continuous and discrete-time LTI systems** 2.1 Explanation of LTI systems 2.2 Impulse response and step response, convolution, 2.3 Input-output behavior with aperiodic convergent inputs, cascade interconnections. 2.4 Characterization of causality and stability of LTI systems. 2.5 System representation through differential equations and difference equation 2.6 State-space Representation of systems. State-Space Analysis, 2.7 Multi-input, multi-output representation. State Transition Matrix and its Role. 2.8 Periodic inputs to an LTI system, 2.9 The notion of a frequency response and its relation to the impulse response.	1. Concept of system and its properties 2. Convolution 3. Time domain and frequency domain signals

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Theoretical Assignment related to impulse response and step response of LTI Systems.

ii. Numerical Problems related to LTI systems

EE207.3: Analyzing the different signals and systems using Fourier series and Fourier transform.

Approximate Hours

Item	Approx Hrs
Cl	10
LI	0
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 To discuss role of Fourier series and Fourier transform **SO3.2** To study the different properties of Fourier series and Fourier transform **SO3.3** To understand the significance of DTFT	.	**Unit-3: Fourier Series and Fourier Transform** 3.1 Introduction to Fourier series and types of Fourier series 3.2 Fourier series representation of periodic signals, Waveform and Symmetries 3.3 Calculation of Fourier Coefficients 3.4 Introduction to Fourier transform and types of Fourier transform	1. Basics of Fourier series 2. Basics of Fourier transform

		3.5 Fourier Transform convolution 3.6 Fourier Transform multiplication and their effect in the frequency domain ,magnitude and phase response 3.7 Fourier domain duality 3.8 Introduction to discrete Fourier transform 3.9 Properties of DTFT 3.10 Parseval’s Theorem	

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Written Assignments related to Fourier series and fourier transform.
   ii. Numerical Problems related to different properties of Fourier series and Fourier transform

EE207.4: Understanding the significance of signals and system using Laplace transform and Z- transform

Approximate Hours

Item	Approx Hrs
Cl	10
LI	0
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Discuss the role of Laplace transform for continuous time signals and systems **SO4.2** Understand the significance of poles and zeros for signals and systems **SO4.3** Analyze the Z-transform of discrete time signals and systems **SO4.4** Study the significance of ploes and zeros for signals and systems	.	**Unit-4 : Laplace and z- Transforms** 1 4.1 Review of the Laplace Transform for continuous time signals. 4.2 Review of the Laplace Transform for continuous time systems. 4.3 Poles and zeros of signals 4.4 Poles and zeros of system functions. 4.5 Laplace domain analysis 4.6 solution to differential equations and system behaviour. 4.7 Introduction to the z-Transform for discrete time signals and systems 4.8 Introduction to the z-Transform for discrete time systems 4.9 poles and zeros of systems and sequences 4.10Z- transform domain analysis.	i. Basics of Laplace transform ii. Basics of Z-transform iii. Continuous time signals and discrete time signals

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Numerical Problems related to Laplace transform

ii. Numerical Problems Based on Z-transform

EE207.5: Analyzing the signals by applying Sampling and Reconstruction theorems, applications of signals and systems.

Approximate Hours

Item	Approx Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Discussion about sampling theorem **SO5.2** Understand the Reconstruction **SO5.3** Application of sampling and reconstruction. **SO5.4** Study of different types of application of signals and systems		**Unit 5: Sampling and Reconstruction** 5.1 Introduction to the Sampling Theorem and its implications 5.2 Derivation of sampling theorem. 5.3 Characteristics and significance of sampling theorem 5.4 Reconstruction: ideal interpolator zero-order hold and first-order hold 5.5 Aliasing and its effects 5.6 Relation between continuous and discrete time systems. 5.7 Introduction to the applications of signal and system theory 5.8 modulation techniques for communication and filters 5.9 feedback control systems.	1. Analogand Digital converters. 2. Samplingand its Types

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Theoretical Assignment based on reconstruction and Hold
   ii. Numerical Problem based on Sampling theorem.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE207.1: Understanding the concept and properties of different types of Signals and Systems	7	1	1	09
EE207.2: Understanding the behavior of continuous and discrete time LTI systems	9	1	1	11
EE207.3: Analyzing the different signals and systems using Fourier series and Fourier transform.	10	1	1	12
EE207.4: Understanding the significance of signals and system using Laplace transform and Z- transform	10	1	1	12
EE207.5: Analyzing the signals by applying Sampling and Reconstruction theorems, applications of signals and systems.	9	1	1	11
Total Hours	45	5	5	55

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Signal and System Properties	02	05	03	10
CO-2	Behavior of continuous and discrete-time LTI systems	04	04	02	10
CO-3	Fourier series and Fourier Transform	02	06	02	10
CO-4	Laplace and z- Transforms	03	04	03	10
CO-5	Sampling and Reconstruction	03	05	02	10
Total		14	24	12	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Signal and System will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Demonstration of Instruments.
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, WhatApp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) **Books** :

S. No.	Title	Author	Publisher	Edition & Year
1	Signals and systems	A. V. Oppenheim, A. S. Willsky and S. H. Nawab,	Prentice Hall India,	1997
2	Signals and systems	H. P. Hsu	McGraw Hill Education	2010.
3	Signals and Systems	S. Haykin and B. V. Veen	John Wiley and Sons,	2007
4	Linear Systems and Signals	B. P. Lathi	Oxford University Press	2009
5	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni,Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs,POs and PSOs Mapping

Course Title: B. Tech. Electrical Engineering
Course Code: EE207
Course Title: Signal and System

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Understanding the concept and properties of different types of Signals and Systems	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO 2: Understanding the behavior of continuous and discrete time LTI systems	3	3	3	3	2	2	1	3	2	2	2	3	3	2
CO3: Analyzing the different signals and systems using Fourier series and Fourier transform..	3	2	3	2	2	1	2	2	2	2	2	3	3	2
CO 4: Understanding the significance of signals and system using Laplace transform and Z- transform	3	3	2	2	2	2	2	3	2	2	2	2	2	3
CO 5: Analyzing the signals by applying Sampling and Reconstruction theorems, applications of signals and systems.	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO1: Understanding the concept and properties of different types of Signals and Systems	SO1.1 SO1.2 SO1.3		**UNIT-1: Signal and system properties** 1.1,1.2,1.3,1.4,1.5,1.6,1.7	1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 2: Understanding the behavior of continuous and discrete time LTI systems	SO2.1 SO2.2 SO2.3		**UNIT-2**: **Behavior of continuous and discrete-time LTI systems** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9	1,2,3
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO3: Analyzing the different signals and systems using Fourier series and Fourier transform..	SO3.1 SO3.2 SO3.3		**Unit-3: Fourier Series and Fourier Transform** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 4: Understanding the significance of signals and system using Laplace transform and Z-transform	SO4.1 SO4.2 SO4.3 SO4.4		**UNIT-4: Laplace and z- Transforms** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8, 4.9,4.10	1,2,3
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 5: Analyzing the signals by applying Sampling and Reconstruction theorems, applications of signals and systems.	SO5.1 SO5.2 SO5.3 SO5.4		**UNIT-5: Sampling and Reconstruction** 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9.	1,2

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-IV

Course Code: **EE208**
Course Title : **Electromagnetic Fields**
Pre- Requisite: Engineering Mathematics, Engineering Physics

Rationale: The purpose of the course is to familiarize the students with the Concept of electric Fields, magnetic fields, time-varying fields and electromagnetic waves.

Course Outcomes: Students will be able to

EE208.1: Develop understanding of vector analysis and its use in different types of coordinate systems.
EE208.2: Understand different concepts and laws that govern static Electric fields and apply them to solve magnetostatics problems.
EE208.3: Study the nature of electric field inside conductor, insulator and Dielectrics.
EE208.4: Understand different concepts and laws that governs static Magnetic fields and apply them to solve magnetostatics problems
EE208.5: Analyze electromagnetic wave propagation in different media.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	EE208	Electromagnetic Fields	4	0	1	1	6	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Scheme of Assessment:
Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PCC	EE208	Electromagnetic Fields	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE208.1: Develop understanding of vector analysis and its use in different types of coordinate systems.

Approximate Hours

Item	Approx. Hrs.
Cl	14
LI	0
SW	2
SL	1
Total	17

Session Outcomes (SOs)	Lab Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO1.1** Understand the concept of vectors and basic vector operations. **SO1.2** Understand the concept of Coordinate system, their types, Representation and Conversion. **SO1.3** Study the concept of Gradient, Divergence and Curl and calculate them for given problem.		**Unit-1: Coordinate system and Electric fields** 1.1 Addition and subtraction of Vectors, 1.2 Scalar and vector multiplications of Vectors, triple products. 1.3 Components of vectors. 1.4 Tutorial-I 1.5 Cartesian co-ordinate system 1.6 cylindrical co-ordinate system 1.7 Spherical co-ordinate system 1.8 Tutorial-II 1.9 Vector operator Del Gradient of Scalar 1.10 Divergence of Vector field 1.11 Curl of Vector field 1.12 Divergence Theorems 1.13 stoke's Theorems 1.14 Tutorial-III	1. Practice of numerical Problems Related to coordinate systems. 2. Practice of numerical Problems Related to Gradient Divergence and Curl.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

i. Numerical Problems Related to coordinate systems.
ii. Numerical Problems Related to Gradient, Divergence and Curl.

EE208.2: Understand different concepts and laws that govern static Electric fields and apply them to solve magneto statics problems.

Approximate Hours

Item	Approx. Hrs.
Cl	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
Students will be able **SO2.1** Apply Coulombs law and gauss law to calculate electric field intensity and Electric flux density for given problem. **SO2.2** Understand the concept of electric Potential, Potential Difference and equipotential surface **SO2.3** Learn the Concept of Electric Dipole and solve related numerical problems		**Unit-2: Electrostatics** 2.1 Coulomb's law 2.2 electric field intensity due to different charge distribution viz. line charge, sheet charge, 2.3 electric potential, 2.4 Tutorial-I 2.5 properties of potential function, potential gradient, equipotential surfaces, line of force, 2.6 Gauss law, applications of Gauss law. 2.7 Electric dipole, dipole moment, potential & 2.8 electric field intensity due to dipole, 2.9 Tutorial-II	1. Concept of Electric charge 2. Practice of numerical problems based on Coulomb's law and Gauss Law.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Numerical Problems based on Coulomb's Law and Gauss Law.

ii. Numerical Problems based on Electric Potential and Electric Dipole

EE208.3: Study the nature of electric field inside conductor, insulator and Dielectrics.

Approximate Hours

Item	Approx. Hrs.
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
Students will be able to **SO 3.1** Analyze the behavior of electric field inside conductor, insulator and dielectric. **SO 3.2** Study Capacitance and their different types and Solve related Numerical Problems.	.	**Unit-3: Conductors, Dielectrics and Capacitance.** 3.1 Conductor & insulator, 3.2 Behavior of conductors in an electric field, electric field inside a dielectric, polarization, 3.3 Boundary value conditions for electric Field,	1. Conductor, Insulator and Dielectric 2. Practice of Numerical Problems of Capacitance. 3. Practice of Numerical Problems of Laplace and Poisson's Equations.

SO 3.3 Study of Ohm's law in point form and Continuity equation. **SO 3.4** Understand Different Electrostatic Boundary Value conditions and their mathematical relation.		3.4 Capacitance & Capacitances of various types of capacitors, Energy stored and energy density in static electric field, 3.5 Tutorial-I 3.6 Current density, conduction & convection current density ohms law in point form, 3.7 Equation of continuity. Laplace's & Poisson's equations, 3.8 solution of Laplace's equation 3.9 Tutorial-II	

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Numerical Problems related to Laplace and Poisson's Equations.
   ii. Numerical Problems related to Capacitance and Current Density.

EE208.4: Understand different concepts and laws that governs static Magnetic fields and apply them to solve magnetostatics problems

Approximate Hours

Item	Approx. Hrs.
Cl	18
LI	0
SW	2
SL	1
Total	21

Session Outcomes (SOs)	Lab Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO4.1** Understand and apply Biot Savart's Law to calculate magnetic field intensity for given problems. **SO4.1** Understand the concept of Magnetic Potential and their types **SO4.2** Understand Inductance and their types and solve related numerical problems. **SO4.3** Understand faraday's Law and its application **SO4.4** Understand Transformer and motional EMFs and their significance. **SO 4.5** Understand maxwell's equation and their different forms under different circumstances	.	**Unit-4 : Magnetostatics-II** 4.1 Biot-Savart Law, Ampere Law, 4.2 Magnetic flux and magnetic flux density, 4.3 Scalar and Vector Magnetic potentials. 4.4 Tutorial-I 4.5 Steady magnetic fields produced by current carrying conductors. 4.6 Force on a moving charge, Force on a differential current element, 4.7 Force between differential current elements. 4.8 Magnetic dipole & dipole moment, a differential current loop as dipole, 4.9 torque on a current carrying loop in magnetic field, 4.10 Tutorial-II 4.11 Magnetic Boundary conditions. 4.12 Self and Mutual inductances, determination of self & mutual inductances, 4.13 Energy stored in magnetic Field & energy density, 4.14 Faraday's Law, transformer & motional EMFs, Displacement current, 4.15 Maxwell's equations as Generalization of circuit equations, 4.16 Maxwell's equation in free space, Maxwell's equation for harmonically varying Field, static and steady fields, 4.17 Maxwell's equations in differential & integral form, Motional Electromotive forces. 4.18 Tutorial-III	1. Magnetic flux 2. Magnetic flux density, Magnetic field Intensity. 3. Inductance and their types. 4. Faraday's Law 5. Practice of Numerical problems

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Numerical Problems Based on Calculation of Inductance magnetic energy
   ii. Numerical Problems Based Biot Savart's Law, Ampere Law and Faraday's Law.

EE208.5: Analyze electromagnetic wave propagation in different media.

Approximate Hours

Item	Approx. Hrs.
Cl	10
LI	0
SW	2
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO5.1** Understand the concept Electromagnetic Waves and their mathematical representation in different media **SO5.2** understand pointing vector theorem and their application. **SO5.3** Understand the concept of polarization and their types		**Unit 5: Electromagnetic Waves** 5.1 Electro Magnetic Waves 5.2 Derivation of Wave Equation , 5.3 Uniform plane wave in time domain in free space 5.4 uniform plane wave in free space, 5.5 Uniform plane wave in dielectrics and conductors, 5.6 Tutorial-I 5.7 Pointing Vector theorem, 5.8 Polarization of waves, Reflection by conductors and dielectric – Normal & Oblique incidence,	1. Electro Magnetic Waves 2. Polarization of waves,

		5.9 Reflection at surface of a conducting medium, 5.10 Tutorial-II	

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**

Theoretical Assignment related to pointing vectors and electromagnetic waves.

i. Numerical Problem based on different parameters of Electromagnetic waves.

b. **Mini Project:**

Draw the chart of Different Types of polarization.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE208.1: Develop understanding of vector analysis and its use in different types of coordinate systems.	14	02	1	17
EE208.2: Understand different concepts and laws that govern static Electric fields and apply them to solve magneto statics problems.	9	2	1	12
EE208.3: Study the nature of electric field inside conductor, insulator and Dielectrics.	9	1	1	11
EE208.4: Understand different concepts and laws that governs static Magnetic fields and apply them to solve magneto statics problems	18	2	1	21
EE208.5: Analyze electromagnetic wave propagation in different media.	10	2	1	13
Total Hours	60	9	5	74

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Vector Calculus.	02	03	05	10
CO-2	Static Electric Field.	02	03	03	8
CO-3	Conductors, Dielectrics and Capacitance.	02	03	02	7
CO-4	Static Magnetic Field and Maxwell's Equations.	03	06	06	15
CO-5	Electromagnetic Waves	03	05	02	10
Total		12	20	18	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Electromagnetic fields will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Demonstration of Instruments.
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, WhatApp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) Books :

S.No.	Title	Author	Publisher	Edition & Year
1	Elements of Electromagnetic	Mathew N.O Sadiku	Oxford university press	Fourth, 2009
2	Element of Engineering Electromagnetics	N.N. Rao;	PHI	Sixth, 2006
3	Engineering Electromagnetic;	William H. Hayt;	TMH.	Ninth, 2020
4	Electromagnetic Field	S.P. Seth;	Dhanpat Rai & Sons	2001
5	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni,Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE208
Course Title: Electromagnetic Fields

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Develop understanding of vector analysis and its use in different types of coordinate systems	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO 2: Understand different concepts and laws that govern static Electric fields and apply them to solve magnetostatics problems	3	3	3	3	2	2	1	3	2	2	2	3	3	2
CO3: Study the nature of electric field inside conductor, insulator and Dielectrics	3	3	2	2	1	1	2	2	1	2	2	3	2	3
CO 4: Understand different concepts and laws that governs static Magnetic fields and apply them to solve magnetostatics problems	3	3	2	2	2	1	1	3	2	2	2	2	3	3
CO 5: Analyze electromagnetic wave propagation in different media	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO1: Develop understanding of vector analysis and its use in different types of coordinate systems	SO1.1SO1.2 SO1.3		**Unit-1: Coordinate system and Electric fields** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8, 1.9,1.10,1.11,1.12,1.13,1.14	1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 2: Understand different concepts and laws that govern static Electric fields and apply them to solve magnetostatics problems	SO2.1SO2.2 SO2.3		**Unit-2: Electrostatics** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9	1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO3: Study the nature of electric field inside conductor, insulator and Dielectrics	SO3.1SO3.2 SO3.3 SO3.4		**Unit-3: Conductors, Dielectrics and Capacitance.** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1,2,3
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 4: Understand different concepts and laws that governs static Magnetic fields and apply them to solve magnetostatics problems	SO4.1SO4.2 SO4.3SO4.4 SO4.5		**Unit-4 : Magnetostatics-II** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10,4.11,4.12,4.13,4.14,4.15,4.16,4.17,4.18	1,2,3,4,5
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 5: Analyze electromagnetic wave propagation in different media	SO5.1SO5.2 SO5.3		**Unit 5: Electromagnetic Waves** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10	1,2

Semester-IV

Course Code:	**HSMC02**
Course Title :	**Principle of management**
Pre-requisite:	Student should have basic knowledge about the Energy sources.
Rationale:	This course helps in achieving the goals of the organization effectively and efficiently and guides the managers to fulfill their commitment towards its employees and society.

Course Outcomes:

HSMC02.1: to learn about management and its principles.
HSMC02.2: to understand the process of planning and decision making.
HSMC02.3: Apply the concept of organizing for the effective functioning of a management.
HSMC02.4: Evaluate leadership style to anticipate the consequences of each leadership style.
HSMC02.5: Demonstrate the techniques for controlling and coordination.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours(CI+LI+SW+SL)	
HSMC	HSMC02	Principle of Management	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture(L) and Tutorial (T) and others), **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Scheme of Assessment:
Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
HSMC	HSMC202	PRINCIPLE OF MANAGEMENT	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

HSMC02.1: to learn about management and its principles.

Approximate Hours

Item	AppX Hrs
Cl	07
LI	0
SW	2
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the principles of management **SO1.2** Understand the theories of management given by some scientist **SO1.3** Understand the various types of business organization .		**Unit-1: Management** 1.1 Definition of Management - Science or Art 1.2 Management and administration 1.3 Development of management Thought 1.4 Contribution of Taylor 1.5 contribution of Fayol 1.6 Functions of 1.7 Management Types of Business organization.	1. Case study

a. **Assignments:**
   i. Drawing figures (tree diagrams), poster making etc.

b. **Mini Project:**
   i. Case study of a particular situation.

HSMC02.2: to understand the process of planning and decision making.
Approximate Hours

Item	AppX Hrs
Cl	10
LI	0
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO2.1 Understand the concept of Planning **SO2.2** Understand the objective and process of making objective **SO2.3** understand the planning premises.	.	**Unit-2 : Planning** 2.1 Nature of Planning 2.2 Purpose of Planning 2.3 Steps involved in Planning 2.4 Objectives 2.5 Setting Objectives 2.6 Process of making Objectives 2.7 Strategies 2.8 Policies 2.9 Planning Premises 2.10 Forecasting, Decision-making	

SW-2 Suggested Sessional Work(SW):

a. **Assignments:**
   i. Case study about the planning.

Mini Project:
   i. Draw the steps of using process of making objective.

HSMC02.3: Apply the concept of organizing for the effective functioning of a management.

Approximate Hours

Item	AppX Hrs
Cl	8
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO3.1 To Understand the organizational structure of any organization. **SO3.2**To understands the process of staffing. **SO3.3**To Understand the HRD policies and power and authorities for their employees.		**Unit-3 : Organizing** 3.1 Nature and Purpose of Formal organization and informal organization 3.2 Structure of Organization Chart 3.3 Process of organizational chart 3.4 Authority relationship(Line and Staff Authority) 3.5 Centralization and De-Centralization 3.6 Delegation of Authority 3.7 Staffing, Selection process technique 3.8 Managerial effectiveness	

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Learning the organizational structure.

HSMC02.4: Evaluate leadership style to anticipate the consequences of each leadership style.

Approximate Hours

Item	AppX Hrs
Cl	8
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 to understand the process of directing **SO4.2** Understanding the motivation and motivation theories. **SO4.3** to understand the communication and communication process.	.	**Unit-4 :Leadership** 4.1 Scope - Human Factors - Creativity and Innovation. 4.2 Harmonizing Objectives 4.3 Leadership - Types of Leadership Motivation 4.4 Motivation theories, Motivational Techniques 4.5 Job Enrichment, communication , communication process. 4.6 barrier and breakdown of communication 4.7 effective communication 4.8 electronic media communication	

SW-4 **Suggested Sessional Work (SW):**

HSMC02.5: Demonstrate the techniques for controlling and coordination.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	2
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 Understand the process of controlling. **SO5.2** understand role of computer in management. **SO5.3** learn how to control overall performance in any organisation **SO5.4** Understanding the global theory of management		**Unit 5: Controlling and Coordination** 5.1 system of controlling 5.2 process of controlling 5.3 requirement for effective control 5.4 budget as control technique 5.5 information technology in controlling 5.6 use of computer in handling the information 5.7 productivity 5.8 control of overall performance 5.9 direct and preventive control, reporting 5.10 the global environment 5.11globalization and liberalization 5.12 international management, global theory of management	

SW-5 Suggested Sessional Work(SW):

a. **Assignments:**

Learn how to control overall performance in any organization

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
HSMC02.1: To Understand the historical development of management in any	7	2	1	10
HSMC02.2: To understand the concept of planning, process of planning and planning premises.	10	1	1	12
HSMC02.3: To understand the concept of organizing, staffing, organizational chart and power and authorities of the employees.	8	2	1	11
HSMC02.4: Understand the concept of directing, communication, process of communication.	8	1	1	10
HSMC02.5: Understand the process of budgeting, controlling and reporting.	12	2	1	15
Total Hours	45	8	5	58

Suggestion for End Semester Assessment

Suggested Specification Table(For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Historical Development	03	02	0	05
CO-2	Planning	02	08	0	10
CO-3	Organizing	08	07	0	15
CO-4	Directing	08	07	0	15
CO-5	Controlling	03	02	0	05
Total		24	26	0	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Principle of management will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. ICT Based Teaching Learning(Video lecture/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
7. Brainstorming

Suggested Learning Resources:

(a) **Books**:

S. No.	Title	Author	Publisher	Edition &Year
1	Essentials of management	Harold kooritz & Heinz wehrich	Tata McGraw-Hill	1998
2	Essentials of management	Joseph L Massie	Prentice Hall of india	Fourth edition2003
3	Lecture note provided by Dept. of Electrical engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs,POs and PSOs Mapping

Course Title: B. Tech. Electrical Engineering
Course Code: HSMC02
Course Title: Principle of management

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: To Understand the historical development of management in any	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO2: To understand the concept of planning, process of planning and planning premises.	3	3	3	3	2	2	1	3	2	2	2	3	3	2
CO3: To understand the concept of organising, staffing, organizational chart and power and authorities of the employees.	3	3	2	2	1	1	2	2	1	2	2	3	2	3
CO4: Understand the concept of directing, communication, process of communication.	3	3	2	2	2	1	1	3	2	2	2	2	3	3
CO5: Understand the process of budgeting, controlling and reporting.	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO1:** To Understand the historical development of management in any	SO1.1 SO1.2 SO1.3		**Unit-1:** Historical Development 1.1,1.2,1.3,1.4,1.5,1.6,1.7	1
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO2:** To understand the concept of planning, process of planning and planning premises.	SO2.1 SO2.2 SO2.3		**Unit-2:** Planning 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9, 2.10	
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO3:** To understand the concept of organizing, staffing, organizational chart and power and authorities of the employees.	SO3.1 SO3.2 SO3.3		**Unit-3:** Organizing**.** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8	
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO4:** Understand the concept of directing, communication, process of communication**.**	SO4.1 SO4.2 SO4.3		**Unit-4 :** Directing 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO5:** Understand the process of budgeting, controlling and reporting.	SO5.1 SO5.2 SO5.3 SO5.4		**Unit 5:** Controlling 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10, 5.11, 5.12	

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-IV

Course Code:	**OC201**
Course Title :	**Environmental Science (Audit)**
Pre-requisite:	To study this course, the student must have a knowledge about the environmental components, pollution, biodiversity and ecosystem at senior secondary level.
Rationale:	Environmental awareness is today's need as pollution impact is highly increasing. Environmental legislation and Audit is the mechanism to enforce environment friendly techniques/methods to business and industries. And hence knowledge of environmental legislation and audit is an essential requirement for environment engineers. This course therefore aims to develop in students, knowledge of the legal concepts, procedures and techniques which have evolved. The course also provides knowledge of tools about the environmental audit. The course will also help students to understand and carry out the environmental auditing and life cycle assessment

Course Outcomes: After the completion of this course the students will be able to

OC201.1: understand about air, water and soil pollution and there causes.
OC201.2: aware of various laws and policies for environment protection
OC201.3: understand about benefits and barriers of EMS and purpose of EIA.
OC201.4: understand about objective and scope of Environmental Auditing and their types.
OC201.5: prepare an audit report for a given organization and evaluate the impact of their activities on environment

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours(CI+LI+SW+SL)	
Other Courses	OC201	Environmental Science (Audit)	2	0	1	1	4	0

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e .Lecture(L) and Tutorial (T)and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
Other Courses	OC201	Environmental Science (Audit)	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

OC201.1: understand about air, water and soil pollution and there causes.

Approximate Hours

Item	AppX Hrs
Cl	07
LI	0
SW	1
SL	2
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Understand air pollution and its sources. **SO1.2**Know about gaseous and particulate pollutants. **SO1.3**Observe the sources of water pollution. **SO1.4**Learn about water quality parameter. **SO1.**5Evaluate the effects of noise pollution.		**Unit-1: Industrial pollution and its mitigation** 1.1 Air Pollution: Sources, classification of air pollutants, 1.2 mitigation and control measures of Particulate matters and gaseous pollutants. 1.3 Water Pollution: sources, classification, 1.4 water quality parameters, 1.5 control measures of water pollution. 1.6 Soil pollution and impacts, soil conservation, 1.7 Noise pollution: sources, effects and control measures	1. Difference between pollution and pollutants. 2. Water quality standards

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Classify the air pollutants on different basis.

ii. Describe control measures of noise pollution.

b. Mini Project: Enlist the PPEs which used to minimize the effects of noise pollution.

c. Other Activities (Specify):

i. Measure the air quality of different places by using Sammer App.

OC201.2: aware of various laws and policies for environment protection .Approximate Hours

Item	AppX Hrs
Cl	6
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO2.1 Know about the environmental acts. **SO2.2** To learn about Water Pollution act. **SO2.3** To understand the air Pollution Act. **SO2.4** To discuss about Environmental protection act **SO2.5** To learn about the waste management act.	.	**Unit-2 : Environmental Law and Policy** 2.1 Highlights of the Environmental Acts, 2.2 Institutional arrangements for The water (Prevention & Control of pollution) Act 1974, 2.3 The Air (Prevention & Control of pollution) Act 1981, 2.4 The Environmental Protection Act 1986, 2.5 The waste management Act 1996, 2.6 The National Green Tribunal Act 2010.	1. What is the difference between law and policies?

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Mention the measure provisions of air pollution control act.
   ii. Describe waste management act..

OC201.3: understand about benefits and barriers of EMS and purpose of EIA.

Approximate Hours

Item	AppX Hrs
Cl	6
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Know about ISO 14000 & 14001 **SO3.2** Learn applications of EMS **SO3.3** Know the methods of EIA **SO3.4** Apply the methods of EIA **SO3.5** Discuss about sustainable development.		**Unit-3 : Environmental Management System** 3.1 ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – 3.2 Concept of continual improvement and pollution prevention, 3.3 Applications of EMS, Environmental Management plan. 3.4 Introduction and Principle – purpose of EIA, 3.5 Sustainable development and EIA, 3.6 The EIA Process – methodologies and practice	1. ISO Certification

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Methods of EIA
   ii. Applications of EMS
   iii. Environmental Management Plan

b. **Mini Projects:**
   i. Study the EIA reports of different developmental Projects and create a EIA report for cement plant.

OC201.4: understand about objective and scope of Environmental Auditing and their types

Approximate Hours

Item	AppX Hrs
Cl	5
LI	0
SW	1
SL	1
Total	7

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
SO4.1 Define environmental auditing. **SO4.2** Know the Scopes of Environmental auditing. **SO4.3** Learn the objectives of environmental auditing. **SO4.4** Apply the methods of Auditing. **SO4.**5 Create the auditing reports.	.	**Unit-4 : EnvironmentalAudit-Scope and Requisites** 4.1 Introduction to Environmental Auditing. Objectives and scope, Types, 4.2 Basic structure of Environmental Auditing,General Audit Methodology, 4.3 Elements of AuditProcess: coverage-, GOI notification on environmental audit- 4.4 Benefits to industry. Reporting environmentalaudit findings- 4.5 Importance of environmental audit report to industry, public and the government	1 Basic introduction of environmental auditing.

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Objectives, scope& Typesof environmental auditing.

b. **Other Activities (Specify):**Create an environmental audit report for cement plant.

OC201.5: prepare an audit report for a given organization and evaluate the impact of their activities on environment

Approximate Hours

Item	AppX Hrs
Cl	6
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
SO5.1 Know about Environmental performance indicators **SO5.2** Understanding sustainability in the context of environmental auditing **SO5.3** Learn about Risk Assessment and Management **SO5.4** Understanding Life Cycle Assessment (LCA) **SO5.**5 Create report of Energy audit.		**Unit 5: Tools and Techniques for Environmental Auditing** 5.1 Environmental performance indicators 5.2 Understanding sustainability in the context of environmental auditing 5.3 Introductory Risk Assessment and Management 5.4 Introductory Life Cycle Assessment (LCA) 5.5 Brief about Water audit 5.6 Brief about Energy audit	1. How to prepare audit report of Energy, water and Waste

SW-5 Suggested Sessional Work (SW):

a. Assignments:

Prepare an interpretive electricity consumption report of the organization/ institution over a five-year period (either actual or arbitrary data can be used).

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
   1. Prepare an audit report of electricity consumption of the university campus

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
OC201.1: understand about air, water and soil pollution and there causes.	7	1	2	10
OC201.2: aware of various laws and policies for environment protection	6	1	1	8
OC201.3: understand about benefits and barriers of EMS and purpose of EIA.	6	1	1	8
OC201.4: understand about objective and scope of Environmental Auditing and their types.	5	1	1	7
OC201.5: prepare an audit report for a given organization and evaluate the impact of their activities on environment	6	1	1	8
Total Hours	30	5	6	41

Suggestion for End Semester Assessment

Suggested Specification Table(For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Industrial pollution and its mitigation	03	01	01	05
CO-2	Environmental Law and Policy	02	06	02	10
CO-3	Environmental Management System	03	07	05	15
CO-4	Environmental Audit- Scope and Requisites	00	10	5	15
CO-5	Practical/ Hands on Exercise	3	2	0	05
Total		11	26	13	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Environmental Science will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. ICT Based Teaching Learning(Video lecture/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
7. Brainstorming

Suggested Learning Resources:

(a) Books:

S.No.	Title	Author	Publisher	Edition&Year
1	Environmental Health and Safety Audits: A Compendium of Thoughts and Trends	Cahill, L.B	Bernan Press.	2017
2	Handbook of Energy Audits	Thuman, A., Niehus, T., Younger, W.J.	River Publishers	2012
3	Environmental Audits. Mercury Learning & Information.	Taylor and Francis Van Guilder, C.V.,	Mercury Learning and Information	2014
4	A Guide to Local Environmental Auditing	Barton, H., and Bruder N.,	Routledge	1993
5	Lecture note provided by Dept. of Environmental Science, AKS University, Satna .			

****

Curriculum Development Team

1. **Prof. G C Mishra, Director IQAC, AKS University**
2. **Dr Mahendra Kumar Tiwari, Professor & Head, Dept. Environmental Science**
3. **Dr. RLS Sikarwar, Professor Dept. Environmental Science**
4. **Mrs Suman Patel Dept. Environmental Science**
5. **Dr Rahul Omar, Assistant Professor, Dept. of Cement Technology**

COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: OC201
Course Title: Environmental Science (Audit)

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: understand about air, water and soil pollution and there causes.	1	1	1	2	1	1	1	2	2	1	1	2	2	2
CO2: aware of various laws and policies for environment protection	1	2	1	3	1	2	3	1	2	2	2	3	1	1
CO3: understand about benefits and barriers of EMS and purpose of EIA.	1	2	1	2	1	1	2	1	2	2	1	2	1	2
CO4: understand about objective and scope of Environmental Auditing and their types.	1	3	1	2	1	3	2	1	3	2	2	2	2	2
CO5: prepare an audit report for a given organization and evaluate the impact of their activities on environment	1	3	1	3	3	3	2	2	2	2	2	2	3	2

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO1:** understand about air, water and soil pollution and there causes.	SO1.1 SO1.2 SO1.3		**Unit-1: Industrial pollution and its mitigation** 1.1,1.2,1.3,1.4,1.5,1.6	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO2:** aware of various laws and policies for environment protection	SO2.1		**Unit-2:** Environmental Law and Policy 2.1, 2.2, 2.3, 2.4, 2.5, 2.6	
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO3:** understand about benefits and barriers of EMS and purpose of EIA.	SO3.1 SO3.2 SO3.3		**Unit-3:** Environmental Management System**.** 3.1,3.2,3.3,3.4,3.5,3.6	
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO4:** understand about objective and scope of Environmental Auditing and their types.	SO4.1 SO4.2		**Unit-4 :** Environmental Audit- Scope and Requisites 4.1,4.2,4.3,4.4,4.5,4.6	
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO5:** prepare an audit report for a given organization and evaluate the impact of their activities on environment	SO5.1 SO5.2 SO5.3		**Unit 5:** Practical/ Hands on Exercise 5.1,5.2,5.3,5.4,5.5,5.6	

Semester-V

Course Code: **EE309**

Course Title : **Power Systems-I**

Pre- requisite: Basic Electrical Engineering, Electrical Power Generation

Rationale: The electricity is generated in bulk at remote places near to coal mines (thermal power plants), dams (hydro power) and transmitted to long distances and then distributed in cities and villages and to industry. The transmission and distribution of electric power is a complex issue which requires knowledge of different types of transmission lines and power equipments. Technicians are required to operate and maintain the power transmission and distribution system so that electrical energy is continuously available to the consumers economically. It is therefore required that the technicians should be also able to work independently in the various area of transmission and distribution system. The objective of this course is to enable the students to analyze the performance of transmission lines, distribution systems, insulators and cables.

Course Outcomes: After the completion of this course the students will be able to

EE309.1: Understand the concepts of power systems.
EE309.2: Understand the various power system components.
EE309.3: Understand the generation of over-voltages and insulation coordination.
EE309.4: Evaluate fault currents for different types of faults and to understand basic protection schemes.
EE309.5: Understand concepts of HVDC power transmission and renewable energy generation.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	EE309	Power Systems I	3	2	1	1	7	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others).
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Couse Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment**	**Total Marks**
			Class/ Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	**(ESA)**	(PRA+ ESA)
PCC	EE309	Power Systems I	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	CourseTitle	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
PCC	EE309-L	Power Systems I	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE309.1: Understand the concepts of power systems.

Approximate Hours

Item	Approx. Hrs.
Cl	6
LI	6
SW	2
SL	2
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
The students will be able to **SO1.1** Understanding of structure of power system **SO1.2** To understand generation, transmission & distribution **SO1.3** To analyze three phase system	1. To determine direct axis reactance and quadrature axis reactance of a salient pole alternator. 2. Use of CT and PT for measuring high current and high voltage. 3. Visit to a generating station and submit a report on it.	**Unit-1 Basic Concepts** 1.1 Evolution of Power Systems and Present-Day Scenario. 1.2 Structure of a power system: Bulk Power Grids andMicro-grids 1.3 Generation: Conventional and Renewable Energy Sources. 1.4 Distributed Energy Resources. Energy Storage 1.5 Transmission and Distribution Systems: Line diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems). Synchronous Grids and Asynchronous (DC) interconnections. 1.6 Review of Three-phase systems. Analysis of simple three-phase circuits. Power Transfer in AC circuits and Reactive Power	1. Renewable and Non renewable energy sources. 2. Three phase A.C. circuits.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Draw line diagram of Power system network.

ii. Give importance of reactive power.

EE309.2: Understand the various power system components.

Approximate Hours

Item	Approx. Hrs.
Cl	15
LI	12
SW	1
SL	2
Total	30

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
The students will be able to **SO2.1** Understand the concept of Overhead Transmission Lines its types and Cables **SO2.2** To know various compensation technique **SO2.3** To understand per unit calculations.	1. To determine location of fault in a cable using cable fault locator. 2. To study Ferranti effect and voltage distribution in H.V. long transmission line using	**Unit-2 Power System Components** 2.1 Overhead Transmission Lines and Cables: Electrical and Magnetic Fields around conductors, Corona. Parameters of lines and cables. 2.2 Capacitance and Inductance calculations for simple configurations. 2.3 Travelling-wave Equations. 2.4 Sinusoidal Steady state representation	1. Principle, Types & Equivalent circuit of Transformer. 2. Working principle and performance of synchronous machine.

	transmission line model. 3. To study various types of cables and their testing. 4. To find out the performance of short transmission line. 5. To find out the performance of medium transmission line. 6. To find out the performance of long transmission line.	of Lines: Short, medium and long lines. 2.5 Power Transfer, Voltage profile and Reactive Power 2.6 Characteristics of transmission lines. Surge Impedance Loading. 2.7 Series and Shunt Compensation of transmission lines. 2.8 Transformers: Three-phase connections and Phase-shifts 2.9 Three-winding transformers, auto-transformers, Neutral Grounding transformers. 2.10 Tap-Changing in transformers. Transformer Parameters. Single phase equivalent of three-phase transformers. 2.11 Synchronous Machines: Steady-state performance characteristics. Operation when connected to infinite bus. 2.12 Real and Reactive Power Capability Curve of generators. 2.13 Typical waveform under balanced terminal short circuit conditions – steady state, transient and sub-transient equivalent circuits.	

		2.14 Loads: Types, Voltage and Frequency Dependence of Loads. 2.15 Per-unit System and per-unit calculations	

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Numerical Assignments Based power factor improvement and per unit.

EE309.3: Understand the generation of over-voltages and insulation coordination.

Approximate Hours

Item	Approx. Hrs.
Cl	5
LI	0
SW	1
SL	1
Total	7

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
The students will be able to **SO3.1** Understand the concept of over-voltages & Insulation Coordination **SO3.2** To analyze protection against Over-voltages		**Unit-3 : Over-voltages and Insulation Requirements** 3.1 Generation of Over-voltages: Lightning and Switching Surges. 3.2 Protection against Over-voltages, Insulation Coordination. 3.3 Propagation of Surges. 3.4 Voltages produced by traveling surges. 3.5 Bewley Diagrams.	1. Lightning.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**

i. Discuss protection against lightning.

EE309.4: Evaluate fault currents for different types of faults and to understand basic protection schemes.

Approximate Hours

Item	Approx. Hrs.
Cl	10
LI	12
SW	2
SL	2
Total	26

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
the students will be able to **SO4.1** Understand Symmetrical Components and various types of faults. **SO4.2** To understand switchgear devices and its application. **SO4.3** Understand various types of protection schemes.	1. To determine negative and zero sequence reactances of an alternator. 2. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation. 3. To study the IDMT over current relay and	**Unit 4: Fault Analysis and Protection Systems** 4.1 Method of Symmetrical Components (positive, negative and zero sequences). 4.2 Balanced and Unbalanced Faults. 4.3 Representation of generators, lines and transformers in sequence networks. 4.4 Computation of Fault Currents. Neutral Grounding. 4.5 Switchgear: Types of Circuit Breakers.	1. Formulas used to solve numerical problems related to faults. 2. Practice of Numerical problems based upon symmetrical components.

	determine the time current characteristics 4. To study percentage differential relay, Impedance, MHO and Reactance type distance relays. 5. To study Buchholz, Over Voltage relays. 6. Visit to a substation and prepare a report on it.	4.6 Attributes of Protection schemes, Back-up Protection. 4.7 Protection schemes Over-current and their application 4.8 Directional protection and their application 4.9 Distance protection and their application 4.10 Differential protection and their application	

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Numerical Problems based on various types of faults

ii. Discuss relation between relay and circuit breaker.

EE309.5: Understand concepts of HVDC power transmission and renewable energy generation

Approximate Hours

Item	Approx. Hrs.
Cl	9
LI	0
SW	2
SL	2
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
The students will be able to **SO5.1** Understand DC Transmission Systems **SO5.2** Understand Solar PV systems **SO5.3** Understand Wind Energy Systems		**Unit 5: Introduction to DC Transmission & Renewable Energy Systems** 5.1 DC Transmission Systems: Line-Commutated Converters (LCC) and Voltage Source Converters (VSC). 5.2 LCC and VSC based dc link. 5.3 Real Power Flow control in a dc link. 5.4 Comparison of ac and dc transmission. 5.5 Solar PV systems: I-V and P-V characteristics of PV panels, power electronic interface of PV to the grid. 5.6 Wind Energy Systems: Power curve of wind turbine. 5.7 Fixed and variable speed turbines. 5.8 Permanent Magnetic Synchronous Generators and Induction Generators. 5.9 Power Electronics interfaces of wind generators to the grid.	1. Relationship between ac and dc transmission. Parameters. 2. Renewable energy system.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**

Discuss LCC and VSC based dc link.

i. Discuss solar and wind energy system.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE309.1: Understand the concepts of power systems.	6	6	2	2	16
EE309.2: Understand the various power system components.	15	12	1	2	30
EE309.3: Understand the generation of over-voltages and insulation coordination.	5	0	1	1	7
EE309.4: Evaluate fault currents for different types of faults and to understand basic protection schemes.	10	12	2	2	26
EE309.5: Understand concepts of HVDC power transmission and renewable energy generation.	9	0	2	2	13
Total Hours	45	30	8	9	92

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	**U**	**A**	
CO-1	Basic Concepts	02	03	05	10
CO-2	Power System Components	02	05	03	10
CO-3	Over-voltages and Insulation Requirements	02	02	06	10
CO-4	Fault Analysis and Protection Systems	02	03	05	10
CO-5	Introduction to DC Transmission & Renewable Energy Systems	02	04	04	10
Total		10	17	23	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Process calculation will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Design Demonstration
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, WhatApp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) **Books** :

S. No.	Title	Author	Publisher	Edition & Year
1	Power System Analysis	J. Grainger and W. D. Stevenson	McGraw Hill Education	1994
2	Electric Energy Systems Theory	O. I. Elgerd	McGraw Hill Education	1995
3	Power System Analysis	A. R. Bergen and V. Vittal	Pearson Education Inc.	1999
4	Modern Power System Analysis	D. P. Kothari and I. J. Nagrath	McGraw Hill Education	2003
5	Electric Power Systems	B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac	Wiley	2012
6	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE309
Course Title: Power system-1

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Understand the concepts of power systems.	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO.2: Understand the various power system components.	3	3	3	3	2	2	1	3	2	2	2	3	3	2
CO.3: Understand the generation of over-voltages and insulation coordination.	3	3	2	2	1	1	2	2	1	2	2	3	2	3
CO.4: Evaluate fault currents for different types of faults and to understand basic protection schemes.	3	3	2	2	2	1	1	3	2	2	2	2	3	3
CO.5: Understand concepts of HVdc power transmission and renewable energy generation.	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	**CO1:** Understand the concepts of power systems.	SO1.1 SO1.2 SO1.3	1,2,3	**Unit-1:** Basic Concepts 1.1,1.2,1.3,1.4,1.5,1.6	1,2
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	**CO.2:** Understand the various power system components.	SO2.1 SO2.2 SO2.3	1,2,3,4,5,6	**Unit-2:** Power System Components 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9, 2.10,2.11,2.12,2.13,2.14,2.15	1,2
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	**CO.3:** Understand the generation of over-voltages and insulation coordination.	SO3.1 SO3.2		**Unit-3:** Over-voltages and Insulation Requirements 3.1,3.2,3.3,3.4,3.5	1
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	**CO.4:** Evaluate fault currents for different types of faults and to understand basic protection schemes.	SO4.1 SO4.2 SO4.3 SO4.4	1,2,3,4,5,6	**Unit-4 :** Fault Analysis and Protection Systems 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10	1,2
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	**CO.5:** Understand concepts of HVdc power transmission and renewable energy generation.	SO5.1 SO5.2 SO5.3		**Unit 5:** Introduction to DC Transmission & Renewable Energy Systems 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	1,2

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-V

Course Code: **EE310**

Course Title : **Control System**

Pre- requisite: Student should have basic knowledge of mathematics, Specially Laplace Transform, there properties and its use to solve differential equations

Rationale: The control system plays an important part in modern mechanical, electrical and Electronic systems. The Purpose of this subject is to introduce the basic concept, and types of control system, its time and Frequency Domain analysis to determine the response and stability of given system by using different methods.

Course Outcomes: At the end of this course, students will be able to

EE310.1: Understand the concept of Control System, their types and procedure of Calculation of overall Transfer function using Various Methods.
EE310.2: Understand and Apply the procedure of Time Domain analysis of given Control System.
EE310.3: Determine the Stability of given system by using Different Methods
EE310.4: Understand and Apply different control Strategies to obtain desired Response of Given system.
EE310.5: Understand and Apply Procedure of State Space Analysis, Transfer function Decomposition, Observability and Controllability.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl (L+T)	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	EE310	Control System	3	2	1	1	7	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Scheme of Assessment:

Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
PCC	EE310	Control System	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	CourseTitle	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
PCC	EE310-L	Control System	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE310.1: Understand the concept of Control System, their types and procedure of Calculation of overall Transfer function using Various Methods.

Approximate Hours

Item	Approx .Hrs.
Cl	9
LI	4
SW	2
SL	1
Total	16

Session Outcomes (SOs)	Lab Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO1.1** Understand the concept of Control system and their different types and significance. **SO1.2** Understand and Apply the mathematical modeling of given system. **SO1.3** Determine overall transfer function of given system by using different methods like block Diagram Reduction, Signal flow Graph and Manson's Gain Formula.	1. Study of different blocks of control system. 2. Study of transfer function of field controlled DC motor	**Unit-1: Control System** **1.1** Open loop and Close Loop systems**.** **1.2** Review of Laplace transform and their properties**.** 1.3 Block diagram and its reduction, 1.4 Signal flow graph, 1.5 Manson's Gain Formula, 1.6 transfer function model of linear systems , 1.7 Mathematical Models of physical systems, 1.8 DC and AC servomotors, 1.9 Synchros	1. Laplace Transform and their properties. 2. Practice of numerical problems of Laplace Transform.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

i. Theoretical Assignments Related to AC and DC Motors, Synchros etc.

ii. Numerical Problems Related to Block Diagram Reduction, Manson's Gain Formula, Force-voltage analogy and force-current analogy.

EE310.2: Understand and Apply the procedure of Time Domain analysis of given Control System.

Approximate Hours

Item	Approx. Hrs.
Cl	9
LI	10
SW	2
SL	1
Total	22

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO2.1** Understand the concept of Transient and steady state response. **SO2.2** Determine the Time response of given system **SO2.3** Understand the concept of Steady state error and Determine the Steady state error of given system **SO2.4** Understand the concept of Sensitivity and Determine the Sensitivity of given system.	1. Analysis of different types of Test Signals 2. Determination of Time response of open loop system 3. Determination of Time response of close loop system 4. Determination of Time response of 1st order system 5. Determination of Time response of 2nd order system	**Unit-2: Feedback Control System.** 2.1 Transient and Steady state response, Time domain analysis of first order Control System. 2.2 Time domain analysis of second order and higher order control systems, Design Specification of control system 2.3 concept and estimation of Steady state error for first order control system 2.4 concept and estimation of Steady state error for Second order control system 2.5 Static positional error coefficient, Static velocity error coefficient 2.6 Static acceleration error coefficient. 2.7 Concept of sensitivity and its mathematical analysis 2.8 Analysis of sensitivity of open loop 2.9 Analysis of sensitivity of close loop control system, Performance indices.	1. Basic Test and their types 2. Practice of numerical problems related to time response, steady state response and sensitivity.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Theoretical Assignment related to Sensitivity and Steady state error.
   ii. Numerical problems related to time response, steady state response and sensitivity.

EE310.3: Determine the Stability of given system by using Different Methods

Approximate Hours

Item	Approx. Hrs.
Cl	9
LI	10
SW	2
SL	1
Total	22

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
Students will be able to **SO3.1** Understand the concept of stability and their conditions. **SO3.2** Determine the stability of given system by Routh Hurwitz criterion to determine the stability of given system. **SO3.3** Understand and Apply various graphical methods used for stability analysis to solve	1. Formation of transfer function using MATLAB 2. Determination of Pole-Zero plot of given system using MATLAB Simulation software. 3. Determination of Nyquist plot of given system using MATLAB Simulation software. 4. Determination of Bode plot of given system using MATLAB Simulation software.	**Unit-3: Stability** 3.1 Concept of stability, 3.2 Characterstic of stable, unstable and marginally stable system. 3.3 Routh-Hurwitz stability criterion. 3.4 Nyquist criterion. 3.5 Bode plot-I 3.6 Bode plot-II 3.7 Gain margin and phase margin, 3.8 Root locus 3.9 Lyapunov's criterion.	1. Concept of poles and zeros. 2. Stability analysis using pole zero plot. 3. Practice of numerical problems related to Stability analysis

related numerical problems.	5. Determination of Root Locus plot of given system using MATLAB Simulation software.		

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Theoretical Assignments Stability, their types and methods of Determination.
   ii. Numerical Problems related to Routh-Hurwitz criterion, Root Locus, Nyquist plot and Root locus.

EE310.4: Understand and Apply different control Strategies to obtain desired Response of Given system.

Approximate Hours

Item	Approx. Hrs.
Cl	8
LI	6
SW	2
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO4.1** understand the different approaches used in system design and their significance.	1. Analyze the effect of Proportional, Derivative and integral control action on system Performance.	**Unit-4 : Compensations & Control actions** 4.1 Approaches to system design 4.2 Phase lead compensation 4.3 Phase lag compensation	1. Practice of Numerical Problems Related to compensati on and

SO4.2 understand the concept of compensation and their types and solve related problems. **SO4.3** understand the concept of Control actions and their types and solve related problems.	2. Analyze the effect of PI and PD control action on system Performance 3. Analyze the effect of PID control action on system Performance	4.4 Phase Lead-Lag Compensation 4.5 Concept and types of Control actions. 4.6 Proportional control & Derivative control 4.7 Integrative control and PID control, 4.8 Feedback Control and ON-OFF Control action. 1	control actions

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Numerical Problems related to Controller design.
ii. Numerical Problems Based Related to compensation.

Mini Project:

i. Draw a block diagram chart of different types of control actions.

EE310.5: Understand and Apply Procedure of State Space Analysis, Transfer function Decomposition, Observability and Controllability.

Approximate Hours

Item	Approx. Hrs.
Cl	10
LI	0
SW	2
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO5.1** Understand the state variable model of control system. **SO5.2** Apply Transfer Function Decomposition to design the system **SO5.3** Understand the concept of controllability and test it for a given system. **SO5.4** Understand the concept of observability and test it for a given system.		**Unit 5: State Space Representation** **5.1** State Variable Model, state equation, **5.2** Transfer function from the state equation and vice-versa **.** **5.3** Diagonalization of State Matrix. **5.4** Solution of state equations. **5.5** Eigenvalues and Stability Analysis **5.6** State variables of a dynamic system, **5.7** design using State variable Technique. **5.8** Controllability. **5.9** Observability. **5.10** Pole placement using state feedback.	1. Practice of Numerical problems of state space analysis. 2. Practice of Numerical problems of Transfer function decomposition. 3. Practice of Numerical problems of Observability and controllability.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**

Numerical problems of state space analysis..

i. Numerical problems of Transfer function decomposition.

ii. Numerical problems of Observability and controllability.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Instructu in (LI)	Sessiona lWork (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE310.1: Understand the concept of ControlSystem, their types and procedure of Calculation of overall Transferfunction using Various Methods.	9	4	2	1	16
EE310.2: Understand and Apply the procedureof Time Domain analysis of given Control System.	9	10	2	1	22
EE310.3: Determine the Stability of given system by using Different Methods	9	10	2	1	22

EE310.4: Understand and Apply different control Strategies to obtain desired Response of Given system.	8	6	2	1	17
EE310.5: Understand and Apply Procedure ofState Space Analysis, Transfer function Decomposition, Observability and Controllability.	10	0	2	1	13
Total Hours	45	30	10	5	90

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Control system	02	03	05	10
CO-2	Feedback control system	02	05	03	10
CO-3	Stability	02	02	06	10
CO-4	Compensation and control action	02	04	04	10
CO-5	State Space Representation	02	03	05	10
Total		10	17	23	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Control system will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Demonstration of Control Actions.
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, WhatApp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	"Control System Engg"	I.J.Nagrath and M.Gopal,	New Age International Publication	7th , 2021
2	Control Systems Principles and Design.	M.Gopal	Tata McGraw Hill	4th , 2012
3	Modern Control Engineering	K. Ogata	PHI.	5th , 2015
4	Linear control system	B.S. Manke	Khanna publisher	12th , 1986
5	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineerin*g
Course Code: EE310
Course Title: Control System

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Understand the concept of Control System, their types and procedure of Calculation of overall Transfer function using Various Methods	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO 2: Understand and Apply the procedure of Time Domain analysis of given Control System	3	3	3	3	2	2	1	3	2	2	2	3	3	2
CO3: Determine the Stability of given system by using Different Methods	3	3	2	2	1	1	2	2	1	2	2	3	2	3
CO 4: Understand and Apply different control Strategies to obtain desired Response of Given system	3	3	2	2	2	1	1	3	2	2	2	2	3	3
CO 5: Understand and Apply Procedure of State Space Analysis, Transfer function Decomposition, Observability and Controllability	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

: POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO1: Understand the concept of Control System, their types and procedure of Calculation of overall Transfer function using Various Methods	SO1.1 SO1.2 SO1.3	1,2	**Unit-1: Control System** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 2: Understand and Apply the procedure of Time Domain analysis of given Control System	SO2.1 SO2.2 SO2.3 SO2.4	1,2,3,4,5	**Unit-2: Feedback Control System.** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9	1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO3: Determine the Stability of given system by using Different Methods	SO3.1 SO3.2 SO3.3	1,2,3,4,5	**Unit-3: Stability** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1,2,3
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 4: Understand and Apply different control Strategies to obtain desired Response of Given system	SO4.1 SO4.2 SO4.3	1,2,3	**Unit-4 : Compensations & Control actions** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 5: Understand and Apply Procedure of State Space Analysis, Transfer function Decomposition, Observability and Controllability	SO5.1 SO5.2 SO5.3 SO5.4		**Unit 5: State Space Representation** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10	1,2,3

Semester-V

Course Code: **EE311**

Course Title: **MICROPROCESSOR AND MICROCONTROLLERS**

Pre- requisite: Student should have basic knowledge of number system, Boolean equations, arithmetic and logical operations, logic gates and operations of different combinational and sequential circuits.

Rationale: In current scenario the microprocessor and microcontroller-based systems are extensively used in various electronic devices. Such systems are required to design and maintain by engineer. Therefore, the goal of this course is for students to become competent to understand design and maintenance of such type of microprocessor and microcontroller-based systems.

Course Outcomes:

EE311.1: Understanding the architecture, pin details and operation of eight-bit and sixteen-bit microprocessor.

EE311.2: Ability to develop programming skills of eight-bit and sixteen-bit microprocessor.

EE311.3: Understanding the architecture, pin details and function of various I/O and memory interfacing IC's used with 8086 microprocessor.

EE311.4: Understanding the architecture, pin details and function of various communication and bus interfacing IC's used with 8086 microprocessor.

EE311.5: Understanding of the architecture, pin details, operation and application of 8051.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	EE311	MICROPROCESSOR AND MICROCONTROLLERS	3	2	1	1	7	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Scheme of Assessment:

Theory

Course Category	Course Code	Coursetitle	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA + CAT+ AT)		
PCC	EE311	Microprocessor and Microcontrollers	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	CourseTitle	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
PCC	EE311-L	Microprocessor and Microcontrollers	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE311.1: Understanding the architecture, pin details and operation of eight-bit and sixteen-bit microprocessor.

Approximate Hours

Item	Approx Hrs
Cl	12
LI	4
SW	2
SL	1
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the historical background of microprocessor and microcontroller. **SO1.2** Understand the architecture, pin configuration and operation of eight-bit microprocessor. **SO1.3** Understand the architecture, pin configuration and operation of sixteen-bit microprocessor	1.Study of 8086 Microprocessor 2.Interfacing of peripherals with 8086 microprocessor	**Unit-1: Intel 8086/8088 Architecture** 1.1 Von Neuman Architecture 1.2 Moore's Law 1.3 Evolution of IC technology 1.4 Evolution of microprocessors 1.5 Architecture of 8085 microprocessor 1.6 Pin details of 8085 microprocessor 1.7 Architecture of 8086 microprocessor 1.8 Pin details of 8086 microprocessor 1.9 Concept of Segmented Memory 1.10 Maximum-Mode and Minimum-Mode Operation of 8086 microprocessor 1.11 Addressing Modes 1.12 Basic Peripherals and their interfacing with 8086/8088	1. Basics of evolution of semiconductor devices 2. Number system

SO1.4 Understand about various addressing modes **SO1.5** Understand basic peripherals and interfacing with eight/sixteen-bit microprocessor.			

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Make evolution tree of IC technology.
   ii. Prepare the presentation on the microprocessor discussed in the previous session.

EE311.2: Ability to develop programming skills of eight-bit and sixteen-bit microprocessor.

Approximate Hours

Item	Approx Hrs
Cl	6
LI	14
SW	2
SL	1
Total	23

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Understanding of different types of instructions supported by 8086 microprocessor. **SO2.2** Able to write assembly language	1. Hexadecimal addition of two numbers (8085 microprocessor kit). 2. The decimal addition of two decimal numbers.	**Unit-2: Assembly Language Programming with 8086/8088** 2.1 Instruction Set and Timing Diagrams 2.2 Programming techniques 2.3 Flow Chart	1. Various arithmetic operation on eight-bit and sixteen-bit numbers. 2. Basics about programming

programs to perform various arithmetic and logical operation with eight-bit/ sixteen-bit microprocessor. **SO2.3** Understand the concept of procedures, modular programming and macros.	3. Add two sixteen-bit numbers using 8085 microprocessor kit. 4. To add two binary number each eight byte long (8086 microprocessor kit) 5. Addition of 8 bit number series neglecting the carry generated. 6. To find the maximum number in a given string and store it in location 0510 using 8086 microprocessor. 7. Ascii multiplication using 8086 microprocessor kit.	2.4 Machine Language, Assembly Language and High-level language programming 2.5 Assembly language programs to perform various arithmetic and logical operations 2.6 Procedures, Modular programming and Macros	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Write assembly language program to perform arithmetic operation on eight-bit microprocessor.

ii. Write assembly language program to perform arithmetic operation on sixteen-bit microprocessor.

EE311.3: Understanding the architecture, pin details and function of various I/O and memory interfacing IC's used with 8086 microprocessor.

Approximate Hours

Item	Approx Hrs
Cl	10
LI	2
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Understand the concept of different types of interrupts supported by 8086 microprocessor. **SO3.2** Understand the architecture, pin details and operation of 8259A. **SO3.3** Understand the architecture, pin details and operation of 8255. **SO3.4** Understand the architecture, pin details and operation of 8253.	1. Study of Programmable Interrupt Controller 8259A	**Unit-3: I/O and Memory interfacing using 8086** 3.1 Interrupt of 8086/8085 Microprocessor 3.2 Architecture of Programmable Interrupt Controller 8259A 3.3 Pin details of Programmable Interrupt Controller 8259A 3.4 Operation of Programmable Interrupt Controller 8259A 3.5 Architecture of 8255 3.6 Pin details of 8255 3.7 Operation of 8255 3.8 Architecture of Programmable Interval Timer 8253 3.9 Pin details of Programmable Interval Timer 8253 3.10 Operation of Programmable Interval Timer 8253	1. Concept of interfacing circuits

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Concept of memory organization and their interfacing with microprocessor.

EE311.4: Understanding the architecture, pin details and function of various communication and bus interfacing IC's used with 8086 microprocessor.

Approximate Hours

Item	Approx Hrs
CI	8
LI	6
SW	1
SL	1
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand the architecture, pin details and operation of 8251. **SO4.2** Understand the architecture, pin details and operation of 8279. **SO4.3** Understand the architecture, pin details and operation of 8257. **SO4.3** Understand the interfacing of ADC and DAC systems.	1. Study of 8251 universal synchronous asynchronous receiver transmitter (USART) 2. Read Hex byte from the keyCourse Category the kit and split it into two nibbles. 3. Study of 8251 DMA controller	**Unit-4: Communication and Bus interfacing with 8086** 4.1 Block diagram of 8251 universal synchronous asynchronous receiver transmitter (USART) 4.2 Advantage and disadvantages of 8251 universal synchronous asynchronous receiver transmitter (USART) 4.3 Architecture of 8279 programmable keyboard/display controller. 4.4 Pin details of 8279 programmable keyboard/display controller 4.5 Operating modes of 8279 programmable keyboard/display controller 4.6 Block diagram of 8257 DMA Controller 4.7 Pin details of 8257 DMA Controller 4.8 Analog to Digital Interfacing	1. Difference between of analog and digital signals 2. Concept of ADC and DAC.

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Interfacing of ADC and DAC system with 8086 microprocessor.

EE311.5: Understanding of the architecture, pin details, operation and application of 8051.

Approximate Hours

Item	Approx Hrs
Cl	6
LI	4
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand the architecture and pin details of 8051. **SO5.2** Understand the assembly language programming. **SO5.3** Understand the various applications of microprocessor and microcontroller.	**1.** Flashing display of SUPERB on 7 segment display using 8051 microcontroller kit. **2.** Stepper motor controller using 8051 kit.	**Unit 5: 8051 Microcontroller** 5.1 Architecture of 8051 Microcontroller 5.2 Pin details of 8051 Microcontroller 5.3 Addressing modes 5.4 Instruction set 5.5 Assembly language programs 5.6 Application of microcontrollers.	1. Remember the difference between microprocessor and microcontroller.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

Architecture and pin diagram of 8051 microcontroller.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE311.1: Understanding the architecture, pin details and operation of eight-bit and sixteen-bit microprocessor.	12	4	2	1	19
EE311.2: Ability to develop programming skills of eight-bit and sixteen-bit microprocessor.	6	14	2	1	23
EE311.3: Understanding the architecture, pin details and function of various I/O and memory interfacing IC's used with 8086 microprocessor.	10	2	1	1	14
EE311.4: Understanding the architecture, pin details and function of various communication and bus interfacing IC's used with 8086 microprocessor.	8	6	1	1	16
EE311.5: Understanding of the architecture, pin details, operation and application of 8051.	6	4	1	1	12
Total Hours	42	30	7	5	84

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	**U**	**A**	
CO-1	Intel 8086/8088 Architecture	04	03	05	12
CO-2	Assembly Language Programming with 8086/8088	02	02	07	11
CO-3	I/O and Memory interfacing using 8086	02	02	06	10
CO-4	Communication and Bus interfacing with 8086	03	03	05	11
CO-5	8051 Microcontroller	02	02	02	06
Total		10	18	22	50

Legend: **R: Remember,** **U: Understand,** **A: Apply**

The end of semester assessment for Microprocessor and Microcontroller will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Design Demonstration
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Microprocessors and Interfacing	A P Godse, D A Godse	Technical Publication Pune	
2	Advanced Microprocessor & Peripherals	Ray A K, K M Bhurchandi	Tata McGraw, Hill	Second Edition, 2012
3	Microprocessor Architecture, Programming, and Applications with the 8085	Ramesh Gaonkar	Penram Publications	
4	The 8051 Microcontroller and Embedded Systems: Using Assembly and C	Mazidi & Mazidi	Pearson Publication	
5	The 8051 Microcontroller	Kenanth Ayala	Cengage Learning India	
6.	Microprocessor & Microcontroller System	A P Godse, D A Godse	Technical Publication Pune	
7	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE311
Course Title: Microprocessor and Microcontroller

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO11	PO1 2	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Understanding the architecture, pin details and operation of eight-bit and sixteen-bit microprocessor.	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO2: Ability to develop programming skills of eight-bit and sixteen-bit microprocessor.	3	3	3	3	1	2	1	2	2	2	2	3	3	2
CO3: Understanding the architecture, pin details and function of various I/O and memory interfacing IC’s used with 8086 microprocessor.	3	3	2	2	1	1	2	2	1	2	2	3	2	3
CO4: Understanding the architecture, pin details and function of various communication and bus interfacing IC’s used with 8086 microprocessor.	3	3	2	2	2	1	1	3	2	2	2	2	3	3
CO5: Understanding of the architecture, pin details, operation and application of 8051.	3	3	3	3	1	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO1:** Understanding the architecture, pin details and operation of eight-bit and sixteen-bit microprocessor.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1,2	**Unit-1:** Intel 8086/8088 Architecture 1.1,1.2,1.3,1.4,1.5,1.6,1.7, 1.8,1.9,1.10,1.11,1.12	1,2
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO2:** Ability to develop programming skills of eight-bit and sixteen-bit microprocessor.	SO2.1 SO2.2 SO2.3	1,2,3,4,5,6,7	**Unit-2:** Assembly Language Programming with 8086/8088 2.1, 2.2, 2.3, 2.4, 2.5, 2.6	1,2
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO3:** Understanding the architecture, pin details and function of various I/O and memory interfacing IC's used with 8086 microprocessor.	SO3.1 SO3.2 SO3.3 SO3.4	1	**Unit-3:** I/O and Memory interfacing using 8086 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9. 3.10	1
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO4:** Understanding the architecture, pin details and function of various communication and bus interfacing IC's used with 8086 microprocessor.	SO4.1 SO4.2 SO4.3 SO4.4	1,2,3	**Unit-4 :** Communication and Bus interfacing with 8086 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	1, 2
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO5:** Understanding of the architecture, pin details, operation and application of 8051.	SO5.1 SO5.2 SO5.3	1,2	**Unit 5:** 8051 Microcontroller 5.1,5.2,5.3,5.4,5.5,5.6	1

Semester-V

Course Code: **EE301**

Course Title: **Wind and Solar Energy Systems**

Pre-requisite: Students should have basic knowledge of Renewable Energy.

Rationale: A process of introducing formal knowledge of Renewable Energy (Solar and Wind). In this process, the study of generation, need, practical difficulties, and future aspects will be provided.

Course Outcomes:

EE301.1: Understand the energy scenario and the growth of power generation from renewable energy sources.
EE301.2: Understand the basic physics of wind and solar power generation.
EE301.3: Understand the power electronic interfaces for wind and solar generation.
EE301.4: Understand the issues related to the grid integration of solar and wind energy systems.
EE 301.5: Study the Network Integration Issues.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Professional Elective course (PEC)	EE301	Wind and Solar Energy Systems	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field, or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project, etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL have to be planned and performed under the teacher's continuous guidance and feedback to ensure the Learning outcome.

Scheme of Assessment:
Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PEC	EE301	Wind and Solar Energy Systems	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE 301.1: Understand the energy scenario and the growth of power generation from renewable energy sources.

Approximate Hours

Item	AppX Hrs
Cl	08
LI	0
SW	01
SL	01
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the past works in wind power. **SO1.2** Understand the Indian and global aspects. **SO1.3** Understand the workings of wind power generation. **SO1.4** Understand the concept of different distribution functions. .	.	**Unit-1: Physics of Wind Energy** 1.1 History of wind power 1.2 Indian and Global statistics 1.3 Wind physics 1.4 Betz limit 1.5 Tip speed ratio 1.6 stall and pitch control 1.7 Wind speed statistics probability distributions 1.8 Wind speed and power-cumulative distribution functions	1. Understand the Wind Power System.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Write down all the concepts of Wind Power with numerical.

b. **Mini Project:**
   i. Draw the basic diagrams of various systems with theory.

EE301.2: Understand the basic physics of wind and solar power generation.

Approximate Hours

Item	AppX Hrs
Cl	8
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 To Understand the Modern Wind Systems. **SO2.2** To understand the various turbines. **SO2.3** To understand the different types of generators. **SO2.4** To understand the various converters. **SO2.5** To understand the generator-converter configuration and control strategies.	.	**Unit-2 Wind Generator Topologies.** 2.1 Review of Modern Wind Turbine Technologies 2.2 Fixed and Variable Speed Wind Turbines 2.3 Induction Generators 2.4 Doubly-Fed Induction Generators and Their Characteristics 2.5 Permanent-Magnet Synchronous Generators 2.6 Power electronics converters 2.7 Generator-Converter configurations 2.8 Converter Control	1. Learn and gain knowledge of the topologies of wind power systems.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Make notes of topologies of Wind Power Generation.

b. Mini Project:

i. Draft the Wind Power Generation System.

EE301.3: Understand the power electronic interfaces for wind and solar generation.

Approximate Hours

Item	AppX Hrs
Cl	13
LI	0
SW	01
SL	01
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 To Understand the Basic Concept of Solar Power Generation. **SO3.2** To Understand the various factors affecting solar power. **SO3.3** To Understand the different technologies. **SO3.4** To Understand the various resources.	.	**Unit-3: Solar Resources.** 3.1 Introduction 3.2 solar radiation spectra 3.3 solar geometry 3.4 Earth-Sun angles 3.5 observer Sun angles 3.6 solar day length 3.7 Estimation of Solar Energy Availability 3.8 Solar thermal power generation 3.9 Technologies 3.10 Parabolic trough, central receivers 3.11 parabolic dish, Fresnel 3.12 Solar Pond 3.13 Elementary Analysis	1. To ensure all the concepts of Solar Resources.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Make notes of Solar Resources.

EE301.4: Understand the issues related to the grid integration of solar and wind energy systems.

Approximate Hours

Item	AppX Hrs
Cl	09
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Evaluation of Characteristics of Photovoltaic. **SO4.2** To Understand the PV Panel **SO4.3** To Study the converters for solar system **SO4.4** To Study MPPT Algorithms **SO4.5** To study control Strategies.	.	**Unit-4: Solar Photovoltaic** 4.1 Technologies-Amorphous 4.2 monocrystalline 4.3 Polycrystalline 4.4 V-I characteristics of a PV cell 4.5 PV module 4.6 Array 4.7 Power Electronic Converters for Solar Systems 4.8 Maximum Power Point Tracking (MPPT) Algorithms, 4.9 Converter Control	1. Make Well-Organized Notes on All Concepts of Solar Power Generation.

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Make a Tabular List of MPPT Algorithms.

Mini Project:

i. Evaluate different control strategies.

EE 301.5: Study the Network Integration Issues.

Approximate Hours

Item	AppX Hrs
Cl	07
LI	0
SW	01
SL	01
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 To Understand the grid requirements. **SO5.2** To Understand the Power Regulation. **SO5.3** To Study the disturbances in the grid. **SO5.4** To Understand the Isolated Operation.		**Unit 5: Network Integration Issues** 5.1 Overview of Grid Code Technical Requirements. 5.2 Fault ride-through for wind farms - real and reactive power regulation. 5.3 voltage and frequency operating limits 5.4 solar PV and wind farm behavior during grid disturbances 5.5 Power quality issues 5.6 Power System Interconnection Experiences in the World. 5.7 Hybrid and isolated operations of solar PV and wind systems.	1. To ensure Complete notes of the chapter.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**

Make a list of problems associated with the grid.

b. **Mini Project:**

Draw the chart of different faults associated with the grid.

Brief of Hours Suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE301.1: Understand the concepts of the physics of wind energy.	08	01	01	10
EE301.2: Understand the wind power topologies.	08	01	01	10
EE301.3: Understand the solar resources.	13	01	01	15
EE301.4: Understand the concept of solar photovoltaic.	09	01	01	11
EE301.5: Study the Network Integration Issues.	07	01	01	09
Total Hours	45	05	05	55

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Physics of wind power	03	01	01	05
CO-2	Wind power topologies	02	06	02	10
CO-3	The solar resources	02	05	05	12
CO-4	Solar Photovoltaic	03	05	05	13
CO-5	Network integration Issues	02	03	05	10
Total		11	23	16	50

Legend: R: Remember, U: Understand, A: Apply

The end-of-semester assessment for Wind and solar energy will be held with the written examination of 50 marks.

Note. Detailed Assessment rubrics need to be prepared by the course-wise teachers for the above tasks. Teachers can also design different tasks as per requirement, for end-semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to the electrical power plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, WhatsApp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) **Books** :

S. No.	Title	Author	Publisher	Edition & Year
1	Wind Power Systems	T. Ackermann	John Wiley and Sons Ltd.	2005
2	Renewable and Efficient Electric Power Systems	G. M. Masters	John Wiley and Sons	2004
3	Solar Energy: Principles of Thermal Collection and Storage	S. P. Sukhatme	McGraw Hill	1984
4	Grid integration of wind energy conversion systems	H. Siegfried and R. Waddington	John Wiley and Sons Ltd.	2006
5	Renewable Energy Applications	G. N. Tiwari and M. K. Ghosal	Narosa Publications	2004
6	Solar Engineering of Thermal Processes	J. A. Duffie and W. A. Beckman	John Wiley & Sons	1991
7	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE301
Course Title: Wind and Solar energy systems

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Understand the concepts of the physics of wind energy.	2	3	2	2	1	1	1	3	2	1	2	2	3	3
CO2: Understand the wind power topologies.	2	3	3	2	2	2	1	3	2	2	2	3	3	2
CO 3: Understand the solar resources.	2	2	2	2	1	1	2	2	1	2	2	3	2	3
CO 4: Understand the concept of solar photovoltaic.	3	3	2	2	2	1	1	3	2	1	2	2	3	3
CO 5: Study the Network Integration Issues.	3	3	3	3	1	2	2	3	2	2	2	2	3	2

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**EE301.1:** Understand the concepts of the physics of wind energy.	SO1.1 SO1.2 SO1.3 SO1.4		**Unit-1:** Physics of wind power 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**EE301.2:** Understand the wind power topologies.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		**Unit-2:** Wind power topologies 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**EE301.3:** Understand the solar resources.	SO3.1 SO3.2 SO3.3 SO3.4		**Unit-3:** The solar resources 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,3.11,3.12,3.13	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**EE301.4:** Understand the concept of solar photovoltaic.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		**Unit-4 :** Solar Photovoltaic 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**EE301.5:** Study the Network Integration Issues.	SO5.1 SO5.2 SO5.3 SO5.4		**Unit 5:** Network integration Issues 5.1,5.2,5.3,5.4,5.5,5.6,5.7	1

Semester-V

Course Code:	**EE302**
Course Title:	**Electrical Drive**
Pre-requisite:	Electrical machine-1, Electrical Machine-2 and power electronics
Rationale:	Electrical drive technology converts electrical energy from power supply system or from battery into mechanical energy and transmits the resulting force into motion. Many applications that make our daily lives easier – like lifts, escalators, gate drives, washing machines, mixers, electric razors, etc.

Course Outcomes: After successful completion of this course students will be able to

EE302.1: Understand the Characteristics of dc motor.
EE302.2: Understand the concepts speed control using chopper
EE302.3: Understand the methods using Induction motor characteristics.
EE302.4: Understand the methods using Induction motor characteristics
EE302**.5:** To Understand the speed control of Slip ring Induction Motor.

Course Category	**Course Code**	**Course Title**	**Scheme of studies (Hours/Week)**					**Total Credits (C)**
			Cl	**LI**	**SW**	**SL**	**Total Study Hours (CI+LI+SW+SL)**	
Program Elective (PEC)	EE302	Electrical Drive	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/ Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+ AT)		
PEC	EE302	Electrical Drive	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE302.1: Understand the Characteristics of dc motor.

Approximate Hours

Item	Approx Hrs
Cl	09
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Explain conventional speed control technique(s) of DC motors. **SO1.2** Explain various solid state speed controls of single and three phase DC drives. **SO1.3** Describe the speed control of chopper controlled DC drives. **SO1.4** Describe the basic concept of various control loops used in electrical drives **SO1.5** . Explain the nature of speed torque characteristic of various types of loads and drive motors with the help of neat sketch.	.	**Unit-1: DC motor characteristics** 1.1 Review of emf and torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor 1.2 change in torque-speed curve with armature voltage, example 1.3 load torque-speed characteristics, operating point 1.4 armature voltage control for varying motor speed, flux weakening for high speed operation **1.5 Chopper fed DC drive** ,Review of dc chopper and duty ratio control 1.6 chopper fed dc motor for speed control 1.7 steady state operation of a chopper fed drive 1.8 armature current waveform and ripple 1.9 calculation of losses in dc motor and chopper, smooth starting	1. DC Machine

SW-1 Suggested Sessional Work (SW):

a. **Survey: DC Motor Drive**

EE302.2: Understand the concepts speed control using chopper

Approximate Hours

Item	Approx Hrs
Cl	10
LI	0
SW	2
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Explain the multi quadrant operation of electrical drive. **SO2.2** Describe different methods of braking used in any electric drive. **SO2.3** Select a motor on the basis of duty cycles of motors.		**Unit-2 Multi-quadrant DC drive** 2.1 Review of motoring and generating modes operation of a separately excited dc machine 2.2 four quadrant operation of dc machine; single-quadrant and two-quadrant 2.3 four-quadrant choppers, steady-state operation of multi-quadrant chopper fed dc drive, 2.4 regenerative braking 2.5 Closed-loop control of DC Drive 2.6 **Control** structure of DC drive, 2.7 inner current loop and outer speed loop 2.8 modeling of chopper as gain with switching delay 2.9 current controller specification and design 2.10 speed controller specification and design	1. Basic of Chopper

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Analysis the tariff, load management

EE302.3: Understand the methods using Induction motor characteristics.

Approximate Hours

Item	Approx Hrs
Cl	10
LI	0
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Explain speed control methods of a 3 phase induction motor. **SO3.2** Explain the working of various 3 phase induction motor drives for precise variable speed control. **SO3.3** To introduce Energy management technique during speed control	.	**Unit-3 : Induction motor characteristics** 3.1 Review of induction motor equivalent circuit 3.2 torque-speed characteristic 3.3 variation of torque speed curve 3.4 applied voltage, applied frequency 3.5 applied voltage and frequency 3.6 V/F Method 3.7 typical torque-speed curves of fan 3.8 pump loads(Various Load) 3.9 operating point 3.10 flux weakening operation	1. energy consumption in KW and unit

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   1. To analysis the speed control method

EE302.4: Understand the methods using Induction motor characteristics
Approximate Hours

Item	Approx Hrs
Cl	8
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 To Understand the concept of Scalar control **SO4.2** to Analysis the factors affecting motor **SO4.3** Analysis the various parameter	.	**Unit-4: Scalar control or constant V/f control of induction motor** 4.1 Review of three-phase voltage source inverter 4.2 generation of three-phase PWM signals 4.3 sinusoidal modulation 4.4 space vector theory 4.5 conventional space vector modulation 4.6 constant V/f control of induction motor 4.7 steady-state performance analysis	1. motor Charactristics

		based on equivalent circuit 4.8 speed drop with loading slip regulation	

EE302.5: To Understand the speed control of Slip ring Induction Motor.

Approximate Hours

Item	Approx Hrs
Cl	5
LI	0
SW	2
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Explain the principle of two modes of variable frequency control in 3 phase induction motor **SO3.2** Selection of equipment **SO3.3** Torque Calculation	.	**Unit-5 Control of slip ring induction motor** 5.1 Impact of rotor resistance of the induction motor 5.2 torque-speed curve 5.3 Impact of rotor resistance of the induction motor torque-speed curve 5.4 operation of slip-ring induction motor with external rotor resistance 5.5 starting torqu	1.star rating

SW-5 Suggested Sessional Work (SW):

a. Assignments:

Discuss speed control method

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE302.1: Understand the Characteristics of dc motor.	9	2	1	12
EE302.2: Understand the concepts speed control using chopper	10	2	1	13
EE302.3: Understand the methods using Induction motor characteristics.	10	1	1	12
EE302.4: Understand the methods using **Induction motor characteristics**	8	2	1	11
EE302.5: To Understand the speed control of Slip ring Induction Motor	5	2	1	8
Total Hours	42	9	5	56

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	DC motor characteristics	02	03	05	10
CO-2	Multi-quadrant DC drive	02	04	04	10
CO-3	Induction motor characteristics	02	02	06	10
CO-4	Scalar control or constant V/f control of induction motor	03	07	05	15
CO-5	Control of slip ring induction motor	01	02	02	05
Total		10	18	22	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Electric drive will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Design Demonstration
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whats'app, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Fundamentals of Electrical Drives	Dubey, Gopal K	Narosa Publishing House, New Delhi ,2 nd Edition	2013
2	Power Electronics	Bimbhra, P.S.	Khanna Publishers, New Delhi 5 th Edition	2014
3	Power Electronics	Singh M.D., Khanchandani K.	Tata McGraw-Hill Education New Delhi	Eighth, 2023
4	Variable Speed Drives and Power Electronics	Barnes, Malcolm	Newnes, Elsevier	2003
5.	Power Electronics: Circuits, Devices and Applications	Muhammad, Rashid H	Pearson, New Delhi, 2003,3 rd Edition or latest	2003

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE302
Course Title: Electrical Drive

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adapt ability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
EE302.1: Understand the Characteristics of dc motor.	3	3	2	3	3	2	1	2	3	2	2	3	3	2
EE302.2: Understand the concepts speed control using chopper	3	3	3	3	2	2	1	2	1	2	2	2	2	2
EE302.3: Understand the methods using Induction motor characteristics.	3	3	2	2	3	1	2	2	1	2	2	3	2	2
EE302.4: Understand the methods using Induction motor characteristics	3	3	2	2	2	1	1	3	2	2	2	2	3	3
EE302.5: To Understand the speed control of Slip ring Induction Motor	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory nstruction(LI)	Classroom Instruction(CI)	lf-Learning(SL)
O:1,2,3,4,5,6,7,8,9,1 0,11,12 PSO 1,2	**E302.1:** Understand the characteristics of dc motor.	SO1.1 SO1.2 SO1.3		**Unit-1 DC motor characteristics** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8, 1.9	1
O:1,2,3,4,5,6,7,8,9,1 0,11,12 PSO 1,2	**EE302.2:** Understand the concepts speed control using chopper	SO2.1 SO2.2 SO2.3		**Unit-2 Multi-quadrant DC drive** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9,2.10	1
O:1,2,3,4,5,6,7,8,9,1 0,11,12 PSO 1,2	**E302.3:** Understand the methods using Induction motor characteristics .	SO3.1 SO3.2 SO3.3		**Unit-3 : Induction motor characteristics** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	1
O:1,2,3,4,5,6,7,8,9,1 0,11,12 PSO 1,2	**E302.4:** Understand the methods using Induction motor characteristics s	SO4.1 SO4.2 SO4.3 SO4.4		**Unit-4 : Scalar control or constant V/f control of induction motor** 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8	1
O:1,2,3,4,5,6,7,8,9,1 0,11,12 PSO 1,2	**E302.5:** To Understand the peed control of Slip ring Induction Motor	SO5.1 SO5.2 SO5.3		**Unit 5: Control of slip ring induction motor** 5.1,5.2,5.3,5.4,5.5	1

Semester-V

Course Code:	**OEC301**
Course Title :	**Electronic Devices**
Pre- requisite:	Student should have basic knowledge of physics, Semiconductor Electronics and Electronic devices such as Diodes, Transistors, FET's etc.
Rationale:	Students will demonstrate an understanding of semiconductor physics and the operation of the most common semiconductor devices (PN junctions, metal-semiconductor devices, metal oxide semiconductor devices, and bipolar junction transistors), and will be prepared for subsequent courses with this course as a prerequisite.

Course Outcomes:

OEC301.1: Understanding of the concept of semiconductor materials, pn junction, pn junction diodes and special purpose diodes.

OEC301.2: Understanding of Diode Applications as Rectifiers , filters for rectifiers, voltage regulators.

OEC301.3: Explain the principle, construction and working of Transistor , and different biasing techniques.

OEC301.4: Explain the principle, construction and working of FET's , JFET's, MOSFET's

OEC301.5: Explain the principle, construction and working of feedback .amplifiers, Oscillators and its types

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Open Elective Course (OEC)	OEC301	Electronic Devices	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ESA)
OEC	OEC301	Electronic Devices	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

OEC301.1: Understanding of the concept of semiconductor materials, PN junction, PN junction diodes and special purpose diodes.

Approximate Hours

Item	Approx Hrs
Cl	07
LI	0
SW	1
SL	1
Total	09

Session Outcomes (SOs)	Lab Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the concept of semiconductor material **SO1.2** Understand the concept of PN junction and its characteristics **SO1.3** Understand the concept of PN junction diode and its working **SO1.4** understand the different type of diode	.	**Unit-1:Diode and its types** 1.1 Pn junction diode, equivalent circuit and its V-I characteristics 1.2 Junction capacitance of diode 1.3 applications as Clipping, Clamping circuits, 1.4 Voltage doublers, 1.5 special purpose diodes- photodiode, LED, 1.6 tunnel diode, Varactor diode, 1.7 pin diode.	1. Semiconductor and its types 2. Concept of PN junction

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Explain forward biasing and reverse biasing of PN junction.
   ii. Describe the application of clipping and clamping circuit.

OEC301.2: Understanding of Diode Applications as Rectifiers ,filters for rectifiers, voltage regulators.

Approximate Hours

Item	Approx Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understanding of diodes. **SO2.2** Learn the working of rectifier **SO2.3** Understand the construction and working of filters and its types **SO2.4** Understand the working of voltage regulator. And its types		**Unit-2: Electronic power supply component** 2.1 Construction and working of rectifier 2.2 Construction and working of half wave rectifier 2.3 Construction and working of full wave rectifier 2.4 Construction and working of bridge rectifier 2.5 Construction and working of filters 2.6 Series inductor filter, Shunt capacitor	1. Concept of diode and its types 2. Concept of power supply in Electronics 3. Operation Of regulators

		filter, L-C filter and Pi filter 2.7 Construction and working of voltage regulator 2.8 Construction and working of series voltage regulator 2.9 Construction and working of shunt voltage regulator	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Theoretical Assignment related to different parts of power supply components.
ii. Explain the working principle of Rectifier, filters and voltage regulators.

Mini Project:

i. Draw a Poster of Power supply of electronic devices

OEC301.3: Explain the principle, construction and working of Transistor, and its types with configuration and different biasing techniques.

Approximate Hours

Item	Approx Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 To study of Transistor, their types **SO3.2** To understand the Design and Characteristic of transistor using its different configuration and biasing techniques **SO3.3** Analysis using h parameters and cascading.	.	**Unit-3: Transistor** 3.1 Construction and working of transistor and its types 3.2 CB CE CC configuration of transistor and its input output characteristics 3.3 Purpose of biasing, DC operating point and DC load line 3.4 Base bias, Emitter bias 3.5 Voltage divider bias, Collector feedback bias 3.6 Graphical analysis of Thermal Runaway, Thermal stability. ac load line, 3.7 Current gain voltage gain and power gain 3.8 input and output impedance 3.9 analysis using h-parameters, cascading.	1. Significance of holes and electrons 2. Forward and reverse biasing techniques

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Make a poster of different biasing techniques.
   ii. explain different biasing techniques.

OEC301.4: Explain the principle, construction and working of FET’s, JFET’s, MOSFET’s

Approximate Hours

Item	Approx Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand the building Blocks construction and operation of different types of FET's **SO4.2** Understand the building Blocks construction and operation of JFET's and its types. **SO4.3** Understand the construction and working of MOSFET's and its types **SO4.4** Understand the applications of FET JFET and MOSFET	.	**Unit-4 : FET and MOSFET** 4.1 construction and working of JFET and its types 4.2 V-I characteristics of JFET and pinch off voltage 4.3 Construction and working of MOSFET 4.4 Construction and working of Depletion MOSFET 4.5 Construction and working of enhancement MOSFET 4.6 low frequency common source and common drain amplifiers 4.7 FET biasing techniques 4.8 The common source and common drain amplifier at high frequencies 4.9 FET as a voltage variable resistor 4.10 MOSFET as a switches 1	1. Difference between BJT and FET 2. Difference between FET and MOSFET

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Theoretical Assignments Based on Different types of FET's

ii. Numerical Problems Based on JFET's

Mini Project:

i. Draw a table of difference between BJT,JFET and MOSFET.

OEC301.5: Explain the principle, construction and working of feedback .amplifiers, Oscillators and its types

Approximate Hours

Item	Approx Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Discussion about the difference between amplifier and feedback amplifier **SO5.2** Understand the concept of feedback and its types **SO5.3** Understand the Building blocks and Operations of Oscillators		**Unit 5: Feedback amplifiers and oscillators** 5.1 General feedback theory 5.2 Types of feedback current and voltage feedback 5.3 Negation and positive feedback and its effect 5.4 Feedback amplifiers 5.5 Types of feedback amplifiers	1. Structure and operation of Amplifiers 2. Characteristics of amplifier

SO5.4 Study of different types oscillators		5.6 Working and construction of oscillators 5.7 Condition for oscillation, Wein bridge oscillator, RC phase shift oscillator 5.8Hartley oscillator 5.9 colpitts oscillator, crystal oscillator, Tunnel diode oscillator	

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**

Theoretical Assignment based on Different oscillators

b. **Mini Project:**

Draw the chart of Different Types of feedback amplifier and oscillators.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
OEC301.1: Understanding of the concept of semiconductor materials, pn junction,pn junction diodes and special purpose diodes.	7	1	1	09
OEC301.2: Understanding of Diode Applications as Rectifiers ,filters for rectifiers, voltage regulators.	9	1	1	11
OEC301.3: Explain the principle, construction and working of Transistor and its different biasing techniques.	9	1	1	11
OEC301.4: Explain the principle, construction and working of FET's ,JFET's, MOSFET's	9	1	1	11
OEC301.5: Explain the principle, construction and working of feedback . amplifiers, Oscillators and its types	9	1	1	11
Total Hours	43	5	5	53

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Diode and its types	02	05	03	10
CO-2	Electronics power supply components	04	06	00	10
CO-3	Transistor	02	06	02	10
CO-4	FET's and MOSFET's	03	07	00	10
CO-5	Feedback amplifier and oscillators	03	05	02	10
Total		14	29	07	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Electronic Device will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Demonstration of Instruments.
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, WhatApp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) **Books** :

S. No.	Title	Author	Publisher	Edition & Year
1	Solid State Devices	H.S.Kalsi.	Tata McGraw Hill.	Fourth, 2019
2	Applied electronics	R.S Sedha	S. Chand	Fifth ,2018
3	Solid state electronics devices	Ben G. Streetman and Sanjay Banerjee	prentice Hall India Learning Private Limited	Sixth,2006
4	Semiconductor physics and devices	Donald A. Neamen	Tata McGraw Hill.	Fourth,2016
5	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: OEC301
Course Title: Electronic Devices

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Understanding of the concept of semiconductor materials, pn junction,pn junction diodes and special purpose diodes.	3	3	2	3	3	2	1	2	3	2	2	3	3	2
CO.2: Understanding of Diode Applications as Rectifiers ,filters for rectifiers, voltage regulators.	3	3	3	3	2	2	1	2	1	2	2	2	2	2
CO 3: Explain the principle, construction and working of Transistor and its different biasing techniques.	3	3	2	2	3	1	2	2	1	2	2	3	2	2
CO 4: Explain the principle, construction and working of FET's ,JFET's, MOSFET's	3	3	2	2	2	1	1	3	2	2	2	2	3	3
CO 5: Explain the principle, construction and working of feedback . amplifiers, Oscillators and its types	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO1:** Understanding of the concept of semiconductor materials, pn junction,pn junction diodes and special purpose diodes.	SO1.1 SO1.2 SO1.3 SO1.4		**Unit-1** Diode and its types 1.1,1.2,1.3,1.4,1.5,1.6,1.7	1,2
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO.2:** Understanding of Diode Applications as Rectifiers ,filters for rectifiers, voltage regulators.	SO2.1 SO2.2 SO2.3 SO2.4		**Unit-2** Electronics power supply components 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9	1,2,3
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO 3:** Explain the principle, construction and working of Transistor and its different biasing techniques.	SO3.1 SO3.2 SO3.3		**Unit-3 :** Transistor 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1,2
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO 4:** Explain the principle, construction and working of FET’s ,JFET’s, MOSFET’s	SO4.1 SO4.2 SO4.3 SO4.4		**Unit-4 :** FET’s and MOSFET’s 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9	1,2
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO5:** Operate and maintain solid state drives for speed control of 3 phase Synchronous motor.	SO5.1 SO5.2 SO5.3 SO4.4		**Unit 5:** Feedback amplifier and oscillators 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	1,2

Semester-V

Course Code: **OEC302**

Course Title : **DATA STRUCTURE AND ALGORITHMS**

Pre- requisite: Basics of programming

Rationale: Study of Data structures will help students to understand structuring and managing of data. Insights from data structures help students in industry placements. Good knowledge of Data structure will provide students chance to appear in product bases companies also students will able to develop problem solving skills after the study of this subject.

Course Outcomes: On successful completion of this course, the students will be able to:

OEC302.l: Understanding abstract specification of data-structures and their implementation.
OEC302.2: Understanding time and space complexity of programs and data-structures.
OEC302.3: Knowledge of basic data-structures, their applications and relative merits.
OEC302.4: Ability to convert an algorithmic solution to a program using suitable data-structures and analyze the trade-offs involved in terms of time and space complexity
OEC302.5: Acquire basic knowledge of the graphs.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Open Elective Course (OEC)	OEC302	DATA STRUCTURE AND ALGORITHMS	3	0	2	1	6	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C:Credits.

Scheme of Assessment:
Theory

Course Category	Course Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks (PRA + ESA)**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
OEC	OEC 302	DATA STRUCTURE AND ALGORITHMS	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

OEC302.l Understanding abstract specification of data-structures and their implementation.

Approximate Hours

Item	AppX Hrs
Cl	07
LI	0
SW	2
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Understand the requirement of data structure. **SO1.2** Understanding standard for data structure. **SO1.3** Understanding types of complexity. **SO1.4** Critically evaluate various types of complexity. **SO1.**5 Understand asymptotic Notation. .		**Unit-1: Introduction and basic terminology** 1. Notion of data- structures and algorithms. 2. $log n$, n, 2^n: understanding growth ofthese functions, and applications (binary search and extensions to similar problems) 3. $log n$, n, 2^n: understanding growth ofthese functions, and applications (binary search and extensions to similar problems) 4. Worst-case complexity 5. average-case time complexity 6. average-case time complexity 7. Asymptotic Notation: $O(\quad)$, □( )	1. Learning about various complexities.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

i. Critically evaluate worst case complexity,

ii. Explain Asymptotic Notation.

b. **Mini Project:**

Compare various Complexities.

OEC302.2. Understanding time and space complexity of programs and data-structures**.**

Approximate Hours

Item	AppX Hrs
Cl	8
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 To Understand the need for Abstract data types. **SO2.2** To learn about array . **SO2.3** To understand the role of link list. **SO2.4** To understand doubly link list.		**Unit-2 : Abstract Data Types (ADTs): arrays and linked list ADTs.** 1. Stacks, Queues: ADTs and implementations using arrays, linked lists. 2. Doubly linked lists: ADT and implementation 3. Dictionary ADT: implementation using array. 4. Dictionary ADT: implementation using linked lists. 5. Dictionary ADT: implementation using binary search. 6. Tree ADT and examples 7. Implementation of trees and basic traversal algorithms 8. Binary trees and in order traversal and Project metrics.	1. Try to Implement Link list.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Prepare a program of Binary tree insertion.
ii. Explain TREE traversal.

b. Mini Project:
Implement basic tree traversal.

OEC302.3 Knowledge of basic data-structures, their applications and relative merits

Approximate Hours

Item	AppX Hrs
Cl	7
LI	0
SW	2
SL	2
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Learning about priority queue design concept. **SO3.2** Understand heap. **SO3.3** Differentiate between queue and heap. **SO3.4** Understand heap sort		**Unit-3: Priority Queues and Heaps** 3.1 Priority Queue ADT 3.2 Definition of heaps 3.3 Implementation of Priority Queues using heaps 3.4 Implementation of Priority Queues using running time analysis 3.5 Implementation of heaps using arrays. 3.6 Heap-sort -1 3.7 Heap-sort-2	1. Learning various approaches of implementing heap and queues.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Explain top-down and bottom-up approach of heap.
ii. Evaluate types of queue.

b. Mini Project:
i. Create a program on priority queue.

c. Other Activities (Specify):
i. Design and develop a program on heap.

OEC302.4 Ability to convert an algorithmic solution to a program using suitable data-structures and analyse the trade-offs involved in terms of time and space complexity.

Approximate Hours

Item	AppX Hrs
Cl	8
LI	0
SW	2
SL	2
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Understanding different types of trees. **SO4.2** Learn about different types of tree insertion. **SO4.3** Creating M-way search trees.		**Unit-4 : Binary Search Trees, AVL Trees, 2-4 trees** 4.1 Binary Search Trees: definition and some basic algorithms. 4.2 Implementation of Dictionary ADTs using Binary Search trees 4.3 Implementation of Dictionary ADTs using running time analysis 4.4 AVL trees: height balance condition, rotations, and	1. Differentiate between binary tree and 2-3 trees.

		implementation of dictionary ADT -1 4.5 AVL trees: height balance condition, rotations, and implementation of dictionary ADT -2 4.6 2-4 Trees: Multi-way search trees 4.7 implementation of dictionary ADT 4.8 Informal discussion of extension to B-trees and removal	

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Write down the types of trees.

ii. Explain the working of red black trees.

b. Mini Project:

i. Write a program to implement all types of trees.

c. Other Activities (Specify):

Develop the ability to create height balance trees..

OEC302.5 Acquire basic knowledge on hashing.
Approximate Hours

Item	AppX Hrs
Cl	10
LI	0
SW	2
SL	2
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Understand the scope of sorting **SO5.2** Understand the need of Hashing **SO5.3** Learn about different sorting techniques.		**Unit 5- Hashing and sorting** 5.1.Map ADT 5.2 Hash Tables and implementation of Map using Hash Tables 5.3 Design of hash functions 5.4 Collision resolution schemes: chaining, open addressing schemes like linear probing, quadratic probing, double hashing 5.5 Applications of Hashing: finding duplicates, set intersection, etc. 5.6 Tries: implementation of Map ADT using tries. 5.7 Compressed tries and suffix tries. 5.8 Bubble sort, insertion sort, selection sort. 5.9 Merge sort and divide and conquer paradigm 5.10. Quick sort	1. Learn different sorting techniques.

SW-5 Suggested Sessional Work (SW):

a. **Assignments**
   i. Find out challenges in different sorting methods.
   ii. what is hashing? Explain different methods of hashing.

b. **Mini Project:**
   i. Implement sorting in C.

c. **Other Activities (Specify):**
   Explain hashing.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
OEC302.1 Understanding abstract specification of data-structures and their implementation	7	2	1	10
OEC302.2. Understanding time and space complexity of programs and data-structures	8	2	1	11
OEC302.3 Knowledge of basic data-structures, their applications and relative merits	7	2	2	11
OEC302.4 Ability to convert an algorithmic solution to a program using suitable data-structures and analyse the trade-offs involved in terms of time and space complexity.	8	2	2	12
OEC302.5 Acquire basic knowledge on hashing.	10	2	2	14
Total Hours	40	10	8	58

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO1	Introduction and basic terminology	02	01	01	04
CO 2	Abstract Data Types (ADTs): arrays and linked list ADTs.	02	04	02	08
CO 3	Priority Queues and Heaps	03	05	04	12
CO 4	Binary Search Trees, AVL Trees, 2-4 trees	02	08	05	15
CO 5	Hashing and sorting.	03	05	03	11
Total		12	23	15	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Data Structures and Algorithms will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit any software development company
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Data Structures and Algorithms in Java	Michael T. Goodrich and Roberto Tamassia, John Wiley & Sons;	McGraw Hill International edition	3rd Edition 2004
2	Data Structures and Algorithms in Python	Michael T. Goodrich and Robert	Khanna Publishing Co.	1st edition.

****

Curriculum Development Team

1. **Dr. Akhilesh K. Waoo, HOD, Department of Computer Science and Engineering.**
2. **Dr. Pramod Singh, Assistant Professor, Department of Computer Science and Engineering.**
3. **Ms. Shruti Gupta, Assistant Professor, Department of Computer Science and Engineering.**
4. **Ms. Pragya Shrivastava, Assistant Professor, Department of Computer Science and Engineering.**
5. **Mr. Lokendra Gaur, Assistant Professor, Department of Computer Science and Engineering.**
6. **Mr. Vinay Kumar Dwivedi, Assistant Professor, Department of Computer Science and Engineering.**
7. **Ms. Pinki Sharma, Assistant Professor, Department of Computer Science and Engineering.**
8. **Ms. Pushpa Kushwaha, Assistant Professor, Department of Computer Science and Engineering.**

Cos, POs and PSOs Mapping

Programming Title: B. Tech. Electrical Engineering
Course Code: OEC302
Course Title: Data Structure and Algorithm

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1 Understanding abstract specification of data-structures and their implementation	3	3	2	3	3	2	1	2	3	2	2	3	3	2
CO2. Understanding time and space complexity of programs and data-structures	3	3	3	3	2	2	1	2	1	2	2	2	2	2
CO3 Knowledge of basic data-structures, their applications and relative merits	3	3	2	2	3	1	2	2	1	2	2	3	2	2
CO4 Ability to convert an algorithmic solution to a program using suitable data-structures and analyse the trade-offs involved in terms of time and space complexity.	3	3	2	2	2	1	1	3	2	2	2	2	3	3
CO5 Acquire basic knowledge on hashing.	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO1** Understanding abstract specification of data-structures and their implementation	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**Unit-1** Introduction and basic terminology 1.1,1.2,1.3,1.4,1.5,1.6,1.7	1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO2.** Understanding time and space complexity of programs and data-structures	SO2.1 SO2.2 SO2.3 SO2.4		**Unit-2** Abstract Data Types (ADTs): arrays and linked list ADTs 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8	1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO3** Knowledge of basic data-structures, their applications and relative merits	SO3.1 SO3.2 SO3.3 SO3.4		**Unit-3:** Priority Queues and Heaps 3.1,3.2,3.3,3.4,3.5,3.6,3.7	1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO4** Ability to convert an algorithmic solution to a program using suitable data-structures and analyse the trade-offs involved in terms of time and space complexity.	SO4.1 SO4.2 SO4.3		**Unit-4 :** Binary Search Trees, AVL Trees, 2-4 trees 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8	1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO5** Acquire basic knowledge on hashing.	SO5.1 SO5.2 SO5.3 SO4.4 SO4.5		**Unit 5:** Hashing and sorting 5.1,5.2,5.3,5.4,5.5,5.6, 5.7,5.8,5.9,5.10	1

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-V

Course Code:	**OEC303**
Course Title :	**Analog and Digital Communication**
Pre- requisite:	Student should have basic knowledge of Analog Electronics, Digital Electronics, Fourier Series and Fourier Transform
Rationale:	This course aims to introduce the basic concepts of Modulation in the communication System, the behavior of the communication systems in the presence of noise. the different analog and digital modulation schemes for transmission of information. and Applications of different modulation techniques

Course Outcomes:

OEC303.1: To develop ability to analyse system requirements of analog and digital communication systems. To understand the generation and detection of various Amplitude modulation techniques.

OEC303.2: To understand the concept of angle Modulation, to acquire the knowledge of each block in FM and PM transmitters and receivers, To understand the concepts of baseband transmissions.

OEC303.3: Analyze and design of various Pulse modulation and demodulation techniques, Understand the effect of noise present Pulse modulation, Attain the knowledge of conversion of pulse modulation to digital output.

OEC303.4: To understand and analyze the significance of Digital modulation techniques, Attain the knowledge about ASK, FSK and PSK Transmitters and Receivers and its types.

OEC303.5: To analyze the importance of different Modulation and communication techniques in modern communication system.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Open Elective OEC	OEC303	Analog and Digital Communication	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self-Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Course Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment**	**Total Marks**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	**(ESA)**	(PRA+ ESA)
OEC	OEC 303	Analog and Digital Communication	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

OEC303.1: To develop ability to analyze system requirements of analog and digital communication systems. To understand the generation and detection of various Amplitude modulation techniques.

Approximate Hours

Item	Approx Hrs
Cl	08
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Lab Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the concept of communication system **SO1.2** Understand the need of modulation and its types **SO1.3** Understand the concept of AM.	.	**Unit-1: Basics communication system** 1.1 Explanation of Communication system and its block diagram 1.2 Modulation and Demodulation. 1.3 Need for modulation. 1.4 Amplitude modulation and Demodulation. 1.5 Mathematical expression of AM. 1.6 generation of AM waves 1.7 Concept of SSB,DSB and VSB 1.8 AM receivers	1. Types of Amplifiers 2. Types of signals

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Theoretical Assignments of voltage, Current and Power Measurement.
   ii. Numerical Problems Related to Resolution, Sensitivity and error of Measurement.

OEC303.2: To understand the concept of angle Modulation, To acquire the knowledge of each block in FM and PM transmitters and receivers, To understand the concepts of Information theory

Approximate Hours

Item	Approx Hrs
Cl	10
LI	0
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understanding of angle modulation **SO2.2** Learn the function and operation of FM **SO2.3** Understand the concept of PM. **SO2.4** Understand the techniques of generation and detection of FM and PM		**Unit-2: Angle Modulation** 2.1 frequency modulation 2.2 Mathematical representation of FM 2.3 Types of FM 2.4 FM modulators 2.5 FM demodulators 2.6 Pre-and De-emphasis, 2.7 Super heterodyne receiver 2.8 Phase modulation 2.9 Generation of PM 2.10 PM detection	1. Concept of modulation 2. Basics Fourier series

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Theoretical Assignment related to different types of FM
ii. Differentiate between PM and FM.

OEC303.3: Analyze and design of various Pulse modulation and demodulation techniques, Understand the effect of noise present Pulse modulation, Attain the knowledge of conversion of pulse modulation to digital output.

Approximate Hours

Item	Approx Hrs
Cl	11
LI	0
SW	1
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Understand the concept of various pulse modulation schemes **SO3.2** To study the process of sampling and quantization **SO3.3** To understand the significance and importance of PCM,DM and ADM.	.	**Unit-3:Pulse Modulation** 3.1 Pulse modulation and its types 3.2 Concept of PAM 3.3 Sampling and its types 3.4 Concept of PPM 3.5 Concept of PWM 3.6 Quantization and its types 3.7 Time division multiplexing 3.8 Concept of PCM 3.9 Delta modulation 3.10 Adaptive delta modulation 3.11 Comparison of PCM,DM and ADM	1. Different Types modulation techniques 2. Concept of binary numbers

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Theoretical Assignments related to different pulse modulation.
ii. Written assignments comparison between PAM, PWM,PPM and PCM

OEC303.4: To understand and analyze the significance of Digital modulation techniques, Attain the knowledge about ASK, FSK and PSK Transmitters and Receivers and its types.

Approximate Hours

Item	Approx Hrs
Cl	08
LI	0
SW	1
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Discuss the significance of digital modulation techniques **SO4.2** Understand the concept of ASK,PSK and FSK. **SO4.3** Study the characteristics of digital modulation over analog modulation	.	**Unit-4 : Digital Modulation.** 4.1 Explanation of digital modulation techniques 4.2 ASK modulation 4.3 Types of ASK 4.4 FSK modulation 4.5 Types of FSK 4.6 PSK modulation 4.7 Types of PSK 4.8 Concept of phase locked loop	1. Significance of ASK PSK and FSK . 2. Importance of digital modulation 3. Applications of digital modulation.

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Theoretical Assignments Based on Different types ASK FSK and PSK

ii. Written assignment based on the differentiation of ASK FSK and PSK

OEC303.5: To analyze the importance of different Modulation and communication techniques in modern communication system

Approximate Hours

Item	Approx Hrs
Cl	08
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand the concept of various communication system **SO5.2** Understand the Building blocks of optical fiber communication **SO5.3** Understand the Building blocks and Operations of telephone system **SO5.4** Study of different types of switching and		**Unit 5: Communication techniques** 5.1 Optical communication and its block diagram 5.2 Losses in optical fibre and multiplexing 5.3 Introduction to telephone exchange system and telecommunication traffic 5.4 Switching techniques and its types 5.5 Resource sharing and multiple access techniques 5.6 Introduction to microwave communication 5.7 Introduction to radar communication	1. Basics of optic fiber cables 2. Multiplexing techniques 3. Wired and wireless communication medium

multiple access techniques **SO5.5** Significance of communication systems		5.8 Introduction to satellite communication.	

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
   Explain different types of communication system.
b. **Mini Project:**
   Draw the different parts of satellite communication system

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
OEC303.1: To develop ability to analyze system requirements of analog and digital communication systems. To understand the generation and detection of various Amplitude modulation techniques.	8	1	1	10
OEC303.2: To understand the concept of angle Modulation, To acquire the knowledge of each block in FM and PM transmitters and receivers, To understand the concepts of baseband transmissions.	10	1	1	12
OEC303.3: Analyze and design of various Pulse modulation and demodulation techniques, Understand the effect of noise present Pulse modulation, Attain the knowledge of conversion of pulse modulation to digital output.	11	1	1	13
OEC303.4: To understand and analyze the significance of Digital modulation techniques, Attain the knowledge about ASK, FSK and PSK Transmitters and Receivers and its types	8	1	1	10
OEC303.5: To analyze the importance of different Modulation and communication techniques in modern communication system.	8	1	1	10
Total Hours	45	5	5	55

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Basics of communication system	02	05	03	10
CO-2	Angle Modulation	04	06	00	10
CO-3	Pulse Modulation	02	06	02	10
CO-4	Digital Modulation	03	07	00	10
CO-5	Communication techniques	03	05	02	10
Total		14	29	07	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Analog and Digital Communication will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Demonstration of Instruments.
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, WhatApp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	“Modern Digital and Analog Communication Systems	B. P. Lathi, Zhi Ding and Hari M. Gupta	Oxford University Press	4th Edition2017
2	Communication systems: Analog and digital communication	R P Singh S D Sapre	McGraw hill Education	3rd Edition2017
3	Digital and Analog Communication Systems	K. Sam Shanmugam	Wiley India	Edition, 2008. -
4	Principles of Communication Systems	Herbert Taub, Donald L Schilling, Goutam Saha,	McGraw-Hill	3rd Edition,2008
5	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: OEC303
Course Title: Analog and Digital Communication

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: To develop ability to analyse system requirements of analog and digital communication systems. To understand the generation and detection of various Amplitude modulation techniques.	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO 2: To understand the concept of angle Modulation, To acquire the knowledge of each block in FM and PM transmitters and	3	3	3	3	2	2	1	3	2	2	2	3	3	2

receivers, To understand the concepts of baseband transmissions.														
CO3: Analyze and design of various Pulse modulation and demodulation techniques, Understand the effect of noise present Pulse modulation, Attain the knowledge of conversion of pulse modulation to digital output	**3**	**3**	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**2**	**2**	**3**	**2**	**3**
CO 4: To understand and analyze the significance of Digital modulation techniques, Attain the knowledge about ASK, FSK and PSK Transmitters and Receivers and its types.	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**3**	**2**	**2**	**2**	**2**	**3**	**3**
CO 5: To analyze the importance of different Modulation and communication techniques in modern communication system.	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**3**

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO:1,2,3,4,5,6,7,8, 9,10,11,12 PSO 1,2	CO1: To develop ability to analyse system requirements of analog and digital communication systems .To understand the generation and detection of various Amplitude modulation techniques.	SO1.1 SO1.2 SO1.3		**Unit-1: Basics of communication system** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	1,2
PO:1,2,3,4,5,6,7,8, 9,10,11,12 PSO 1,2	CO 2: To understand the concept of angle Modulation, To acquire the knowledge of each block in FM and PMtransmitters and receivers, To understand the concepts of baseband transmissions.	SO2.1 SO2.2 SO2.3 SO2.4		**Unit-2: Angle Modulation** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9,2.10.	1,2
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO3: Analyze and design of various Pulse modulation and demodulation techniques, Understand the effect of noise present Pulse modulation, Attain the knowledge of conversion of pulse modulation to digital output	SO3.1 SO3.2 SO3.3		**Unit-3 Pulse Modulation** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,3.11	1,2
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO 4: To understand and analyze the significance of Digital modulation techniques, Attain the knowledge about ASK, FSK and PSK Transmitters and Receivers and its types.	SO4.1 SO4.2 SO4.3		**Unit-4 : Digital Modulation.** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	1,2,3
PO:1,2,3,4,5,6,7,8, 9,10,11,12 PSO 1,2	CO 5: To analyze the importance of different Modulation and communication techniques in modern communication system.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		**Unit 5: Communication techniques** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	1,2,3

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester V

Course Code:	**OEC304**
Course Title:	**Computer Networks**
Pre- requisite:	Fundamentals of Computer.
Rationale:	Problem solving skills can help people develop more skills and build a Computer Network.

Course Outcome:

OEC304.1: Understand the architecture principles that have enabled the orders of magnitude expansion of the Internet

OEC304.2: Understand networked applications and their protocols, their installation, operation, and performance tuning

OEC304.3: Understand layering as a means of tackling complexity, layering applied to the Internet

OEC304.4: Understand protocols as a structured means of reliable communications

OEC304.5: Be familiar with tools for configuring, monitoring and tuning the Internet and hosts

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits(C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Open Elective Course (OEC)	OEC304	Computer Networks	3	0	1	1	5	3

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self Learning,

C: Credits.

Note: SW & SL must be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
OEC	OEC304	Computer Networking.	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

OEC304.1. Understand the architecture principles that have enabled the orders of magnitude expansion of the Internet

Item	AppX Hrs
Cl	7
LI	0
SW	1
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the Fundamentals of Internet Operation **SO1.2** Grasp Internet Design Principles **SO1.3** Comprehend Performance Metrics and Measurement **SO1.4** Introduction to Internet Layers		**Module-1.0 Introduction**: 1.1 Importance of the Internet in modern computing. 1.2 Present a high-level overview of the processes involved when browsing a website. 1.3 Discuss the roles of browsers, web servers, 1.4 URLs, domain names, 1.5 IPaddresses, and packets in this process. 1.6 Explain the concepts of packet switching and circuit switching. 1.7 Discuss the advantages of store-and-forward networks.	1. learn Basics of Computer Fundamental

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Define and explain the following performance metrics in the context of computer networking: end-to-end throughput, delay, jitter, and drop rates.

ii. Discuss the practical implications of each metric on the user experience and network efficiency.

b. Mini Project:

i. Network Performance Analysis of Popular Websites

OEC304.2. Understand networked applications and their protocols, their installation, operation, and performance tuning.

Item	AppX Hrs
Cl	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understanding InternetNames and DNS **SO2.2** Application LayerProtocols **SO2.3** Web Applications andtheir Architecture **SO2.4** Peer-to-Peer Applications and P2PFile Distribution **SO2.5** Audio and Video Streaming Challenges		**Module- 2.0 Application Layer Protocols & Web Applications, P2P, and Streaming Challenges.** 2.1 Emphasize the importance of domain names and URLs. 2.2 Explain DNS and its role in translating domain names to IP addresses. 2.3 Discuss the	1. Enhance the understanding of Internet Protocol (IP) versions, IPv4 and IPv6, and their significance in modern networking.

		hierarchical structure of DNS. 2.4 Conduct a hands-on DNS resolution simulation. 2.5 HTTP, SMTP, and SNMP 2.6 HTTP, discussing the request-response model and methods. 2.7 SMTP in email communication. 2.8 SNMP and its role in network management. 2.9 Practical activity analyzing HTTP requests.	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Identify and explain at least three types of HTTP requests (e.g., GET, POST) and their purposes in the context of the chosen website.

ii. Explain the role of Simple Mail Transfer Protocol (SMTP) in the process of sending and receiving emails.

b. Mini Project:

i. Web Application Performance Analysis.

OEC304.3. Understand layering as a means of tackling complexity, layering applied to the Internet

Item	AppX Hrs
Cl	6
LI	0
SW	2
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Understanding of Socket Programming **SO3.2** Building a Simple Client-Server Application **SO3.3** Understanding UDP Sockets **SO3.4** Hands-On Linux Network Programming **SO3.5** Discussion on Practical Applications **SO3.**6 Q&A and Problem-Solving Session		**Module-3.0 T Socket Programming & Building a Simple Client-Server Application** 3.1 Socket programming and its role in network communication. 3.2 The fundamental concepts of sockets, including client and server roles. 3.3 The types of sockets and their applications. 3.4 multi-cycle processor 3.5 Brief demonstration of a simple socket programming scenario. 3.6 The steps involved in establishing a connection between a client and server.	**1.** Proficiency in Linux network programming, specifically focusing on socket programming

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. The fundamental differences between TCP (Transmission Control Protocol) and UDP (User Datagram Protocol) in the context of socket programming.

ii. TCP would be more appropriate than UDP and vice versa, considering factors like reliability, connection-oriented nature, and overhead.

b. Mini Project:

i Secure Chat Application using Sockets

OEC304.4. Understand protocols as a structured means of reliable communications.

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understanding of Transport Layer Protocols **SO4.2** Process-to-Process Delivery and Multiplexing **SO4.3** Port Numbers and Header Structure **SO4.4** Reliable Transmission Mechanisms **SO4.5** TCP Connection Setup and Teardown **SO4.6**. Hands-On Exercise: Implementing		**Unit-4.0 Transport Layer & Process-to-Process Delivery and Multiplexing.** 4.1 Differentiate between TCP (Transmission Control Protocol) and UDP (User Datagram Protocol). 4.2 The concept of process-to-process delivery facilitated by the transport layer. 4.3 Multiple processes on a host can communicate over a network 4.4 The concept of multiplexing and its role in	**1.**Enhance your understanding of the Transport Layer protocols, TCP and UDP, by engaging in self-directed learning activities.

a Basic TCP Application		transport layer communication 4.5 Emphasize the role of port numbers in distinguishing different applications. 4.6 The mechanisms used by TCP for reliable communication, including sequence numbers, acknowledgments (ACKs), timeout, and retransmissions. 4.7 Break down the three-way handshake process for TCP connection establishment. 4.8 Address any uncertainties and clarify concepts. 4.9Ask where students investigate and present a comparison between TCP and UDP in a specific application or use case.	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Packet analyzer tool (e.g., Wireshark) to capture network traffic during a file download, and identify instances of TCP and UDP packets.

ii. The implications of using TCP or UDP in this specific scenario and how the choice of protocol might impact the overall performance of the file transfer.

Mini Project:

I Reliable File Transfer Application

OEC304.5. How the data is stored, and input-output is performed in computers.

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand about Memory. **SO5.2** Use of flash memory. **SO5.3** learn about I/O and memory mapping. **SO5.4** learn about data transfer techniques. **SO5.5**. learn Limitation of ILP. **SO5.6** use of SMT processor. **SO5.7** Learn about multicore systems and cache coherence issues		**Unit-5.0** Storage **and I/O, Superscalar processors and multicore systems** 5.1 Introduction to magnetic disks (notion of tracks, sectors) 5.2 flash memory. 5.3 I/O mapped, and memorymapped I/O. 5.4 I/O data transfer techniques: 5.5 programmed I/O, 5.6 Interrupt- driven I/O, and DMA. 5.7 Limits of ILP 5.8 SMT processors 5.9 Introduction to multicoresystems and cache coherence issues	1.Computer Memory

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Write the difference between memory mapped I/O and Isolated I/O.

ii What is the drawback of programmed I/O method and how it can be resolved by interrupt initiated I/O.

b. Mini Project:

i. Explain asynchronous serial transmission.

Other Activities (Specify):

Explain booth multiplication algorithm with the help of example.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
OEC304.1. Understand the architecture principles that have enabled the orders of magnitude expansion of the Internet	7	1	1	9
OEC304.2. Understand networked applications and their protocols, their installation, operation, and performance tuning	9	2	2	13
OEC304.3. Understand layering as a means of tackling complexity, layering applied to the Internet	6	2	2	10
OEC304.4. Understand protocols as a structured means of reliable communications	9	1	1	11
OEC304.5. Be familiar with tools for configuring, monitoring and tuning the Internet and hosts	9	1	1	11
Total Hours	40	7	7	54

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO1	Introduction	03	04	03	10
CO2	Application Layer Protocols & Web Applications, P2P, and Streaming Challenges.	05	03	02	10
CO3	T Socket Programming & Building a Simple Client-Server Application	05	02	03	10
CO4	Transport Layer & Process-to-Process Delivery and Multiplexing.	04	04	02	10
CO5	Storage and I/O, Superscalarprocessors and multicore system	03	05	2	10
Total		20	15	15	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Computer Network will be held with writtene xamination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to IT Industry.
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition &Year
1	Introduction to the Theory of Computation	Michael Sipser	Cengage Publications	3
2	Introduction to Automata, Theory	John Hopcroft, Rajeev Motwani, Jeffrey D. Ullmann	John Wiley and Sons	3
3	Automata and Computability	Dexter C. Kozen	McGraHill Higher Education	
4	Elements of the Theory of Computation	John P. Hayes	WCB/McGraw-Hill	2
5	Computer Organization and Architecture: Designing for Performance”,	William Stallings	Pearson Education.	10th Edition

****

Curriculum Development Team

1. **Dr. Akhilesh K. Waoo, HOD, Department of Computer Science and Engineering.**
2. **Dr. Pramod Singh, Assistant Professor, Department of Computer Science and Engineering.**
3. **Ms. Shruti Gupta, Assistant Professor, Department of Computer Science and Engineering.**
4. **Ms. Pragya Shrivastava, Assistant Professor, Department of Computer Science and Engineering.**
5. **Mr. Lokendra Gaur, Assistant Professor, Department of Computer Science and Engineering.**
6. **Mr. Vinay Kumar Dwivedi, Assistant Professor, Department of Computer Science and Engineering.**
7. **Ms. Pinki Sharma, Assistant Professor, Department of Computer Science and Engineering.**
8. **Ms. Pushpa Kushwaha, Assistant Professor, Department of Computer Science and Engineering.**

COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: OEC304
Course Title: Computer Network

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Understand the architecture principles that have enabled the orders of magnitude expansion of the Internet	2	2	3	3	3	1	1	3	1	1	1	3	2	3
CO2: Understand networked applications and their protocols, their installation, operation, and performance tuning	1	3	2	3	2	2	2	2	1	1	1	3	3	2
CO3 Understand layering as a means of tackling complexity, layering applied to the Internet	2	2	2	3	3	2	1	2	1	1	1	3	2	3
CO4 Understand protocols as a structured means of reliable communications	1	2	3	2	3	2	1	3	1	2	1	3	3	3
CO5 Be familiar with tools for configuring, monitoring and tuning the Internet and hosts	1	2	2	2	3	2	1	3	1	1	1	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8, 9,10,11,12 PSO 1,2	**CO1:**Understand the architecture principles that have enabled the orders of magnitude expansion of the Internet	SO1.1 SO1.2 SO1.3 SO1.4		**Unit-1:** Introduction 1.1,1.2,1.3,1.4,1.5,1.6,1.7	1
PO:1,2,3,4,5,6,7,8, 9,10,11,12 PSO 1,2	**CO2:** Understand networked applications and their protocols, their installation, operation, and performance tuning	SO2.1,SO2.2 SO2.3 SO2.4 SO2.5		**Unit-2:** Application Layer Protocols & Web Applications, P2P, and Streaming Challenges. 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9.	1
PO:1,2,3,4,5,6,7,8, 9,10,11,12 PSO 1,2	**CO3** Understand layering as a means of tackling complexity, layering applied to the Internet	SO3.1,SO3.2 SO3.3 SO3.4 SO3.5 SO3.6		**Unit-3** T Socket Programming & Building a Simple Client-Server Application 3.1,3.2,3.3,3.4,3.5,3.6	1
PO:1,2,3,4,5,6,7,8, 9,10,11,12 PSO 1,2	**CO4** Understand protocols as a structured means of reliable communications	SO4.1, SO4.2 SO4.3 SO4.4 SO4.5 SO4.6		**Unit-4 :** Transport Layer & Process-to-Process Delivery and Multiplexing. 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9	1
PO:1,2,3,4,5,6,7,8, 9,10,11,12 PSO 1,2	**CO5** Be familiar with tools for configuring, monitoring and tuning the Internet and hosts	SO5.1,SO5.2 SO5.3,SO5.4 SO5.5 SO5.6 SO5.7		**Unit 5:** Storage and I/O, Superscalar processors and multicore system 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	1

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-V

Course Code:	**OEC305**
Course Title :	**Embedded System**
Pre- requisite:	Student should have basic knowledge of fundamental of electrical components, digital Electronics, C programming on PC, Computer Organization and Microcontrollers.
Rationale:	In the rapidly growing digital world ,role of a embedded systems is increasingly vital in various domains such as industrial and home automation, entertainment systems, medical equipments and many more. The core of all such systems is powered by electronic hardware and associated software.it is therefore evident to impart the knowledge of the related technology and hands on skills to develop and maintain electronics hardware based embedded systems.

Course Outcomes:

OEC305.1: Identify hardware and software components of an embedded system

OEC305.2: Learn the basics of OS and RTOS

OEC305.3: Illustrate different Inter Process Communication (IPC) mechanisms used by tasks/process/tasks to communicate in multitasking environment

OEC305.4: Design simple embedded system-based applications

OEC305.5: To introduce the typical components of an embedded system & different communication interfaces

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Open elective core (OEC)	OEC305	Embedded System	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
OEC	OEC 305	Embedded System	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

OEC305.1: Identify hardware and software components of an embedded system

Approximate Hours

Item	Approx Hrs
Cl	07
LI	0
SW	1
SL	1
Total	09

Session Outcomes (SOs)	Lab Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the concept of embedded system **SO1.2** Understand the concept of purpose of embedded system **SO1.3** Design simple embedded system-based applications **SO1.4** To Understand the architecture design of hardware and software.	.	**Unit-1: Introduction To Embedded Systems** 1.1 History of embedded systems, 1.2 Classification of embedded systems based on generation and Complexity 1.3 Purpose of embedded systems 1.4 The embedded system design process-requirements, Specification 1.5 Architecture design, designing hardware and software, components, system integration, 1.6 Applications of embedded systems, 1.7characteristics of embedded systems.	1. C programming 2. Basics of embedded system.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Theoretical Assignments of embedded system design process requirements.
   ii. Poster of Architecture designing of hardware and software.

OEC305.2: Learn the basics of OS and RTOS

Approximate Hours

Item	Approx Hrs
Cl	11
LI	0
SW	1
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understanding of Different core of the embedded system **SO2.2** Learn the Procedure of general purpose and specific domain processors **SO2.3** Understand the structure and operation of memory shadowing **SO2.4** Understand the structure and operation of sensors and actuators.		**Unit-2: Typical Embedded System** 2.1 Core of the embedded system- 2.2 general purpose and domain specific processors, 2.3 ASICs, PLDs, COTs 2.4 Memory-ROM, RAM, memory according to the type of interface 2.5 Memory shadowing, memory selection for embedded systems, 2.6 Sensors, actuators, 2.7 I/O components: seven segment LED, relay, 2.8 piezo buzzer, push button switch, other sub-systems: reset circuit, 2.9 brownout protection circuit, 2.10 oscillator circuit real time clock, 2.11 watch dog timer.	1. Concept of C programming on PC 2. Basics of RAM and ROM 3. Operation Of oscillator circuit

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Theoretical Assignment related to different parts and different types RAM and ROM

b. Mini Project:

i. Draw a Poster of I/O components seven segment LED display
ii. Make demonstrative model of oscillator circuit real time clock or watch dog timer.

OEC305.3: Design simple embedded system-based applications

Approximate Hours

Item	Approx Hrs
Cl	08
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 To discuss role of embedded system in communication interface **SO3.2** To study the different type of communication interfaces **SO3.3** To understand the Design and Characteristic of external communication interfaces.	.	**Unit-3: Communication Interface** 3.1 Introduction to Onboard communication interfaces 3.2 Explanation of I2C, SPI, CAN 3.3 Introduction to parallel interface; 3.4 Introduction to External communication interfaces 3.5 RS232 and RS485, 3.6 USB, infrared, 3.7 Bluetooth, Wi-Fi, 3.8 ZigBee, GPRS, GSM.	1. Basics of communication system 2. Structure and working of USB Bluetooth 3. Interfacing devices.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Theoretical Assignments related to different transducers, their structure and operation.

Mini Project:

i. Draw a Poster of different types of Communication interfaces.
ii. Make demonstrative model of USB and Bluetooth .

OEC305.4: Design simple embedded system-based applications

Approximate Hours

Item	Approx Hrs
Cl	07
LI	0
SW	1
SL	1
Total	09

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Discuss the role of embedded firmware design **SO4.2** Understand the building Blocks and operation of different design approaches and its types **SO4.3** Understand the building Blocks and operation of different types of development languages Along with their Applications	.	**Unit-4: Embedded Firmware Design And Development** 4.1 Introduction of Embedded firmware design 4.2 Design approaches and types of approaches – 4.3 super Loop based approach, 4.4 operating system based approach; 4.5 introduction to embedded firmware development languages- 4.6 assembly Language based development, 4.7 high level Language based development. 1	1. Embedded system 2. Operating systems 3. Computer languages

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Theoretical Assignments based on Design approaches

Mini Project:

i. Draw a chart of embedded firmware development languages.

OEC305.5: To introduce the typical components of an embedded system & different communication interfaces

Approximate Hours

Item	Approx Hrs
Cl	11
LI	0
SW	2
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Discuss about the basics of RTOS, **SO5.2** Understand the operating system and iyts types **SO5.3** Understand the Building blocks and Operations of multiprocessing and multitasking. **SO5.4** Study of different types of task		**Unit 5: RTOS Based Embedded System Design** 5.1 Operating system 5.2 basics, types of operating systems, 5.3 tasks, process and threads, 5.4 multiprocessing and multitasking, 5.5 task scheduling: non-pre-emptive and pre-emptive scheduling; 5.6 task communication shared memory, 5.7 message passing, 5.8 Remote Procedure Call and	1. Basics of operating system and its types. 2. Basics of Embedded system design

synchronization techniques		Sockets, 5.9 Task Synchronization: 5.10 Task Communication/ Synchronization Issues, 5.11 Task Synchronization Techniques	

SW-5 Suggested Sessional Work (SW):

a. Assignments:

Theoretical Assignment based on operating system and types of operating syatem

b. Mini Project:

Draw the chart of Different Types of multitasking and multiprocessing

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
OEC305.1: Identify hardware and software components of an embedded system	7	1	1	09
OEC305.2: Learn the basics of OS and RTOS	11	1	1	13
OEC305.3: Illustrate different Inter Process Communication (IPC) mechanisms used by tasks/process/tasks to communicate in multitasking environment	8	1	1	10
OEC305.4: Design simple embedded system-based applications	7	1	1	09
OEC305.5: To introduce the typical components of an embedded system & different communication interfaces	11	2	1	14
Total Hours	44	6	5	55

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction To Embedded Systems	02	05	03	10
CO-2	Typical Embedded System	04	06	00	10
CO-3	Communication Interface	02	06	02	10
CO-4	Embedded Firmware Design And Development	03	07	00	10
CO-5	RTOS Based Embedded System Design	03	05	02	10
Total		14	29	07	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Embedded System will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Demonstration of Instruments.
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, WhatApp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) **Books** :

S. No.	Title	Author	Publisher	Edition & Year
1	Embedded System	H.S.Kalsi.	Tata McGraw Hill.	Fourth, 2019
2	Electrical Measurement and Measuring	E.W. Golding,	Sir Isaac Pitman and Sons, Ltd. London	1940
3	Electrical and Electronic measurements and Instrumentation,	A.K. Sawhney,	Dhanpat Rai and Co..	2012
4	Electronic Measurements and Instrumentation	K. Lala Kishore	Pearson Education	Kindle Edition, 2009
5	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Akhilesh K. Waoo, HOD, Department of Computer Science and Engineering.**
2. **Dr. Pramod Singh, Assistant Professor, Department of Computer Science and Engineering.**
3. **Ms. Shruti Gupta, Assistant Professor, Department of Computer Science and Engineering.**
4. **Ms. Pragya Shrivastava, Assistant Professor, Department of Computer Science and Engineering.**
5. **Mr. Lokendra Gaur, Assistant Professor, Department of Computer Science and Engineering.**
6. **Mr. Vinay Kumar Dwivedi, Assistant Professor, Department of Computer Science and Engineering.**
7. **Ms. Pinki Sharma, Assistant Professor, Department of Computer Science and Engineering.**
8. **Ms. Pushpa Kushwaha, Assistant Professor, Department of Computer Science and Engineering.**

COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: OEC305
Course Title: Embedded System

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Identify hardware and software components of an embedded system	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO 2: Learn the basics of OS and RTOS	3	3	3	3	2	2	1	3	2	2	2	3	3	2
CO3: Illustrate different Inter Process Communication (IPC) mechanisms used by tasks/process/tasks to communicate in multitasking environment	3	3	2	2	1	1	2	2	1	2	2	3	2	3
CO 4: Design simple embedded system-based applications	3	3	2	2	2	1	1	3	2	2	2	2	3	3
CO 5: To introduce the typical components of an embedded system & different communication interfaces	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	CO1: Identify hardware and software components of an embedded system	SO1.1 SO1.2 SO1.3 SO1.4		**Unit-1: : Introduction To Embedded Systems** 1.1,1.2,1.3,1.4,1.5,1.6,1.7.	1,2
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	CO 2: Learn the basics of OS and RTOS	SO2.1 SO2.2 SO2.3 SO2.4		**Unit-2: Typical Embedded Systems** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9,2.10,2.11	1,2,3
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	CO3: Illustrate different Inter Process Communication (IPC) mechanisms used by tasks/process/tasks to communicate in multitasking environment	SO3.1 SO3.2 SO3.3		**Unit-3: Communication Interface** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8.	1,2,3
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	CO 4: Design simple embedded system-based applications	SO4.1 SO4.2 SO4.3		**Unit-4 : Embedded Firmware Design And Development** 4.1,4.2,4.3,4.4,4.5,4.6,4.7.	1,2,3
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	CO 5: To introduce the typical components of an embedded system & different communication interfaces	SO5.1 SO5.2 SO5.3 SO5.4		**Unit 5: RTOS Based Embedded System Design** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11	1,2

Semester – V

Course Code: **HSMC03**

Course Title : **Industrial Psychology**

Pre- requisite: Student should have basic knowledge General Psychology, Research Methods and Statistics, Human Resource Management (HRM) etc.

Rationale: Workplaces worldwide are rapidly evolving to meet the increasing expectations of their employees and cultural changes that prioritize well-being and retention as much as productivity. Industrial-organizational psychology is a field that equips companies with the tools to adapt to this ever-changing environment. The aim of this course is to develop an awareness of the major perspectives underlying industrial psychology and to understand the potential that it holds for society and organizations in the present and future.

Course Outcomes: After the completion of this subject, students will be able to

HSMC03.1: Understand key concepts, theoretical perspectives, and trends in industrial psychology.
HSMC03.2: Create a better work environment for better performance.
HSMC03.3: Understand customer behavior.
HSMC03.4: Apply different work methods to improve industrial efficiency.
HSMC03.5: Understand Criteria's in evaluation of job-related factor

Scheme of Studies:

Course Category	CourseCode	Course Title	Scheme of studies (Hours per Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours(CI+LI+SW+SL)	
HSMC	HSMC03	Industrial Psychology	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others).
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)						
			Progressive Assessment (PRA)					End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 Assignments 3 marks Each (CA)	2 Class Test (best 2 out of 3) 10 marks Each (CT)	One Seminar (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+AT)		
HSMC	HSMC03	Industrial Psychology	15	20	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

HSMC03.1: Understand key concepts, theoretical perspectives, and trends in industrial psychology.

Approximate Hours

Item	AppX Hrs
CI	07
LI	0
SW	1
SL	1
Total	09

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 role of the psychologist in industry **SO1.2** Study behavior in work situation **SO1.3** applications of Psychological principles to problems of Placement, counselling and training	.	**Unit-1 : Introduction**: **1.1** The role of the psychologist in industry, **1.2** the field of occupational Psychology **1.3** Study of behavior in work situation **1.4** applications of Psychological principles to problems of selection **1.5** applications of Psychological principles to problems of Placement, **1.6** applications of Psychological principles to problems of Counselling **1.7** applications of Psychological principles to problems of training	1. General Psychology

SW-1 Suggested Sessional Work (SW):

a) Assignments:

i. Definitions, Historical Development, and Characteristics of OR.

b) Mini Project:

i. make a chart on role of the psychologist in industry

HSMC03.2: Create a better work environment for better performance.

Approximate Hours

Item	Appx Hrs
CI	8
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Student will understand physical environment techniques. **SO2.2** Students will understand Group dynamics in Industry		**Unit- 2: Design of Work Environments**: **2.1** Human engineering and physical environment techniques of job analysis. **2.2** Social environment: Group dynamics in Industry **2.3** Personal psychology, Selection, training **2.4** placement, promotion, counselling **2.5** job motivations, **2.6** Job satisfaction. **2.7** Special study of problem of fatigue **2.8** boredom and accidents	1. Human Engineering

SW-2 Suggested Sessional Work (SW):

a. Assignments:
1. Analyze role of physical environment in industrial efficiency.
2. Effect of social environment

HSMC03.3: Understand customer behavior.

Approximate Hours

Item	Appx Hrs
CI	5
LI	0
SW	1
SL	1
Total	7

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Student will understand Customer behavior **SO3.2** Student will understand the role of engineering psychology		**Unit- 3: Understanding Consumer Behavior:** **3.1** Consumer behavior **3.2** study of consumer preference **3.3** effects of advertising **3.4** Industrial morale: The nature and scope of engineering psychology **3.5** application of engineering psychology to industry	1. customer Behavior

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Study of Customer Behavior.
ii. Significance of engineering psychology in industry.

HSMC03.4: Apply different work methods to improve industrial efficiency.

Approximate Hours

Item	Appx Hrs
CI	13
LI	0
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Student will be able to understand the efficiency at work. **SO4.2** Student will be able to understand work curve and its characteristic. **SO4.3** analyze personal factors the affects efficiency **SO4.4** Student will understand the effect of working environment.	.	**Unit- 4: Work Methods:** **4.1** Efficiency at work, **4.2** the concept of efficiency, **4.3** the work curve and its characteristics **4.4** The work methods; hours of work. **4.5** Nature of work, fatigue and boredom. **4.6** Rest pauses. **4.7** The personal factors; age	**1.** Work efficiency and its parameters

.		abilities **4.8** interest, job satisfaction, **4.9** the working environment, noise, illumination. **4.10** Atmospheric conditions. **4.11** Increasing efficiency at work; improving the work methods. **4.12** Time and motion study, its contribution and failure resistance to time and motion studies. **4.13** Need for allowances in time and motion study.	

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Factors that affect work efficiency
   ii. Effect of environmental factors

HSMC03.5: Understand Criteria's in evaluation of job-related factor

Approximate Hours

Item	Appx Hrs
CI	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Student will be understand evaluation of job-related factor **SO5.2** Student will be able understand different processes involve in work and equipment design **SO5.3** Student will understand different factors involve in industrial accidents.		**Unit 5: Work and Equipment Design**: **5.1** Criteria in evaluation of job-related factor, **5.2** job design, human factors, Engineering information, **5.3** input processes, mediation processes, action processes, **5.4** methods design, work space and its arrangement, **5.5** Human factors in job design. Accident and Safety **5.6** The human and economic costs of accidents **5.7** Accident record and statistics **5.8** the causes of accidents **5.9** Situational and individual factors related to accident reduction.	1. industrial accidents and their cause

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Study of Criteria in evaluation of job-related factor.
ii. Situational and individual factors related to accident reduction

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CI)	Sessional Work (SW)	Self Learning (SI)	Total hour (CI+SW+SI)
HSMC03.1: Understand key concepts, theoretical perspectives, and trends in industrial psychology.	7	1	1	9
HSMC03.2: Create a better work environment for better performance	8	1	1	10
HSMC03.3: Understand customer behavior.	5	1	1	07
HSMC03.4: Apply different work methods to improve industrial efficiency.	13	1	1	15
HSMC03.5: Understand Criteria's in evaluation of job-related factor	9	1	1	11
Total Hours	42	5	5	52

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction	2	4	4	10
CO-2	Design of Work Environments	-	5	5	10
CO-3	Understanding Consumer Behavior	3	3	4	10
CO-4	Work Methods	-	5	5	10
CO-5	Work and Equipment Design.	3	4	3	10
Total		8	21	21	50

Legend: R: Remember, U: Understand, A:Apply

The end of semester assessment for Industrial Psychology will be held with written examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Industrial Psychology	Tiffin and McCormick	Prentice Hall	6th Edn., 1975
2	Human Factors Engineering and Design	McCormick	McGraw Hill	4th Edn.,1976
3	Principles of Human relations	N.R.F Mair,	wiley	1952
4	Personnel and Industrial Psychology	Ghiselli & Brown	McGraw Hill	1955

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos,POs and PSOs Mapping

Programme Title: B.tech. Electrical Engineering

Course Code: HSMC03

Course Title: Industrial Psychology

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Teamwork	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: Understand key concepts, theoretical perspectives, and trends in industrial psychology.	1	2	1	1	2	2	2	3	3	3	2	2	2	2
CO2: Create a better work environment for better performance	1	2	1	1	2	3	3	2	2	2	2	2	2	2
CO3: Understand customer behavior.	1	2	1	1	2	3	2	3	2	2	2	3	2	3
CO4: Apply different work methods to improve industrial efficiency.	1	2	1	1	2	2	3	3	2	2	2	2	2	2
CO5: Understand Criteria's in evaluation of job-related factor	1	2	1	1	2	3	2	3	2	2	2	2	2	2

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6, 7,8,9,10,11,12 PSO 1,2	**CO1:** Understand key concepts, theoretical perspectives, and trends in industrial psychology.	SO1.1 SO1.2 SO1.3		Unit-1: Introduction 1.1, 1.2, 1.3, 1.4, 1.5,1.6,1.7	1
PO 1,2,3,4,5,6, 7,8,9,10,11,12 PSO 1,2	**CO2:** Create a better work environment for better performance	SO2.1 SO2.2		Unit-2 Design of Work Environments 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8	1
PO 1,2,3,4,5,6, 7,8,9,10,11,12 PSO 1,2	**CO3:** Understand customer behavior.	SO3.1 SO3.2		Unit-3 : Understanding Consumer Behavior 3.1, 3.2, 3.3, 3.4, 3.5	1
PO 1,2,3,4,5,6, 7,8,9,10,11,12 PSO 1,2	**CO4:** Apply different work methods to improve industrial efficiency.	SO4.1 SO4.2 SO4.3 SO4.4		Unit-4 : Work Methods 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13	1
PO 1,2,3,4,5,6, 7,8,9,10,11,12 PSO 1,2	**CO5:** Understand Criteria's in evaluation of job-related factor	SO5.1 SO5.2 SO5.3		Unit 5: Work and Equipment Design 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9	1

Semester – V

Course Code: **HSMC04**

Course Title : **Operations Research**

Pre- requisite: Student should have basic knowledge of mathematics and business operations.

Rationale: Executives are required to take prompt and accurate decisions, if decision is taken merely on the basis of experience and intuition that may not be fruitful and accurate, but decision taken on the basis of data is more accurate. Operation Research provides quantitative basis or data to take accurate decisions. The tools and models of operations research provide us optimal solutions of the business operations problems; hence the study of operations research is very important to management students.

Course Outcomes:

HSMC04.1: The student will demonstrate the process of problem solving in Operations Research.
HSMC04.2: The student will apply the linear programming problem method to solve the various business management problems quantitatively.
HSMC04.3: The student will use the transportation and assignment techniques to solve the transportation and assignment problems quantitatively.
HSMC04.4: The student will apply network analysis techniques like PERT and CPM to solve the scheduling of activities and resource allocation related problems.
HSMC04.5: The student will calculate the optimum value of game and optimum replacement period using game theory and replacement theory respectively.

Scheme of Studies:

Course Category	CourseCode	Course Title	Scheme of studies (Hours per Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours(CI+LI+SW+SL)	
HSMC	HSMC04	Operations Research	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others).
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)						
			Progressive Assessment (PRA)					End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 Assignments 3 marks Each (CA)	2 Class Test (best 2 out of 3) 10 marks Each (CT)	One Seminar (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ AT)		
HSMC	HSMC04	Operations Research	15	20	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

HSMC04.1: The student will demonstrate the process of problem solving in Operations Research.

Approximate Hours

Item	AppX Hrs
CI	09
LI	0
SW	2
SL	2
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Student will explain about the development of Operations Research **SO1.2** Student will explain about the characteristics and scope of Operations Research **SO1.3** Student will demonstrate the process of operations research to problem solving. **SO1.4** Student will classify different models of operations research.	.	**Unit-1 : Introduction to Operations Research (OR)** 1.1 Meaning and Definitions of Operations Research. 1.2 Historical Development of Operations Research. 1.3 Development of Operations Research in India. 1.4 Characteristics of Operations Research 1.5 Scope of Operations Research. 1.6 Scope of Operations Research in management. 1.7 Operations Research Methodology. 1.8 Operations Research Models. 1.9 Advantages and Limitations of Operations Research.	1. Quantitative approach to decision making. 2. Quantitative Analysis and Computer-Based Information System

SW-1 Suggested Sessional Work (SW):

a) Assignments:

i. Definitions, Historical Development, and Characteristics of OR.

ii. Process and Models of OR.

b) Mini Project:

i. Prepare a flowchart of process of OR to problem solving in a chart paper.

c) Other Activities (Specify):

HSMC04.2: The student will apply the linear programming problem method to solve the various business management problems quantitatively.

Approximate Hours

Item	Appx Hrs
CI	9
LI	0
SW	2
SL	2
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Student will explain about the Concept, Assumptions and Requirements of LPP. **SO2.2** Students will formulate the LPP **SO2.3** Student will solve the LPP by Graphical Method **SO2.4** Student will Solve the LPP by Simplex Method. **SO2.5** Student will solve the LPP by		**Unit- 2: Linear Programming** **2.1** Meaning and Requirements of Linear Programming. Assumptions of Linear Programming. **2.2** Formulation of two variable Maximization type Linear Programming Problem, Formulation of two variable Minimization type Linear Programming Problem **2.3** Formulation of more than two variables Maximization type Linear Programming Problem, Formulation of more than two variables Minimization type Linear Programming Problem, Formulation of Miscellaneous LPPS **2.4** Solution of Maximization Type LPP by Graphical Method, Solution of Minimization Type LPP by Graphical	1. Practice:- Solution of LPP by Graphical Method 2. Practice:- Solution of LPP by Simplex Method..

Big-M and Two phase methods		Method **2.5** Solution of LPP by Graphical Method: Special Cases- Multiple Optimal Solutions, Solution of LPP by Graphical Method: Special Cases- Infeasibility, Unboundness. **2.6** Introduction to Simplex method of LPP, Solution of LPP by Simplex Method: Maximization Type Two Variable Problem **2.7** Solution of LPP by Simplex Method: Maximization Type more than two Variables Problem, Solution of LPP by Simplex Big-M Method: Minimization type two Variable Problem **2.8** Solution of LPP by Simplex Big-M Method: Minimization type More than two variables Problem, Solution of LPP by Simplex Method: Mixed Constraints Problem **2.9** Solution of LPP by Simplex Two-Phase Method, Solution of LPP by Simplex Method: Special Cases	

SW-2 Suggested Sessional Work (SW):

a. Assignments:
1. Formulate the LPP (Problem will be given by the subject teacher)
2. Solve the LPP by Graphical and Simplex Methods (Problem will be given by the subject teacher)

b. Mini Project:

HSMC04.3: The student will use the transportation and assignment techniques to solve the transportation and assignment problems quantitatively.

Approximate Hours

Item	Appx Hrs
CI	9
LI	0
SW	2
SL	2
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Student will formulate the transportation problem **SO3.2** Student will solve the transportation problem **SO3.3** Student will formulate the assignment problem	.	**Unit- 3: Transportation and Assignment Problem** **3.1** Concept of Transportation Problem , Mathematical Formulation of a Transportation Problem **3.2** Initial Basic Feasible Solution by NWC Rule and LCM Method, Initial Basic Feasible Solution by Vogel's Approximation Method	i) Practice-Solution of transportation Problems ii) Practice-Solution of

SO3.4 Student will solve the assignment problem.		(VAM) **3.3** Optimality Test: Minimization type problem stepping stone method, Optimality Test: Minimization type problem by Modified Distribution Method (MODI) **3.4** Optimality Test: maximization type problem stepping stone method, Optimality Test: Maximization type problem by Modified Distribution Method (MODI) **3.5** Transportation Problem: Special Cases (Unbalanced, Multiple Optimal Solution and Prohibited Route Problem), Transportation Problem: Special Cases - Degeneracy Case **3.6** Assignment Problem: Introduction and as a particular case of transportation model, and solution by Complete Enumeration Method, Assignment Problem: Problem Formulation **3.7** Assignment Problem: Solution by Hungarian Assignment Method (HAM), Assignment Problem: Solution by Hungarian Assignment Method (HAM)-Miscellaneous Problems **3.8** Assignment Problem: Solution by Hungarian Assignment Method (HAM)- Special Cases **3.9** Assignment Problem: Solution by Hungarian Assignment Method (HAM)- Maximization type problem	Assignment Problems.

SW-3 Suggested Sessional Work (SW):

a. Assignments:
i. Formulation and solution of the transportation problem
ii. Formulation and solution of the assignment problem

b. **Mini Project:** Make flowchart of the solution of a Transportation and Assignment Problems in a chart paper.

HSMC04.4: The student will apply network analysis techniques like PERT and CPM to solve the scheduling of activities and resource allocation related problems.

Approximate Hours

Item	Appx Hrs
CI	9
LI	0
SW	2
SL	2
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Student will be able to describe the network construction rules. **SO4.2** Student will be able to use the CPM in project management. **SO4.3** Student will be able to use the PERT in project management. **SO4.4** Student will find out the shortest route and longest routes by dynamic programming. **SO4.5** Student will explain about the simulation and process of simulation.		**Unit- 4: PERT and CPM, Dynamic Programming, and Simulation.** **4.1** Introduction to Network Analysis Rules of Network Construction **4.2** Redundancy in precedence relationship: Location and removal Network Construction **4.3** Calculation of Earliest Start and Finish Times and Latest Start and FinishTimes Determining the critical path and calculation of project completion time **4.4** Calculation of Float Times Time-Cost Trade-off: Crashing Resource Leveling **4.5** Resource Allocation PERT: Introduction **4.6** PERT: Network construction and critical path determination, Calculation of Expected time and Variances Difference Between PERT and CPM **4.7** Dynamic Programming: Introduction and Dynamic Programming Vs Linear Programming,	• .Practice:- Network construction and determination of critical path • Practice:- Calculation of Earliest start and Finish Times as wellas Latest Starting and Finish time • Practice-: PERT- Calculation of Expected time andVariances.

		and Terminologies of Dynamic Programming **4.8** Dynamic Programming: Shortest and Longest Route Problems Simulation: Introduction to Simulation and Process of Simulation **4.9** Monte Carlo Technique and its application	

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
i) Network Construction, Critical Path Determination, Calculation of Earliest and Latest starting and finish times, Calculation of float times. Resource analysis and allocation.
ii) PERT- Calculation of Expected time and Variances

b. **Mini Project:** Constrctuction of a network and determination of critical path and project completion time for a real project (Project will be detailed by a subject teacher)

HSMC04.5: The student will calculate the optimum value of game and optimum replacement period using game theory and replacement theory respectively.

Approximate Hours

Item	Appx Hrs
CI	9
LI	0
SW	2
SL	2
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Student will be able to apply the game theory in the competitive business world as a strategic tool. **SO5.2** Student will be able to determine the optimal replacement time which will help in the formulation of replacement policy **SO5.3** Student will describe the general structure of a queuing system.		**Unit 5: Game Theory, Replacement Theory and Queuing Theory.** **5.1** Meaning of a Two Person Game, N Person Game, Pure Strategy Game, Mixed Strategy Game, Zero Sum Game, Non-Zero Sum Game, Fair Game. **5.2** Solution of a game when saddle point exists, Solution of a 2x2 game when saddle point does not exists. **5.3** Solution of a m x n game with dominance rule, Solution of a m x n game with joint (proportional) dominance rule **5.4** Solution of a 2 x n or m x 2 game with graphical method, Solution of a m x n or m x n game with simplex method **5.5** Introduction and Scope of Replacement Theory in Management, Replacement policy for equipment which deteriorates gradually **5.6** Replacement policy for equipment which deteriorates gradually- When time value of money is considered **5.7** Replacement of items that fail suddenly. **5.8** Queuing Theory:	i. Practice:- Formulation and solution of a game. ii. Practice:- Solutionof a replacement problem.

		Introduction, and General Structure of a queuing System **5.9** Characteristics of a Queuing System.	

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Formulation and Solution of a game theory problem.

ii. Solution of replacement theory problems

b. Mini Project: i) Make a flowchart of a solution to a game theory problem.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CI)	Sessional Work (SW)	Self Learning (SI)	Total hour (CI+SW+SI)
HSMC04.1: The student will demonstrate the process of problem solving in Operations Research.	9	2	2	13
HSMC04.2: The student will apply the linear programming problem method to solve the various business management problems quantitatively.	9	2	2	13

HSMC04.3: The student will use the transportation and assignment techniques to solve the transportation and assignment problems quantitatively.	9	2	2	13
HSMC04.4: The student will apply network analysis techniques like PERT and CPM to solve the scheduling of activities and resource allocation related problems.	9	2	2	13
HSMC04.5: The student will calculate the optimum value of game and optimum replacement period using game theory and replacement theory respectively.	9	2	2	13
Total Hours	45	10	10	65

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	INTRODUCTION TO OPERATIONS RESEARCH (OR)	2	4	4	10
CO-2	LINEAR PROGRAMMING	-	5	5	10
CO-3	TRANSPORTATION AND ASSIGNMENT PROBLEM	3	3	4	10
CO-4	PERT AND CPM, DYNAMIC PROGRAMMING, AND SIMULATION.	-	5	5	10
CO-5	GAME THEORY, REPLACEMENT THEORY AND QUEUING THEORY.	3	4	3	10
Total		8	21	21	50

Legend: **R: Remember,** **U:Understand,** **A:Apply**

The end of semester assessment for Operations Research will be held with writtenexamination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition &Year
1	Quantitative Techniques in Management	Vohra, N D	TMH, New Delhi	Latest
2	Problems and Solutions in Operations Research	V. K. Kapoor	Sultan Chand and Sons, New Delhi	Latest
3	Principles of Operations Research with Application to Managerial Decisions	H.M. Wagner	PHI Learning	Latest
4	Operations Research	Kanti Swarup, P K Gupta and Man Mohan	Sultan Chand & Sons, New Delhi	Latest
5	Operations Research	Heera & Gupta	S. Chand	Latest

****

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos,POs and PSOs Mapping

Programme Title: B.tech. Electrical Engineering
Course Code: HSMC04
Course Title: Operations Research

	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
Course Outcomes	**Engineering knowledge**	**Problem Solving**	**Design Skills**	**Laboratory Skills**	**Teamwork**	**Communication Skills**	**Ethical and Professional Behavior**	**Lifelong Learning**	**Global and Societal Impact**	**Project Management**	**Adaptability**	**Professional Development**	**Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.**	**Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.**
Co1: The student will demonstrate the process of problem solving in Operations Research.	1	2	1	1	2	2	2	2	3	3	2	2	1	1
Co2: The student will apply the linear programming problem method to solve the various business management problems quantitatively.	1	2	1	1	2	2	3	2	2	2	2	2	1	2
Co3: The student will use the transportation and assignment techniques to solve the transportation and assignment problems quantitatively.	1	2	1	1	2	2	2	2	2	2	2	3	2	1
Co4: The student will apply network analysis techniques like PERT and CPM to solve the scheduling of activities and resource allocation related problems.	1	2	1	1	2	2	3	3	2	2	2	2	2	1

Co5: The student will calculate the optimum value of game and optimum replacement period using game theory and replacement theory respectively.	**1**	**2**	**1**	**1**	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**1**	**2**

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6, 7,8 PSO 1,2, 3, 4	**Co1:** The student will demonstrate the process of problem solving in Operations Research.	SO1.1 SO1.2 SO1.3 SO1.4		Unit-1: INTRODUCTION TO OPERATIONS RESEARCH (OR) 1.1, 1.2, 1.3, 1.4, 1.5,1.6,1.7, 1.8, 1.9	1,2
PO 1,2,3,4,5,6, 7,8 PSO 1,2, 3, 4	**Co2:** The student will apply the linear programming problem method to solve the various business management problems quantitatively.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2 LINEAR PROGRAMMING 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9,	1,2
PO 1,2,3,4,5,6, 7,8 PSO 1,2, 3, 4	**Co3:** The student will use the transportation and assignment techniques to solve the transportation and assignment problems quantitatively.	SO3.1 SO3.2 SO3.3 SO3.4		Unit-3 : TRANSPORTATION AND ASSIGNMENT PROBLEM 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9,	1,2

PO 1,2,3,4,5,6, 7,8 PSO 1,2, 3, 4	**Co4:** The student will apply network analysis techniques like PERT and CPM to solve the scheduling of activities and resource allocation related problems.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 : PERT AND CPM, DYNAMIC PROGRAMMING, AND SIMULATION. 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9,	1,2
PO 1,2,3,4,5,6, 7,8 PSO 1,2, 3, 4	**Co5:** The student will calculate the optimum value of game and optimum replacement period using game theory and replacement theory respectively.	SO5.1 SO5.2 SO5.3		Unit 5: GAME THEORY, REPLACEMENT THEORY AND QUEUING THEORY. 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9,	1,2

Semester- VI

Course Code:	**EE312**
Course Title :	**Power Systems-II**
Pre- requisite:	Basic Electrical Engineering, Electrical Power Generation, Power System-I
Rationale:	The electricity is generated in bulk at remote places near to coal mines (thermal power plants, dams (hydro power) and transmitted to long distances and then distributed in cities and villages and to industry. The transmission and distribution of electric power is a complex issue which requires knowledge of different types of transmission lines and power equipment. Technicians are required to operate and maintain the power transmission and distribution system so that electrical energy is continuously available to the consumers economically. It is therefore required that the technicians should be also able to work independently in the various area of transmission and distribution system. The objective of this course is makes sure the equipment work together so that the required power is delivered to the load centers at the prescribed voltage and frequency, to help students gain a thorough understanding of the basic concepts and analysis approaches of power systems

Course Outcomes: After the completion of this course the students will be able to

EE312.1: Use numerical methods to analyze a power system in steady state
EE312.2: Understand stability constraints in a synchronous grid
EE312.3: Understand methods to control the voltage, frequency and power flow.
EE312.4: Understand the monitoring and control of a power system.
EE312.5: Understand the basics of power system economics.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	EE312	Power Systems-II	3	2	1	1	7	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others).
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Scheme of Assessment:
Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/ Home Assignment 5 numbe r 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)	(ESA)	(PRA+ ESA)
PCC	EE312	Power Systems-II	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
PCC	EE312 -L	Power Systems-II	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE312.1: Understand the concepts of power systems.

Approximate Hours

Item	Approx. Hrs.
Cl	7
LI	10
SW	2
SL	1
Total	20

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
The students will be able to **SO1.1**Understanding power flow analysis. **SO1.2** To understand numerical methods for solution of nonlinear algebraic equations	1. To obtain formation of Y-bus. 2. To obtain Formation of Z BUS. 3. To Perform Load Flow Analysis using Gauss Seidal (GS) Method. 4. To Perform Load Flow Analysis using Newton-Raphson (NR) Method. 5. To Perform Load Flow Analysis using Fast Decoupled (FD) Method.	**Unit-1 Power Flow Analysis** 1.1 Review of the structure of a Power System and its components. 1.2Analysis of Power Flows: Formation of Bus Admittance Matrix. 1.3 Real and reactive power balance equations at a node. 1.4 Load and Generator Specifications. 1.5 Application of numerical methods for solution of non-linear algebraic equations – Gauss Seidel 1.6 Application of numerical methods for solution of non-linear algebraic equations – Newton-Raphson methods for the solution of the power flow equations. 1.7 Computational Issues in Large-scale Power Systems.	1. Structure of Power system.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Draw line diagram of Power system network.
ii. Numerical on numerical methods.

EE312.2: Understand stability constraints in a synchronous grid.

Approximate Hours

Item	Approx. Hrs.
Cl	8
LI	6
SW	1
SL	2
Total	17

Session Outcomes (SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self-Learning(SL)
The students will be able to **SO2.1** Understand the concept of Swing equation **SO2.2** Analysis using numerical integration **SO2.3** To understand stability constraints on Power System Operation	1. To study Swing Equations of a synchronous machine. 2. To study Power angle curve. 3. To Study series compensation of transmission lines on stability.	**Unit-2 Stability Constraints in synchronous grids** 2.1 Swing Equations of a synchronous machine connected to an infinite bus. 2.2 Power angle curve. 2.3 Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbancelike a three--phase fault. 2.4 Analysis using numerical integration of swing equationsusing Forward Euler 2.5 Analysis using numerical integration of swing equationsusing Runge-Kutta 4th order methods 2.6 Analysis using numerical integration of swingequations using Equal Area Criterion. 2.7 Impact of stability constraintson Power System Operation. 2.8 Effect of generation rescheduling and series compensation of transmission lines on stability.	1. Compensation Techniques 2. Infinite Bus

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Numerical Assignments Based on equal area criterion

EE312.3: Understand methods to control the voltage, frequency and power flow.

Approximate Hours

Item	Approx. Hrs.
Cl	9
LI	6
SW	1
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
The students will be able to **SO3.1** Understand the concept of frequency and voltage **SO3.2** To analyze control of excitation system	1. To Study Power flow control using embedded dc links. 2. To study Droop Characteristics. 3. Methods to improve power factor of load.	Unit-3 : Control of Frequency and Voltage 3.1 Turbines and Speed-Governors, Frequency 3.2 dependence of loads, Droop Control and Power Sharing. 3.3 Automatic Generation Control. 3.4 Generation and absorption of reactive power by various components of a Power System. 3.5 Excitation System Control in synchronous generators, 3.6 Excitation System Control in Automatic Voltage Regulators. 3.7 Shunt Compensators, Static VAR compensators and STATCOMs. 3.8 Tap Changing Transformers. 3.9 Power flow control using embedded dc links, phase shifters	1. Definition of Frequency, Speed, Voltage, load 2. Types of Transformers

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Discuss various types of control used in power system network.

EE312.4: Understand the monitoring and control of a power system.

Approximate Hours

Item	Approx. Hrs.
Cl	8
LI	2
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
the students will be able to **SO4.1** Understand SCADA system **SO4.2** To understand state estimation.	1. To Study SCADA systems.	**Unit 4: Fault Analysis and Protection Systems** 4.1 Overview of Energy Control Centre Functions: SCADA systems. 4.2 Phasor Measurement Units and Wide-Area 4.3 Measurement Systems. 4.4 State-estimation. 4.5 System Security Assessment. 4.6 Normal, Alert, Emergency, 4.7 Extremisstates of a Power System. 4.8 Contingency Analysis. Preventive Control and Emergency Control.	1. Define SCADA

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Discuss measurement systems

EE312.5: Understand the basics of power system economics.

Approximate Hours

Item	Approx. Hrs.
Cl	9
LI	6
SW	2
SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
The students will be able to **SO5.1** Understand pricing principles **SO5.2** Understand Electricity market **SO5.3** Understand regulatory framework	1. Method of calculating residential and commercial or industrial electric bill. 2. Concept of house wiring/sub-circuit/power circuit. 3. To Study DSM.	**Unit 5: Power System Economics and Management** 5.1Basic Pricing Principles: Generator Cost Curves 5.2Utility Functions, Power Exchanges, Spot Pricing. 5.3Electricity Market Models Vertically Integrated 5.4Purchasing Agency, Whole-sale competition, 5.5Retail Competition, 5.6Demand Side-management 5.7Transmission and Distributions charges 5.8 Ancillary Services. 5.9 Regulatory framework.	1. Study Electricity bill.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Discuss transmission and distribution charges.
   ii. Discuss DSM

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE312.1: Use numerical methods to analyse a power system in steady state.	7	10	2	1	20
EE312.2: Understand stability constraints in a synchronous grid.	8	6	1	2	17
EE312.3: Understand methods to control the voltage, frequency and power flow.	9	6	1	1	17
EE312.4: Understand the monitoring and control of a power system.	8	2	1	1	12
EE312.5: Understand the basics of power system economics.	9	6	2	1	18
Total Hours	41	30	7	6	84

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Power Flow Analysis	02	03	05	10
CO-2	Stability Constraints in synchronous grids	02	05	03	10
CO-3	Control of Frequency and Voltage	02	02	06	10
CO-4	Fault Analysis and Protection Systems	02	03	05	10
CO-5	Power System Economics and Management	02	04	04	10
Total		10	17	23	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Power System 2 will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Design Demonstration
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, WhatApp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Power System Analysis	J. Grainger and W. D. Stevenson	McGraw Hill Education	1994
2	Electric Energy Systems Theory	O. I. Elgerd	McGraw Hill Education	1995
3	Power System Analysis	A. R. Bergen and V. Vittal	Pearson Education Inc.	1999
4	Modern Power System Analysis	D. P. Kothari and I. J. Nagrath	McGraw Hill Education	2003
5	Electric Power Systems	B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac	Wiley	2012
6	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE312
Course Title: Power system-2

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Use numerical methods to analyse a power system in steady state.	3	3	2	2	2	1	1	2	3	1	2	2	3	3
CO 2: Understand stability constraints in a synchronous grid.	2	3	3	3	2	2	1	3	2	2	3	3	3	2
CO 3: Understand methods to control the voltage, frequency and power flow.	3	3	2	2	2	1	2	2	1	2	2	3	2	3
CO 4: Understand the monitoring and control of a power system.	3	2	2	3	2	1	1	3	2	2	2	2	3	2
CO 5: Understand the basics of power system economics.	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO:1,2,3,4,5,6,7 ,8,9,10,11,12 PSO 1,2	**CO1:** Use numerical methods to analyse a power system in steady state.	SO1.1 SO1.2	1,2,3,4,5	**Unit-1: :** Power Flow Analysis 1.1,1.2,1.3,1.4,1.5,1.6,1.7.	1
PO:1,2,3,4,5,6,7 ,8,9,10,11,12 PSO 1,2	**CO 2:** Understand stability constraints in a synchronous grid.	SO2.1 SO2.2 SO2.3	1,2,3	**Unit-2:** Stability Constraints in synchronous grids 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8	1,2
PO:1,2,3,4,5,6,7 ,8,9,10,11,12 PSO 1,2	**CO 3:** Understand methods to control the voltage, frequency and power flow.	SO3.1 SO3.2	1,2,3	**Unit-3:** Control of Frequency and Voltage 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1,2
PO:1,2,3,4,5,6,7 ,8,9,10,11,12 PSO 1,2	**CO 4:** Understand the monitoring and control of a power system.	SO4.1 SO4.2 SO4.3 SO4.4	1	**Unit-4 :** Fault Analysis and Protection Systems 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	1
PO:1,2,3,4,5,6,7 ,8,9,10,11,12 PSO 1,2	**CO 5:** Understand the basics of power system economics.	SO5.1 SO5.2 SO5.3	1,2,3	**Unit 5:** Power System Economics and Management 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	1

Semester-VI

Course Code:	**EE313**
Course Title :	**Measurement and Instrumentation**
Pre- Requisite:	Student should have basic knowledge of mathematics, physics, Electrical materials, Electrical Components, Semiconductors and Electronic devices such as Diodes, Transistors, FET's etc.
Rationale:	This course aims to introduce the basic concepts, Working Principles and Applications of Electrical and electronic measuring instruments for measurement of electrical and physical variables.

Course Outcomes: Students will be able to

EE313.1: Understand the concept of measurement, their types and characteristics

EE313.2: Understand construction, working and application of different types of measuring instruments.

EE313.3: Measure the value of unknown resistance, Inductance and capacitance using different methods.

EE313.4: Use CRO to view the pattern of different waveforms and measure their voltage, time period, frequency etc.

EE313.5: Understand the working of different types of transducers to measure unknown physical quantities.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	EE313	Measurement and Instrumentation	3	2	1	1	7	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Couse Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End**	
			Class/ Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+ CT+ SA+ CAT +AT)	**Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
PCC	EE313	Measurement and Instrumentation	15	20	5	5	5	50	50	100

Practical

Course Category	Couse Code	CourseTitle	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
PCC	EE313 -L	Measurement and Instrumentation	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE313.1: Understand the concept of measurement, their types and characteristics

Approximate Hours

tem	Approx. Hrs.
Cl	8
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Lab Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO1.1** Understand the concept of measurement and their different types **SO1.2** Understand analyze Different types of errors involved in measurement. **SO1.3** gain the knowledge of different Characteristic of measuring Instruments.		**Unit-1: Measurement and Measuring System** 1.1 Measurement and its significance, 1.2 Methods of measurement (Direct andIndirect Method), 1.3 Measurement System. 1.4 Standards and their classification, 1.5 Error in Measurement, Types of Errors, 1.6 Accuracy and Precision 1.7 Resolution, Linearity, Hysteresis, Time Lag, 1.8 Noise and their types, noise factor.	1. Necessity of measurement. 2. Effect of noise in measurement. 3. Significance of error in measurement. 4. Practice of numerical questions related to errors, resolution etc.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

i. Theoretical questions related to measurement system and their Characteristic.
ii. Numerical Problems Related to errors, resolution etc.

EE313.2: Understand construction, working and application of different types of measuring instruments.

Approximate Hours

Item	Approx. Hrs.
Cl	12
LI	6
SW	2
SL	1
Total	21

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self- Learning (SL)
Students will be able to **SO2.1** Understand the classification of measuring instruments. **SO2.2** Understand different principles involve in working of measuring instruments. **SO2.3** gain the knowledge about construction, working and application of different measuring instruments.	1. Measurement of active and reactive power inthree phase balanced load bysingle wattmeter method. 2. Measurement of active and reactive power inthree phase balanced load bytwo wattmeter method. 3. Measurement of power factor of single phase loadby power factor meter.	**Unit-2: Electrical & Electronic Measurements** 2.1 indicating, Recordingand integrating instruments, 2.2 Moving Iron, MovingCoil 2.3 Dynamometer type Instruments 2.4 voltmeter, ammeter, Extension of Rangeof Voltmeter and Ammeter, 2.5 Induction type wattmeter. 2.6 Dynamo Meter Type wattmeter 2.7 energy meter (Induction Type), 2.8 P.F. meter (Dynamometer type), 2.9 frequency meter (Resonance and Weston type), 2.10 Instrument Transformers, Current Transformers(C.T.)and Potential Transformer(P.T.) 2.11 DC Voltmeter (Chopper type andsolid-state), 2.12 AC voltmeter using Rectifier, Average, RMS, Peak Responding voltmeters	1. Concept of electric and magnetic fields. 2. Concept of electrical power and electrical energy 3. Working of transformer

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Questions related to moving coil, moving iron and Dynamometer type instruments.

ii. Questions related to voltage, current, power, energy and power factor measuring instruments

EE313.3: Measure the value of unknown resistance, Inductance and capacitance using different methods.

Approximate Hours

Item	Approx. Hrs.
Cl	8
LI	8
SW	1
SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
Students will be able to **SO 3.1** Learn different methods used for resistance measurement. **SO 3.2** Measure unknown value of inductance and capacitance using AC bridges. **SO 3.3** learn the operation of Q meter and its application.	1. Measurement of medium resistance by Wheatstone bridge. 2. Study and Measurement using Maxwell Inductance Bridge. 3. Measurement of inductance of a coil using Anderson Bridge. 4. Measurement of capacitance of a capacitor using Schering Bridge.	**Unit-3 Measurement of Resistance, Inductance and capacitance** 3.1 Measurement of resistance by wheat stone bridge, Measurement of resistance Ammeter-voltmeter method. 3.2 Measurement of Insulation resistance by megger. 3.3 Maxwell's bridge, Maxwell's inductance capacitance bridge. 3.4 Hay's Bridge, 3.5 Anderson Bridge, 3.6 Owen's Bridge, 3.7 Schering Bridge, Wien's Bridge, 3.8 Q meter and its application	1. Concept of resistance, Inductance and capacitance. 2. Numerical problems related to AC bridges.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**

   i. Numerical problems related to AC bridges

EE313.4: Use CRO to view the pattern of different waveforms and measure their voltage, time period, frequency etc.

Approximate Hours

Item	Approx. Hrs.
Cl	8
LI	6
SW	2
SL	1
Total	17

Session Outcomes (SOs)	Lab Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO4.1** Understand Different Part of CRO and Their functions. **SO4.2** Learn the Procedure of voltage, time period and frequency measurement using CRO. **SO4.3** Understand the structure and operation of Dual Beam and Dual Trace CRO. **SO4.4** Understand the structure and operation of Storage Oscilloscopes.	**1.** . Study of Cathode Ray Oscilloscope (C.R.O). **2.** Voltage and Current Measurement using CRO. **3.** Measurement of frequency using Lissajous pattern	**Unit-4 : Cathode Ray Oscilloscope** 4.1 Cathode Ray Tube (CRT), 4.2 CRO, Different parts of CRO, 4.3 Vertical & Horizontal deflection system, 4.4 Time base circuit, 4.5 Oscilloscope probes, Graticule, 4.6 Application of CROs, Lissajous patterns. 4.7 Dual trace CRO, Dual beam CRO, 4.8 Storage (Analog & Digital) Oscilloscopes.	1. Concept of electric field and electric field Intensity 2. Graticule and Their Types. 3. Operation of CRO.

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Theoretical Assignment related to different parts and different types of CRO.

ii. Numerical Problems Deflection sensitivity of CRO.

Mini Project:

i. Draw a Poster of CRO.

ii. Make demonstrative model of CRT

EE313.5: Understand the working of different types of transducers to measure unknown physical quantities.

Approximate Hours

Item	Approx. Hrs.
Cl	9
LI	10
SW	2
SL	1
Total	22

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO5.1** discuss role of Sensor and transducers in instrumentation **SO5.2** study of Transducers, their types and Application **SO 5.3** understand the Design and Characteristic of transducers used for the measurement of strain, Temperature,	**1.** Measurement of Displacement using LVDT. **2.** Measurement of Strain using Strain Gauge. **3.** Measurement of temperature using RTD. **4.** Measurement of temperature	**Unit 5: Transducers** **5.1** Definition and classification. **5.2** Mechanical devices as primary detectors. **5.3** Strain Gauge, Types of strain Gauge, and gauge factor. **5.4** Resistance Temperature Detector (RTD). **5.5** Thermistor, Thermocouple, **5.6** LVDT, RVDT. **5.7** Piezo-Electric transducers, Hall Effect transducers.	1. Different Types of Strain Gauge. 2. Photo conductive cell. 3. Transducer Interfacing

Magnetic Field, displacement, Illumination etc.	using thermocouple. **5.** Study of Photo diode and Photo Transistor.	**5.8** Photo voltaic, photo diode **5.9** photo conductive cells, Photo transistors.	

SW-5 Suggested Sessional Work (SW):

a. Assignments:

- **i.** Theoretical Assignments related to different transducers, their structure and operation.
- **ii.** .Numerical Problems related to Strain Gauge and Hall Effect Transducer.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE313.1: Understand the concept of measurement, their types and characteristics	8	0	2	1	11
EE313.2: Understand construction, working and application of different types of measuring instruments.	12	6	2	1	21
EE313.3: Measure the value of unknown resistance, Inductance and capacitance using different methods.	8	8	1	1	18
EE313.4: Use CRO to view the pattern of different waveforms and measure their voltage, time period, frequency etc.	8	6	2	1	17
EE313.5: Understand the working of different types of transducers to measure unknown physical quantities.	9	10	2	1	22
Total Hours	45	30	9	5	89

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Measurement and Measuring System	02	03	05	10
CO-2	Electrical & Electronic Measurements	02	03	05	10
CO-3	Measurement of Resistance, Inductance and capacitance	02	03	05	10
CO-4	Cathode Ray Oscilloscope	03	03	04	10
CO-5	Transducers	03	03	04	10
Total		12	15	23	50

Legend: **R: Remember,** **U: Understand,** **A: Apply**

The end of semester assessment for Measurement and Instrumentation will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Demonstration of Instruments.
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, WhatApp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Electronic Instrumentation	H.S.Kalsi.	Tata McGraw Hill.	Fourth, 2019
2	Electrical Measurement and Measuring	E.W. Golding,	Sir Isaac Pitman and Sons, Ltd. London	1940
3	Electrical and Electronic measurements and Instrumentation,	A.K. Sawhney,	Dhanpat Rai and Co..	2012

4	Electronic Measurements and Instrumentation	K. Lala Kishore	Pearson Education	Kindle Edition, 2009
5	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE313
Course Title: Measurement and Instrumentation

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Understand the concept of measurement, their types and characteristics	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO 2: Understand construction, working and application of different types of measuring instruments	3	3	3	3	2	2	1	3	2	2	2	3	3	2
CO3: Measure the value of unknown resistance, Inductance and capacitance using different methods	3	3	2	2	1	1	2	2	1	2	2	3	2	3
CO 4: Use CRO to view the pattern of different waveforms and measure their voltage, time period, frequency etc	3	3	2	2	2	1	1	3	2	2	2	2	3	3
CO 5: Understand the working of different types of transducers to measure unknown physical quantities	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO1: Understand the concept of measurement, their types and characteristics	SO1.1 SO1.2 SO1.3		**Unit-1: Measurement and Measuring System** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	1,2,3,4
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 2: Understand construction, working and application of different types of measuring instruments	SO2.1 SO2.2 SO2.3	1,2,3	**Unit-2: Electrical & Electronic Measurements** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9,2.10,2.11,2.12	1,2,3
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO3: Measure the value of unknown resistance, Inductance and capacitance using different methods	SO3.1 SO3.2 SO3.3 SO3.4	1,2,3,4	**Unit-3 Measurement of Resistance, Inductance and capacitance** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8	1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 4: Use CRO to view the pattern of different waveforms and measure their voltage, time period, frequency etc	SO4.1 SO4.2 SO4.3 SO4.4	1,2,3	**Unit-4 : Cathode Ray Oscilloscope** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	1,2,3
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 5: Understand the working of different types of transducers to measure unknown physical quantities	SO5.1 SO5.2 SO5.3	1,2,3,4,5	**Unit 5: Transducers** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	1,2,3

Semester-VI

Course Code: **EE314**

Course Title : **Electronic Design Lab**

Pre-Requisite: Student should have basic knowledge of, Electrical Components, Semiconductors and Electronic devices such as Diodes, Transistors, FET's etc.

Rationale: This course aims to improve the ability of students to design different electronics circuits for different applications using electronic devices such as diode, transistor, FET, MOSFET etc and analyze its input and output response.

Course Outcomes: Students will be able to

EE314.1: Design various diode circuits and analyze their response.
EE314.2: Design various Transistor circuits and analyze their response.
EE314.3: Design power supply circuit and analyze their response.
EE314.4: Design various filter circuits and analyze their response.
EE314.5: Make a project for a given problem

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours(CI+LI+SW+SL)	
Program Core (PCC)	EE314	Electronic design lab	0	2	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical, performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self-Learning.
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Practical

Course Category	Couse Code	CourseTitle	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Lab Assignments 5 number 7 marks each (LA)	Viva	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT +AT)		
PCC	EE314	Electronic design lab	35	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE314.1: Design various diode circuits and analyze their response.

Approximate Hours

Item	Approx.Hrs.
Cl	0
LI	10
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Lab Instruction(LI)	Classroom Instruction (CI)	Self-Learning (SL)
Students will be able to **SO1.1** Design various diode circuits like rectifier, clipper, clamper, voltage doubler etc and analyze their response.	1. Design of half wave rectifier circuit and analyze its output in CRO. 2. Design of full wave bridge rectifier circuit and analyze its output in CRO. 3. Design of diode clippercircuit and analyze its output in CRO. 4. Design of diode clampercircuit and analyze its output in CRO. 5. Design of voltage doublercircuit		1. Diode specifications. 2. Diode biasing.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

Design problems related to diode applications

EE314.2: Design various Transistor circuits and analyze their response.

Approximate Hours

Item	Approx.Hrs.
Cl	0
LI	8
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
Students will be able to **SO2.1** Design various Transistor circuits like amplifiers oscillator etc and analyze response.	1. Design a Transistor amplifier and analyze its output in C.R.O 2. Design a Transistor Oscillator and analyze its output in C.R.O 3. Design of rain alarm system. 4. Design of burgler alarm circuit.		1. Transistor configuration 2. Transistor characteristic

SW-2 Suggested Sessional Work (SW):

a. Assignments:

Design problems related to diode applications

EE314.3: Design power supply circuit and analyze their response.

Approximate Hours

Item	Approx.Hrs.
Cl	0
LI	4
SW	1
SL	1
Total	6

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO3.1 Design AC and DC power Supply circuits	**1.** Design an AC power Supply **2.** Design an DC power Supply		**1.** Components of power supply

SW-3 Suggested Sessional Work (SW):

a. Assignments:

Design problems related to power supply.

EE314.4: Design various filter circuits and analyze their response

Approximate Hours

Item	Approx.Hrs.
Cl	0
LI	6
SW	1
SL	1
Total	8

Session Outcomes (SOs)	Lab Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
Students will be able to **SO4.1** Design various filter circuits and analyze their response	**1.** Design of Low Pass Filter. **2.** Design of High Pass Filter. **3.** Design of band pass filter	.	1. Components of filters

SW-4 Suggested Sessional Work (SW):

Mini Project:

i. Design of LPF, HPF and BPF.

EE314.5: Make a project for a given problem

Approximate Hours

Item	Approx.Hrs.
Cl	0
LI	2
SW	1
SL	1
Total	4

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
Students will be able to **SO5.1** Make a project for a given problem	**1.** Make an electronics project for a given problem.		

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE314.1: Design various diode circuits and analyze their response.	0	10	1	1	12
EE314.2: Design various Transistor circuits and analyze their response.	0	8	1	1	10
EE314.3: Design power supply circuit and analyze their response.	0	4	1	1	6
EE314.4: Design various filter circuits and analyze their response.	0	6	1	1	8
EE314.5: Make a project for a given problem	0	2	1	1	4
Total Hours	0	30	5	5	40

Suggestion for End Semester Assessment

The end of semester assessment for electronic design lab will be held with practical examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Tutorial
2. Group Discussion
3. Practical Demonstration
4. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, WhatApp, Mobile, Online sources)
5. Brainstorming

Suggested Learning Resources:

(a) Books:

1	Lab Manuals provided by Dept. of Electrical Engineering, AKS University, Satna.

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE314
Course Title: Electronic Design Lab

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Design various diode circuits and analyze their response.	3	3	2	2	2	-	1	2	2	1	2	2	2	3
CO2: Design various Transistor circuits and analyze their response.	3	3	3	3	2	-	1	3	2	2	2	2	3	2
CO3: Design power supply circuit and analyze their response.	3	3	2	2	2	-	1	2	2	1	2	2	2	3
CO4: Design various filter circuits and analyze their response.	3	3	2	2	2	-	1	3	2	2	2	2	3	3
CO5: Make a project for a given problem	3	3	3	3	2	-	1	3	2	1	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO1:** Design various diode circuits and analyze their response.	SO1.1	1,2.3.4,5		1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO2:** Design various Transistor circuits and analyze their response.	SO2.1	1,2.3.4		1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO3:** Design power supply circuit and analyze their response.	SO3.1	1,2,		1,
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO4:** Design various filter circuits and analyze their response.	SO4.1	1,2,3		1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO5:** Make a project for a given problem	SO5.1	1		

Semester-VI

Course Code:	**EE303**
Course Title:	**POWER SYSTEM PROTECTION**
Pre- requisite:	Student should have knowledge of Power Transmission & Distribution
Rationale:	An electrical power system consists of generators, transformers, and transmission and distribution lines. In case of fault, an automatic protective scheme comprising of circuit breakers and protective relays isolate the faulty section providing protection to the healthy section. Safety of machines/equipment and human beings is the major criteria of every protection scheme, students should develop skills of operating various controls and switchgear in power system. They are also required to carry out remedial measures for faults/abnormalities in machines/equipment in power system using appropriate diagnostic instrument/devices. This course attempts to develop these skills in students and hence it is a core course for all electrical engineers.

Course Outcomes: After the completion of this course the students will be able to:

EE303.1: Understand the basic concepts of power system protection and relays and Explain the working of different types of switchgear Equipments like circuit breakers. To understand the theory of arcing phenomenon.

EE303.2: Understand how lightning occurs and its behavior and to protect power system against over voltages

EE303.3: Understand insulation coordination.

EE303.4: Explain working of different types of relays in power system, to protect transformer, alternator, feeders transmission line, motor and bus bar.

EE303.5: To understand the concept of static relays, its comparison with electromechanical and digital relays.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Professional Elective Core (PEC)	EE303	POWER SYSTEM PROTECTION	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PEC	EE303	SWITCHGEAR AND PROTECTION	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE303.1: Understand the basic concepts of power system protection and relays and Explain the working of different types of switchgear Equipments like circuit breakers. To understand the theory of arcing phenomenon.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	2
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Explain arc formation, high resistance and zero current interruption **SO1.2** Explain with sketches the operation of circuit breaker. **SO1.3** Compare arc quenching in A.C. and D.C. Circuit Breaker **SO1.4** Explain the resistance switching.	.	**Unit-1: Switchgear** 1.1 Principles of Power System Protection 1.2 Relays, transformers, Circuit breaker: Arc phenomena 1.3 arc extinction 1.4 Construction, working principle of Oil circuit breakers 1.5 Construction, working principle of Air break circuit breaker 1.6 Construction, working principle of Air Blast circuit breaker 1.7 Construction, working principle of Sulphur Hexa Fluoride (SF6) and 1.8 Construction, working principle of vacuum circuit breakers. 1.9 Arc Voltage ,recovery voltage, restriking voltage, RRRV 1.10 Interruption of capacitive and inductive currents	1. Arc formation and various medium to quench arc.

		1.11 resistance switching 1.12 Double frequency transient, Rating of circuit breaker, Define clearing time, reclosing time of circuit breaker	

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Discuss arc phenomenon.

b. **Mini Project:**
   i. Sketch various types of circuit breakers.

EE303.2: Understand how lightning occurs and its behavior and to protect power system against over voltages

Approximate Hours

Item	AppX Hrs
Cl	7
LI	0
SW	2
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 To Understand concept of lightning mechanism **SO2.2** To protect transmission lines, sub-station and various equipments from overvoltage. **SO2.3** To understand different types of lightning arrestors		**Unit-2** Faults and Over-Current Protection 2.1 Review of Fault Analysis, Sequence Networks 2.2 Introduction to Overcurrent Protection 2.3 overcurrent relay co-ordination Equipment Protection Schemes 2.4 Directional, Distance, Differential protection 2.5 Transformer and Generator protection, 2.6 arrangement schemes 2.7 Over voltage protection	1. Cause of overvoltage and how it rectifies.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Discuss lightning mechanism in detail.
   ii. Discuss various causes of overvoltage.
b. **Mini Project:**
   i. Sketch various types of counterpoises
c. **Other Activities (Specify):**
   i. Identify various types of lightning arrestors.

EE303.3: Understand insulation coordination.

Approximate Hours

Item	AppX Hrs
Cl	7
LI	0
SW	1
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 To Understand Impulse volt-time characteristics of electrical apparatus. **SO3.2** To Understand basic impulse insulation level **SO3.3** To Understand insulation levels of sub-station equipments	,.	**Unit-3 : Digital Protection** 3.1 Computer-aided protection. 3.2 Fourier analysis and estimation of Phasors from DFT 3.3 Fourier analysis and estimation of Phasors from DFT 3.4 Sampling, aliasing issues. 3.5 Define BIL 3.6 Insulation levels of sub-station equipments 3.7 Insulation levels of power station	1. Role of insulation in power system network.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Draw a table of various insulation levels.
   ii. Case study of Digital Protection

EE303.4: Explain working of different types of relays in power system, to protect transformer, alternator, feeders transmission line, motor and bus bar.

Approximate Hours

Item	AppX Hrs
Cl	6
LI	0
SW	2
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 To understand various types of protective relays. **SO4.2** Analyse protection against abnormal conditions for alternators, transformers, feeders transmission lines, and bus-bars **SO4.3** To understand protection for long lines using Carrier current protection scheme		**Unit-4 : Modeling and Simulation of Protection Schemes** 4.1 CT modeling and standards 4.2 PT modeling and standards 4.3 basic requirements 4.4 operating principles and characteristics of electromagnetic type over-current 4.5 Simulation of transients using Electro-Magnetic Transients (EMT) 4.6 Simulation of transients using Electro-Magnetic Transients (EMT)	1. Prepare chart of basic elements of protective system. 2. List different types of relays, circuit breakers and collect literature from dealers/Manufactures/users and their websites (such as SEIMENS, BHEL, GE, L&T, Crompton, Power Grid Corporation etc)

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Discuss various types of relay used in power system network.

b. **Mini Project:**
   i. Prepare display chart for various types of fuse.

EE303.5: To understand the concept of static relays, its comparison with electromechanical and digital relays.

Approximate Hours

Item	AppX Hrs.
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 To understand static relay **SO5.2** To understand various types of overcurrent relay **SO5.3** To understand digital relay		**Unit 5: System Protection** 5.1 Introduction 5.2 System Protection Schemes 5.3 Under-frequency, 5.4 Under voltage and df/dt relays 5.5 Out-of-step protection 5.6 Synchro-phasors 5.7 Phasor Measurement Units 5.8 Wide-Area Measurement Systems (WAMS) 5.9 Application of WAMS for improving protection	1 Protection Schemes Keep in mind.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Compare static relay and digital relay

b. **Mini Project:**
   i. Draw inverse time characteristics of various type of relay.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE303.1: Understand the basic concepts of power system protection and relays and Explain the working of different types of switchgear equipments like circuit breakers. To understand the theory of arcing phenomenon.	12	2	1	15
EE303.2: Understand how lightning occurs and its behavior and to protect power system against over voltages	7	2	1	10
EE303.3: Understand insulation coordination.	7	1	1	9
EE303.4: Explain working of different types of relays in power system, to protect transformer,	6	2	1	9

alternator, feeders transmission line, motor and bus bar.				
EE303.5: To understand the concept of static relays, its comparison with electromechanical and digital relays.	9	1	1	11
Total Hours	41	8	5	54

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Switchgear	03	01	01	05
CO-2	Protection Against Lightning	02	06	02	10
CO-3	Insulation coordination	02	07	06	15
CO-4	Protective Relays	03	07	05	15
CO-5	Static Relays	01	02	02	05
Total		11	23	16	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Power system Protection will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to power plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Switchgear Protection and Power Systems	Sunil S. Rao	Khanna Publication	14th edition (1 January 1977)
2	Power System Protection	Badriram & Vishwakarma	McGraw Hill Education	2nd edition (1 July 2017)
3	Power System Engineering	IJ Nagrath and DP Kothari	Tata McGraw-Hill	Third edition (26 April 2019)
4	Electrical Power Systems	C. L. WADHWA	NEW AGE INTERNATIONAL (P) LTD	8th Edition 1983
5	Switchgear and Protection	Veerappan N. & Krishnamurthy	S.Chand New Delhi	2010
6	NPTEL Lecture Series on “Power System Engineering”.			
7	Lecture note provided by Dept.of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos, POs, and PSOs Mapping

Course Title: B. Tech. Electrical Engineering
Course Code: EE303
Course Title: Power System Protection

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Understand the basic concepts of power system protection and relays and Explain the working of different types of switchgear equipments like circuit breakers. To understand the theory of arcing phenomenon.	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO 2: Understand how lightning occurs and its behavior and to protect power system against over voltages	3	3	3	3	2	2	1	3	2	2	2	3	3	2
CO 3: Understand insulation coordination.	3	3	2	2	1	1	2	2	1	2	2	3	2	3
CO 4: Explain working of different types of relays in power system, to protect transformer, alternator, feeders transmission line, motor and bus bar.	3	3	2	2	2	1	1	3	2	2	2	2	3	3
CO 5: To understand the concept of static relays, its comparison with electromechanical and digital relays.	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	**CO1:** Understand the basic concepts of power system protection and relays and Explain the working of different types of switchgear equipment like circuit breakers. To understand the theory of arcing phenomenon.	SO1.1 SO1.2 SO1.3 SO1.4		**Unit-1: Switchgear** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11,1.12	1
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO 2:** Understand how lightning occurs and its behavior and to protect power system against over voltages	SO2.1 SO2.2 SO2.3		**Unit-2: Faults and Over-Current Protection** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7	1
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO 3:** Understand insulation coordination.	SO3.1 SO3.2 SO3.3		**Unit-3 : Digital Protection** 3.1,3.2,3.3,3.4,3.5,3.6,3.7	1
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO 4:** Explain working of different types of relays in power system, to protect transformer, alternator, feeders transmission line, motor and bus bar.	SO4.1 SO4.2 SO4.3		**Unit-4 : Modeling and Simulation of Protection Schemes** 4.1,4.2,4.3,4.4,4.5,4.6	1,2
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO 5:** To understand the concept of static relays, its comparison with electromechanical and digital relays.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		**Unit 5: System Protection** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	1

Semester-VI

Course Code: **EE304**

Course Title : **HVDC Transmission Systems**

Pre-requisite: Students should have basic knowledge of Electrical Power Systems.

Rationale: A process of introducing formal knowledge of different electrical transmission systems, various components, and terminologies used.

Course Outcomes:

EE304.1: Understand the advantages of DC transmission over AC transmission.
EE304.2: Understand the operation of Line Commutated Converters and Voltage Source Converters.
EE304.3: Understand the control strategies used in the HVDC transmission system.
EE304.4: Understand different components of HVDC system
EE304.5: Understand the improvement of power system stability using an HVDC system.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Professional Elective course (PEC)	EE304	HVDC Transmission Systems	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field, or other locations using different instructional strategies)
SW: Sessional Work (includes assignments, seminars, mini projects, etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL have to be planned and performed under the teacher's continuous guidance and feedback to ensure the Learning outcome.

Scheme of Assessment:
Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/ Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA + ESA)
PEC	EE304	HVDC Transmission Systems	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE304.1: Understand the advantages of DC transmission over AC transmission.

Approximate Hours

Item	AppX Hrs
Cl	05
LI	0
SW	01
SL	01
Total	07

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Make a comparative study between AC and DC. **SO1.2** Understand the applications of the HVDC System. **SO1.3** Understand the types of DC Transmission Systems. **SO1.4** Understand the components used in HVDC. **SO1.5** Study the Converters. .	.	**Unit-1: DC Transmission Technology.** 1.1 Comparison of AC and DC Transmission (Economics, Technical Performance, and Reliability. 1.2 Application of DC Transmission 1.3 Types of HVDC Systems 1.4 Components of a HVDC system 1.5 Line Commutated Converter and Voltage Source Converter-based systems	1. Understand the various concepts of the transmission systems.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Write down all the concepts of various transmission systems.

b. **Mini Project:**
   i. Draw the basic diagrams of various systems.

EE304.2: Understand the operation of Line Commutated Converters and Voltage Source Converters.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	01
SL	01
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 To Understand the Line commutated converters. **SO2.2** To understand the harmonics. **SO2.3** To understand the inverter operation. **SO2.4** To understand the effect of commutation overlap. **SO2.5** Expressions for average DC voltage. **SO2.6** To study the reactive power absorption. **SO2.7** Understand the concept of Voltage Source Converter. **SO2.8** Understand the Control of reactive power.	.	**Unit-2 Analysis of Line Commutated and Voltage Source Converters** 2.1 Line Commutated Converters (LCCs): Six pulse converter 2.2 Analysis neglecting commutation overlap harmonics 2.3 Twelve Pulse Converters 2.4 Inverter Operation, Effect of Commutation Overlap 2.5 Expressions for average DC voltage 2.6 AC and reactive power absorbed by the converters 2.7 Effect of Commutation Failure 2.8 Misfire and Current Extinction in LCC Links 2.9 Voltage Source Converters (VSCs): Two and Three-level VSCs 2.10 PWM schemes: Selective Harmonic Elimination 2.11 Sinusoidal Pulse Width Modulation, Analysis of a six-pulse converter 2.12 Equations in the rotating frame, Real and Reactive power control using a VSC	1. Learn and gain knowledge of Line commutated and voltage source converters.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Make notes of this chapter.

b. **Mini Project:**
   i. Draft the converter's Construction.

EE304.3: Understand the control strategies used in the HVDC transmission system

Approximate Hours

Item	AppX Hrs
Cl	10
LI	0
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Lear ning (SL)
SO3.1 To Understand the principle of link control in HVDC. **SO3.2** To Understand the Firing Angle Control. **SO3.3** To Understand the Various Concepts of Control. **SO3.4** To Understand the Reactive Power Control. **SO3.5** To Analyze the AC Voltage Regulation.	.	**Unit-3: Control of HVDC Converters** 3.1 Principles of Link Control in a LCC HVDC system, Control Hierarchy 3.2 Firing Angle Controls – Phase Locked Loop 3.3 Current and Extinction Angle Control 3.4 Starting and Stopping of a Link 3.5 Higher level Controllers Power control 3.6 Frequency Control 3.7 Stability Controllers 3.8 Reactive Power Control 3.9 Principles of Link Control in a VSC HVDC system: Power Flow and DC Voltage Control 3.10 Reactive Power Control/AC voltage regulation	1. To ensure all the concepts of the HVDC System should be learned.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**

i. Make complete Notes of the chapter.

EE304.4: Understand different components of HVDC system

Approximate Hours

Item	AppX Hrs
Cl	09
LI	0
SW	01
SL	01
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Evaluation of Smoothing Reactors. **SO4.2** To Understand the Effects on HVDC Lines. **SO4.3** To Study the DC Line Faults. **SO4.4** To Understand the Mono-polar Operation.	.	**Unit-4: Components of HVDC Systems** 4.1 Smoothing Reactors 4.2 Reactive Power Sources and Filters in LCC HVDC systems DC line: Corona Effects. 4.3 Insulators 4.4 Transient Over-voltages 4.5 DC line faults in LCC systems 4.6 DC line faults in VSC systems 4.7 DC breakers 4.8 Mono-polar Operation 4.9 Ground Electrodes	1. Make Well-Organized Notes on All Concepts of Components of HVDC Systems.

SW-4 **Suggested Sessional Work (SW):**

a. **Assignments:**

i. Make the list of faults associated with HVDC.

Mini Project:

i. Evaluate the working of DC breakers.

EE304.5: Understand the improvement of power system stability using an HVDC system.

Approximate Hours

Item	AppX Hrs
Cl	08
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 To Understand the concept of power system stability. **SO5.2** To Understand the Concept of Power Modulation. **SO5.3** To Study the reasons for the problem of voltage stability. **SO5.4** To Understand the MTDC System. **SO5.5** To Study the Introduction to Modular Multi-level Converters.		**Unit 5: Stability Enhancement using HVDC Control.** 5.1 Basic Concepts: Power System Angular Voltage and Frequency Stability 5.2 Power Modulation: basic principles – synchronous and asynchronous links 5.3 Voltage Stability Problem in AC/DC Systems 5.4 MTDC Links Multi-Terminal and Multi-Infeed Systems 5.5 Series and Parallel MTDC systems using LCCs 5.6 MTDC systems using VSCs 5.7 Modern Trends in HVDC Technology 5.8 Introduction to Modular Multi-level Converters	1. To ensure Complete notes of the chapter related to the Three-Phase Transformer.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

Numerical Problem based on Parallel Operation of Transformers.

b. Mini Project:

i. Draw the chart of different types of connections of a transformer.

Brief of Hours Suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE304.1: Understand the advantages of DC transmission over AC transmission.	05	01	01	07
EE304.2: Understand the operation of Line Commutated Converters and Voltage Source Converters.	12	01	01	14
EE304.3: Understand the control strategies used in the HVDC transmission system.	10	01	01	12
EE304.4: Understand different components of HVDC system	09	01	01	11
EE304.5: Understand the improvement of power system stability using an HVDC system.	08	02	01	11
Total Hours	44	06	05	55

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	**U**	**A**	
CO-1	DC Transmission Technologies	03	01	04	08
CO-2	Analysis of Line Commutated and Voltage Source Converters	02	06	02	10
CO-3	Control of HVDC Converters	02	05	05	12
CO-4	Components of HVDC Systems	03	05	05	13
CO-5	Stability Enhancement using HVDC Control	01	04	02	07
Total		11	21	18	50

Legend: R: Remember, U: Understand, A: Apply

The end-of-semester assessment for HVDC Transmission System will be held with the written examination of 50 marks.

Note. Detailed Assessment rubrics need to be prepared by the course-wise teachers for the above tasks. Teachers can also design different tasks as per requirement, for end-semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to the electrical power plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) **Books** :

S. No.	Title	Author	Publisher	Edition & Year
1	HVDC Power Transmission Systems	K. R. Padiyar	New Age International Publishers	2011
2	High Voltage Direct Current Transmission	J. Arrillaga	Peter Peregrinus Ltd.	1983
3	Direct Current Transmission	E. W. Kimbark	Wiley-Inter science	1971
4	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE304
Course Title: HVDC Transmission Systems

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team Work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: Understand the advantages of DC transmission over AC transmission.	2	2	1	3	2	1	1	1	2	1	1	2	2	2
CO 2: Understand the operation of Line Commutated Converters and Voltage Source Converters.	3	3	3	2	1	2	1	1	1	1	2	2	2	2
CO 3: Understand the control strategies used in the HVDC transmission system.	2	3	2	1	1	2	2	2	1	1	2	3	1	2
CO 4: Understand different components of HVDC system	3	3	2	2	3	2	1	3	2	1	2	2	3	3
CO 5: Understand the improvement of power system stability using an HVDC system.	3	2	2	1	1	3	2	3	1	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2, 3, 4	CO-1: Understand the advantages of DC transmission over AC transmission.	SO1.1, SO1.2 SO1.3, SO1.4 SO1.5		**Unit-1: DC Transmission Technology.** 1.1,1.2,1.3,1.4,1.5	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2, 3, 4	CO-2: Understand the operation of Line Commutated Converters and Voltage Source Converters.	SO2.1SO2.2 SO2.3 SO2.4 SO2.5 SO2.6 SO2.7 SO2.8		**Unit-2**: **Analysis of Line Commutated and Voltage Source Converters** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9, 2.10,2.11,2.12	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2, 3, 4	CO-3: Understand the control strategies used in the HVDC transmission system.	SO3.1, SO3.2 SO3.3 SO3.4 SO3.5		**Unit-3: Control of HVDC Converters** 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2, 3, 4	CO-4: Understand the various components of the HVDC transmission system.	SO4.1, SO4.2 SO4.3 SO4.4		**Unit-4: Components of HVDC Systems** 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2, 3, 4	CO-5: Understand the improvement of power system stability using an HVDC system.	SO5.1, SO5.2 SO5.3 SO5.4 SO5.5		**Unit 5: Stability Enhancement using HVDC Control.** 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7,5.8	1

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester- VI

Course Code:	**EE305**
Course Title :	**High Voltage Engineering**
Pre-requisite:	Students should have basic knowledge of Semiconductor Physics.
Rationale:	A process of introducing formal knowledge of the Process of Breakdown in different materials, Generation, Measurement, and testing of High Voltage.

Course Outcomes:

EE305.1: Understand Breakdown in Gases.
EE305.2: Understand Breakdown in liquid and solid Insulating materials.
EE305.3: Understand the concept of Generation of High Voltages.
EE305.4: Measure High Voltages and Currents.
EE305.5: Perform High Voltage Testing of Electrical Apparatus

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Professional Elective course (PEC)	EE305	High Voltage Engineering	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field, or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project, etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL must be planned and performed under the teacher's continuous guidance and feedback to ensure the Learning outcome.

Scheme of Assessment:
Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment**	**Total Marks**
			Class/ Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	**(ESA)**	(PRA + ESA)
PEC	EE305	High Voltage Engineering	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE305.1: Understand Breakdown in Gases.
Approximate Hours

Item	AppX Hrs
Cl	08
LI	0
SW	01
SL	01
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learni ng (SL)
SO1.1 Understand the Ionization processes and de-ionization processes. **SO1.2** Understand the types of Discharge. **SO1.3** Understand the concept of Breakdown in Gases. **SO1.4** Understand the concept of Townsend's Theory. **SO1.5** Streamer Mechanism, and Corona Discharge.	.	**Unit-1: Breakdown in Gases** 1.1 Ionization processes and de-ionization processes 1.2 Types of Discharge 1.3 Gases in Insulating Materials 1.4 Breakdown in Uniform Gap 1.5 Breakdown in Non-UniformGaps 1.6 Townsend's Theory 1.7 Streamer Mechanism 1.8 Corona Discharge	1. Understan d the various concepts of the Breakdow n in Gases.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Write down all the concepts of Breakdown in Gases.

b. **Mini Project:**
   i. Describe Corona's Discharge through a Chart.

EE305.2: Understand Breakdown in liquid and solid Insulating materials.

Approximate Hours

Item	AppX Hrs
Cl	06
LI	0
SW	01
SL	01
Total	08

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 To Understand the breakdown in liquids. **SO2.2** To understand the breakdown in dielectrics. **SO2.3** To understand the electromechanical breakdown. **SO2.4** To understand the thermal breakdown. **SO2.5** To Understand Applications of insulating materials	.	**Unit-2 Breakdown in liquid and solid Insulating materials.** 2.1 Breakdown in pure and commercial liquids 2.2 Solid dielectrics and composite dielectrics 2.3 Intrinsic breakdown 2.4 Electromechanical breakdown and thermal breakdown 2.5 Partial discharge 2.6 Applications of insulating materials	1. Learn and gain knowledge of Breakdown in liquids and solids.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Make Notes of Breakdown in liquids and Solids.

b. Mini Project:

i. Draft the Chart of Breakdown in Liquids, and Solids.

EE305.3: Understand the concept of Generation of High Voltages.

Approximate Hours

Item	AppX Hrs
Cl	05
LI	0
SW	01
SL	01
Total	07

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Lea rning (SL)
SO3.1 To Understand the Generation of High Voltage. **SO3.2** To Understand the generation of insulation voltage. **SO3.3** To Understand the generation of impulse current. **SO3.4** To Understand the tripping and control of impulse generators.	.	**Unit-3: Generation of High Voltage.** 3.1 Generation of high voltages 3.2 Generation of high D. C. and A.C. voltages 3.3 Generation of impulse voltages 3.4 Generation of impulse currents 3.5 Tripping and control of impulse generators	1. To ensure all the concepts of High Voltage should be learned.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Make the notes of the Chapter.

EE305.4: Measure High Voltages and Currents.

Approximate Hours

Item	AppX Hrs
Cl	14
LI	0
SW	01
SL	01
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Evaluation of various components. **SO4.2** To Understand the Workings of CRO. **SO4.3** To Study the various measurement techniques and applications. **SO4.4** Understand the concept of lightning and overvoltage. **SO4.5** Understand the different leaders. **SO4.6** Study the protective schemes.	.	**Unit-4: Measurements of High Voltages and Currents.** 4.1 Peak Voltage 4.2 Impulse voltage and high direct current measurement method 4.3 Cathode Ray Oscillographs for impulse voltage and current measurement 4.4 Measurement of dielectric constant and loss factor 4.5 Partial discharge measurements 4.6 Lightning and Switching Over-voltages 4.7 Charge formation in clouds 4.8 Stepped leader 4.9 Dart leader 4.10 Lightning Surges 4.11 Switching over-voltages 4.12 Protection against over-voltages 4.13 Surge Diverters 4.14 Surge Modifiers	1. Make Well-Organized Notes on All Concepts of Measurement of High Voltages, and Currents.

SW-4 **Suggested Sessional Work (SW):**

a. **Assignments:**
   i. Make Proper Notes of this Chapter.

b. **Mini Project:**
   i. Evaluate the Diagram of the Various Concepts.

EE305.5: Perform High Voltage Testing of Electrical Apparatus

Approximate Hours

Item	AppX Hrs
Cl	10
LI	0
SW	01
SL	01
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 To Understand the various standards of testing. **SO5.2** To Understandthe IS, IEC Codes. **SO5.3** To Study the testing of various apparatus. **SO5.4** To Understand the Various Equipment. **SO5.5** To Study the Various Layouts.		**Unit 5: High Voltage Testing of Electrical Apparatus and High Voltage Laboratories.** 5.1 Various standards for HV Testing of electrical apparatus 5.2 IS, IEC standards 5.3 Testing of insulators and bushings 5.4 Testing of isolators and circuit breakers 5.5 Testing of cables 5.6 Power transformers and some high-voltage equipment 5.7 High voltage laboratory layout 5.8 Indoor and outdoor laboratories 5.9 Testing facility requirements 5.10 Safety Precautions in H. V. Labs	1. To ensure Complete notes of the chapter related to this chapter.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**Prepare the list of IS, IEC Codes.

b. **Mini Project:**
   i. Draw the chart of Various Equipments.

Brief of Hours Suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE305.1: Understand Breakdown in Gases.	08	01	01	10
EE305.2: Understand Breakdown in liquid and solid Insulating materials.	06	01	01	08
EE305.3: Understand the concept of Generation of High Voltages.	05	01	01	07
EE305.4: Measure High Voltages and Currents.	14	01	01	16
EE305.5: Perform High Voltage Testing of Electrical Apparatus	10	01	01	12
Total Hours	43	05	05	53

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Breakdown in Gases	03	01	01	05
CO-2	Breakdown in Liquids, and insulating solids	02	06	02	10
CO-3	High Voltage Generation	02	05	06	13
CO-4	Measurements of High Voltages and High Currents	03	05	05	13
CO-5	High Voltage Testing of Electrical Apparatus and High Voltage Laboratories	01	04	04	09
Total		11	21	18	50

Legend: R: Remember, U: Understand, A: Apply

The end-of-semester assessment for High Voltage Engineering will be held with the written examination of 50 marks.

Note. Detailed Assessment rubrics need to be prepared by the course-wise teachers for the above tasks. Teachers can also design different tasks as per requirement, for end-semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to the electrical power plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)
9. Brainstorming

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Suggested Learning Resources:

(a) **Books** :

S. No.	Title	Author	Publisher	Edition & Year
1	High Voltage Engineering	M. S. Naidu and V. Kamaraju	McGraw Hill Education	2013
2	High Voltage Engineering	C. L. Wadhwa	New Age International Publishers	2007
3	High Voltage Engineering Fundamentals	D. V. Razevig (Translated by Dr. M. P. Chourasia)	Khanna Publisher	1993
4	High Voltage Engineering Fundamentals	E. Kuffel, W. S. Zaengl and J. Kuffel	Newnes Publication	2000
5	High Voltage and Electrical Insulation Engineering	R. Arora and W. Mosch	John Wiley & Sons	2011
6	Various IS standards for HV Laboratory Techniques and testing.			
7	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

Cos, POs and PSOs Mapping

Course Title: B. Tech. Electrical Engineering
Course Code: EE305
Course Title: High Voltage Engineering

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Teamwork	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: Understand Breakdown in Gases.	2	2	3	2	2	1	1	1	2	1	1	2	2	2
CO 2: Understand Breakdown in liquid and solid Insulating materials.	2	2	1	3	1	2	1	1	1	1	2	2	2	2
CO 3: Understand the concept of Generation of High Voltages.	3	3	2	1	1	2	2	2	1	1	2	3	1	2
CO 4: Measure High Voltages and Currents.	2	3	3	2	3	2	1	3	2	1	2	2	3	3
CO 5: Perform High Voltage Testing of Electrical Apparatus	2	3	3	1	2	3	2	3	1	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2, 3, 4	**CO1:** Understand Breakdown in Gases.	SO1.1,SO1.2 SO1.3, SO1.4 SO1.5		**Unit-1: Breakdown in gases** 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2, 3, 4	**CO 2:** Understand Breakdown in liquid and solid Insulating materials.	SO2.1, SO2.2 SO2.3 SO2.4 SO2.5		**Unit-2**: **Breakdown in liquid and solid Insulating materials.** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2, 3, 4	**CO 3:** Understand the concept of Generation of High Voltages.	SO3.1,SO3.2 SO3.3 SO3.4		**Unit-3 : Generation of High Voltage** 3.1, 3.2, 3.3, 3.4, 3.5	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2, 3, 4	**CO 4:** Measure High Voltages and Currents.	SO4.1, SO4.2 SO4.3, SO4.4 SO4.5		**Unit-4: Measurements of High Voltages and Currents.** 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13, 4.14	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2, 3, 4	**CO 5:** Perform High Voltage Testing of Electrical Apparatus	SO5.1SO5.2 SO5.3 SO5.4SO5.5		**Unit 5: High Voltage Testing of Electrical Apparatus and High Voltage Laboratories.** 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10	1

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester VI

Course Code: **EE306**

Course Title: **Power quality and FACTS**

Pre- Requisite: Engineering Mathematics, Engineering Physics and Electromagnetic field theory.

Rationale: The purpose of this course is to familiarize the students with FACTS devices their operating characteristics and their applications in transmission and distribution system.

Course Outcomes: At the end of this course, students will demonstrate the ability to

EE306.1: Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.
EE306.2: Understand the working principles of FACTS devices, their operating characteristics and Applications
EE306.3: Understand the Voltage Source Converter based FACTs and their operation and control
EE306.4 Understand the power quality problems in distribution System.
EE306.5 understanding the operating behavior and control strategies of DVR, UPQC and STATCOM

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Professional Elective course (PEC)	EE306	Power Quality and FACTs	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop,field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback ofteacher to ensure outcome of Learning.

Course Category	Course Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks (PRA+ ESA)**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (A+CT+ SA+ CAT+ AT)		
PEC	**EE306**	Power Quality and FACTs	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE306.1: Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.

Approximate Hours

Item	AppX Hrs
Cl	4
LI	0
SW	1
SL	2
Total	7

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 understand the AC Transmission system SO1.2 understanding the uncompensated AC transmission lines. SO1.3 understanding the power Compensation schemes SO1.4 be able to understand the Shunt and series compensation.		**Unit-1.0 Transmission Lines and Series/Shunt Reactive Power Compensation** **1.1** Basics of AC Transmission. **1.2** Analysis of uncompensated AC transmission lines. **1.3** Passive Reactive Power Compensation. **1.4** Shunt and series compensation and its Comparison	**1.** numerical

SW-1 Suggested Sessional Work (SW):

a. assignments
   i. numerical problems on the transmission lines
   ii. Explaining the shunt and series compensation and its impact on the performance of transmission line.

EE306.2: Understand the working principles of FACTS devices and their operating characteristics.

Approximate Hours

Item	AppX Hrs
Cl	10
LI	0
SW	2
SL	2
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 understandingthe Thyristor-based FACTS devices: **SO2.2.** understand the Static VAR Compensator (SVC), **SO2.3** to learn about Thyristor Controlled Series Capacitor (TCSC), **SO2.3** to learn about the Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. **SO2.4** to be acknowledged about the Configurations and Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter **SO2.5** learning the applications of FACTS		**Unit-2.0 Thyristor-based Flexible AC Transmission Controllers (FACTS) and Its applications** **2.1** Description and Characteristics of Thyristor-based FACTS devices: **2.2** Static VAR **2.3** Compensator (SVC), **2.4** Thyristor Controlled Series Capacitor (TCSC), **2.5** Thyristor Controlled Braking Resistor and Single **2.6** Pole Single Throw (SPST) Switch. **2.7** Configurations/Modes of Operation, Harmonics and control of SVC **2.8** TCSC. **2.9** Fault Current Limiter **2.10** Applications of FACTS for stability and power flow quality	**1.** numerical

SW-2 Suggested Sessional Work

a. Assignment work

i. Explain the Thyristor controlled Series Capacitor TCSC

ii. Design and explain the simulation diagram for the TCSC and STATCOM based control for power flow quality control.

EE306.3: Understand the Voltage Source Converter based FACTs and their operation and control

Approximate Hours

Item	AppX Hrs
Cl	8
LI	0
SW	1
SL	2
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 understanding the VSC and PWM for VSCs **SO3.2** understanding the SHE, and PWM for SHE, sinusoidal PWM and SVPWM. **SO3.3** understand the principle of operation of reactive power control with SSSC, UPFC **SO3.4** learning about interphase power flow controller **SO3.5** Series Compensator and fault current limiters		**Unit-3.0 Voltage Source Converter Based FACTS controllers** **3.1** Voltage Source Converters (VSC) and Pulse Width Modulation for VSCs. **3.2** Multi-pulse and Multi-level Converters, **3.3** Selective Harmonic Elimination, Sinusoidal PWM and Space Vector Modulation. **3.4** STATCOM: Reactive Power Control: Type I and Type II controllers, **3.5** Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC): **3.6** Interphase Power Flow Controller. **3.7** GTO Controlled Series Compensator. **3.8** Fault Current Limiter.	**1.** numerical

SW-3 Suggested Sessional work

a. **Assignments**
   i. Explain about the static compensators and UPFC power flow controller
   ii. Explain the impact of noise and how to reduce in by PWM and impact of SHE with PWM in harmonics.

EE306.4 Understand the power quality problems in distribution System.

Approximate Hours

Item	AppX Hrs
Cl	5
LI	0
SW	1
SL	2
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 learning different power quality issues in power distribution system **SO4.2** understand about transient and steady state conditions of voltage, frequency and currents **SO4.3** understand waveform distortion and various unwanted variations in power system **SO 4.4** Tolerance and CBEMA curve		**Unit-4.0 Power Quality Problems in Distribution Systems** **4.1** Power Quality problems in distribution systems: **4.2** Transient and Steady state variations in voltage and frequency. **4.3** Unbalance, Sags, Swells, Interruptions, Wave-form **4.4** Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. **4.5** Tolerance of Equipment and CBEMA curve.	**1.** numerical

SW-4 Suggested Sessional work

a. assignments

i. Enumerate different power quality issues in power distribution systems

ii. Explain the various transient condition which distort the voltage and current profiles and explain issues.

EE306.5 understanding the operating behavior and control strategies of DASTATCOM, DVR and UPQC

Approximate Hours

Item	AppX Hrs
Cl	13
LI	0
SW	1
SL	2
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 understanding the reactive power control **SO5.2** understanding the harmonic and unbalance mitigation schemes in distribution systems **SO5.3** Study of synchronous reference frame extraction **SO5.4** learning the working of DVR, UPQC and series active filters		**Unit-5.0 Reactive Power Compensation Schemes** **5.1 R**eactive Power Compensation, **5.2** Harmonics and Unbalance mitigation in Distribution Systems **5.3** Mitigation of harmonics and unbalance in using DSTATCOM **5.4** Shunt Active Filters. **5.5** Synchronous Reference Frame **5.6** Extraction of Reference Currents. **5.7** Current Control Techniques in for DSTATCOM. **5.8** Voltage Sag/Swell mitigation: **5.9** Dynamic Voltage Restorer – Working Principle and Control Strategies. **5.10** Series Active Filtering. **5.11** Unified Power Quality Conditioner (UPQC): **5.12** Working Principle. **5.13** Capabilities and Control Strategies.	1. numerical

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+LI+SW+Sl)
EE306.1: Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.	4	1	2	7
EE306.2: Understand the working principles of FACTS devices and their operating characteristics.	10	2	2	14
EE306.3: Understand the Voltage Source Converter based FACTs and their operation and control	8	2	1	11
EE306.4 Understand the power quality problems in distribution System.	5	2	1	8
EE306.5 understanding the operating behavior and control strategies of DASTATCOM, DVR and UPQC	13	2	1	16
Total Hours	40	12	6	58

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.	01	03	01	05
CO-2	Understand the working principles of FACTS devices and their operating characteristics.	02	10	03	15
CO-3	Understand the Voltage Source Converter based FACTs and their operation and control	03	07	05	15
CO-4	Understand the power quality problems in distribution System.	02	03	-	05
CO-5	PEC-EE08.6 understanding the operating behavior and control strategies of DASTATCOM, DVR and UPQC.	02	06	02	10
Total		10	29	11	50

Legend: **R: Remember, U: Understand, A: Apply**

The end of semester assessment. for Power Quality and FACTS will be held with written examination of 50marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Understanding FACTS: Concepts and Technology of FACTS Systems	N. G. Hingorani and L. Gyugyi	Wiley-IEEE Press	1999
2	FACTS Controllers in Power Transmission and Distribution	K. R. Padiyar	New Age International (P) Ltd.	2007
3	Reactive Power Control in Electric Systems	T. J. E. Miller	John Wiley and Sons, New York	1983
4	Electrical Power Systems Quality	R. C. Dugan	McGraw Hill Education	2012
5	Electric Power Quality	. G. T. Heydt	Stars in a Circle Publications	1991

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos, POs and PSOs mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE306
Course Title: Power Quality and FACTS

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.	3	3	2	3	1	1	3	2	3	3	2	3	3	3
CO3: Understand the working principles of FACTS devices and their operating characteristics.	2	3	3	3	1	1	3	2	3	2	3	3	3	3
CO3: Understand the Voltage Source Converter based FACTs and their operation and control	3	3	2	2	2	1	3	2	3	3	2	3	3	2
CO4: Understand the power quality problems in distribution System.	3	3	1	2	2	1	3	2	1	2	-	3	3	3
CO5: Understanding the operating behavior and control strategies of DSTATCOM, DVR and UPQC.	3	3	3	1	1	1	3	2	1	2	3	3	3	3

Legend: 1 – Low, 3 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,3,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO1. Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.	SO1.1 SO1.2 SO1.3 SO1.4		Unit-1.0 **Transmission Lines and Series/Shunt Reactive Power Compensation** 1.1,1.2,1.3,1.4	1
PO 1,3,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO 3: Understand the working principles of FACTS devices and their operating characteristics.	SO3.1 SO3.3 SO3.3 SO3.4 SO3.5		Unit-2 **Thyristor-based Flexible AC Transmission Controllers (FACTS) and Its applications** 3.1, 3.3, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8,3.9,3.10	1
PO 1,3,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO3 : Understand the Voltage Source Converter based FACTs and their operation and control	SO3.1 SO3.3 SO3.3 SO3.4 SO3.5		Unit-3 : **Voltage Source Converter Based FACTS controllers** 3.1, 3.3,3.3,3.4,3.5,3.6,3.7,3.8	1
PO 1,3,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO 4: Understand the power quality problems in distribution System.	SO4.1 SO4.3 SO4.3 SO4.4		Unit-4 : **Power Quality Problems in Distribution Systems** 4.1, 4.3,4.3,4.4,4.5	1
PO 1,3,3,4,5,6 7,8,9,10,11,12 PSO 1,2	CO 5: understanding the operating behavior and control strategies of DSTATCOM, DVR and UPQC.	SO5.1 SO5.3 SO5.3 SO5.4		Unit 5: **Reactive Power Compensation Schemes** 5.1,5.3,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10, 5.11,5.12,5.13	1

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-VI

Course Code: **OEC306**

Course Title: **Power Plant Engineering**

Pre- requisite: Student should have basic knowledge engineering thermodynamics, mechanical engineering fundamentals and electrical engineering basics.

Rationale: Its primary rationale is to generate electrical power efficiently and reliably to meet the demands of industries, businesses, and households.

Course Outcomes:

OEC306.1: Discuss various components of steam power plant and the factors influencing the site selection for the plant.

OEC306.2: Illustrate the working of gas turbine and combined power plant and its components.

OEC306.3: Explain the components, principles and working of nuclear power plant

OEC306.4: Explain the working of hydroelectric power plant and renewable power system

OEC306.5: Explain the economics involved in Power Plant and identify the factors related to selection of plant

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Open elective course (OEC)	OEC306	Power Plant engineering	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop,field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self Learning,

C:Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback ofteacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT+AT)		
OEC	OEC306	Power plant engineering	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

OEC306.1: Discuss various components of steam power plant and the factors influencing the site selection for the plant...

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	2
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Demonstrate how to conduct routine maintenance on specific plant equipment. Apply safety protocols when operating machinery in the plant. **SO1.2** Evaluate the efficiency of different types of coal in power generation. Assess the environmental impact of a coal-based thermal power plant. Analyse data related to energy output and consumption. **SO1.3** Judge the effectiveness of new technologies in reducing emissions from coal-based power plants. **SO1.4** Design a proposal for optimizing the efficiency of a coal-based thermal power plant.		**Unit-1.0 Introduction** and **Coal based Thermal Power Plants** 1.1 Introduction of power plant 1.2 classification based on energy sources 1.3 Basic Rankine cycle and its modifications 1.4 ; Layout of modern coal power plant; 1.5 ; Super critical boilers, FBC boilers 1.6 Turbines, condensers, steam and heating rates 1.7; Fuel and ash handling; Draught system 1.8 ; Feed water treatment; 1.9 Binary cycles and cogeneration systems	**1.** Subsystems of thermal power plants **2.** Numerical problem related to thermodynamics laws

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Explain classification of power plant based on energy sources.
ii. Explain working and construction of Rankine cycle.

OEC306.2: Illustrate the working of gas turbine and combined power plant and its components.

Approximate Hours

Item	AppX Hrs
Cl	09
LI	00
SW	02
SL	01
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Describe the Brayton cycle and its application in gas turbine engines. Understand the concept of waste heat recovery and its role in combined cycle efficiency **SO2.2** Demonstrate the ability to calculate efficiency ratios for gas turbine power plants. Apply knowledge of gas turbine components to troubleshoot common issues. **SO2.3** Assess the environmental impact of gas turbine power plants in comparison to coal or nuclear plants. Evaluate the economic feasibility of implementing combined cycle technology in different regions. **SO2.4** Design a proposal for enhancing the efficiency of a gas turbine power plant. Develop a plan for integrating renewable energy sources into a combined cycle power plant.		**Unit-2.0 . Gas Turbine and Combined Cycle Power Plants:** 2.1 Brayton cycle 2.2 Brayton cycle analysis and optimization 2.3 numerical based on brayton cycle 2.4 introduction of gas turbine 2.5 component of gas turbine power plants 2.6 Combined cycle power plants 2.7 expression for efficiency of combined cycle power plants 2.8 Integrated Gasifier based Combined Cycle (IGCC) systems. 2.9 numerical based on IGCC systems.	1. Numericals of brayton cycle

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Drive the expression for efficiency of brayton cycle.

ii. Explain working and construction of IGCC system.

OEC306.3: Explain the components, principles and working of nuclear power plant

Approximate Hours

Item	AppX Hrs
Cl	09
LI	00
SW	01
SL	02
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Comprehending the principles of nuclear reactions, reactor dynamics, and the significance of safety measures. **SO3.2** Applying knowledge to operate control systems, manage reactor parameters, and respond to routine operational scenarios. **SO3.3** Assessing reactor performance data, identifying anomalies, and troubleshooting operational issues. **SO3.4** Critically evaluating safety procedures, emergency response plans, and proposing improvements based on		**Unit-3.0 Nuclear Power Plants:** 3.1 Introduction of nuclear power plant 3.2 Basics of nuclear energy conversion 3.3 ; Layout and subsystems of nuclear power plants 3.4 Boiling Water Reactor And Pressurized Water Reactor 3.5 CANDU Reactor 3.6 Pressurized Heavy Water Reactor (PHWR) 3.7); Fast Breeder Reactors (FBR) 3.8 Gas cooled and liquid metal cooled reactors 3.9 Safety measures for nuclear power plants.	1. Safeties measures in functioning of nuclear power plant 2. Environmental impact of nuclear power plant

past incidents or industry best practices. **SO3.5** Developing innovative approaches to enhance plant safety, designing new training methodologies for operators, or implementing novel reactor control strategies.			

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Explain working and construction of nuclear power plant with neat sketch diagram.
   ii. Explain fast breeder reactor.

OEC306.4: Explain the working of hydroelectric power plant and renewable power system

Approximate Hours

Item	AppX Hrs
Cl	09
LI	00
SW	01
SL	02
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1. Apply knowledge of hydroelectric power to solve simple problems related to energy production or efficiency. Analyse case studies of hydroelectric power plants and propose improvements for better performance. **SO4.2 Assess** the sustainability and long-term viability of Hydroelectric power compared to other renewable energy sources. **SO4.3** Design a hypothetical hydroelectric power system considering geographical, environmental, and economic factors. **SO4.4** Develop a proposal for optimizing existing hydroelectric power plants for increased efficiency or reduced environmental impact.		**Unit-4.0 Hydroelectric power plants and Renewable Power Systems** 4.1 .Introduction of hydroelectric power plants 4.2 classification of hydroelectric power plants 4.3 Typical layout and components of hydroelectric power plant 4.4 introduction of renewable power systems 4.5 **:** Principles and working of wind and tidal power plant 4.6 Principles and working of solar photo-voltaic and solar thermal power plant 4.7 Principles and working of geothermal power plant 4.8 Principles and working of biogas power plant 4.9 Principles and working of fuel cell power systems power plant	1. environmental impact of hydroelectric power system

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Explain working and construction of tidal power plant.
ii. Make layout of hydroelectric power system.

OEC306.5: Explain the economics involved in Power Plant and identify the factors related to selection of plant

Approximate Hours

Item	AppX Hrs
Cl	09
LI	00
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Understand the factors influencing energy pricing, such as market forces, government policies, and global trends **SO5.2** Apply economic models to analyze the impact of policy changes (e.g., carbon pricing, subsidies) on energy markets. **SO5.3** Evaluate the costs and benefits of different energy policies on both the economy and the environment **SO5.4** Develop a proposal for an energy strategy that optimizes resource allocation while minimizing environmental impact		**Unit-5. Energy Economics and Environment** 5.1 introduction to energy economics and environment 5.2 Economic and environmental issues 5.3 Power tariffs 5.4 ; Load distribution parameters 5.5 Load curve 5.6 Capital and operating cost of different power plants 5.7 Pollution control technologies 5.8 waste disposal options for coal and nuclear plants 5.9 calculation of energy economics	1. Explain the factors influencing energy prices,

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Explain renewable energy economics,.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Lecture (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+LI+SW+Sl)
OEC306.1: Discuss various components of steam power plant and the factors influencing the site selection for the plant.	9	0	1	2	12
OEC306.2: Illustrate the working of gas turbine and combined power plant and its components.	9	0	2	1	12
OEC306.3: Explain the components, principles and working of nuclear power plant	9	0	2	1	12
OEC306.4: Explain the working of hydroelectric power plant and renewable power system	9	0	2	1	12
OEC306.5: Explain the economics involved in Power Plant and identify the factors related to selection of plant	9	0	2	1	12
Total Hours	45	00	09	6	60

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	**U**	**A**	
CO-1	Introduction and Coal based Thermal Power Plants	03	01	01	05
CO-2	Gas Turbine and Combined Cycle Power Plants	02	06	02	10
CO-3	Nuclear Power Plants	03	07	05	15
CO-4	Hydroelectric Power Plants and Renewable Power Systems:	-	10	05	15
CO-5	Energy Economics and Environment	03	02	-	05
Total		11	26	13	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment .for power plant engineering will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Power Plant Engineering,	Nag P.K	Tata McGraw Hill	2008
2	Power Plant Technology	El Wakil M.M	Tata McGraw Hill	2010
3	Power Plant Engineering	Elliot T.C., Chen K and Swanekamp R C	McGraw Hill	1998
4	Power plant engineering	Er. R.K. Rajput	Laxmi publications.	.2016
5	Training Manual			
6	Training Manual			
7	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna .			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs, POs, and PSOs Mapping

programme Title: B. Tech. Electrical Engineering
Course Code: OEC307
Course Title: Power Plant Engineering

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: Discuss various components of steam power plant and the factors influencing the site selection for the plant.	3	3	2	3	1	1	3	2	3	3	2	3	3	3
CO2: Illustrate the working of gas turbine and combined power plant and its components.	2	3	3	3	1	1	3	2	3	2	3	3	3	3
CO3: Explain the components, principles and working of nuclear power plant	3	3	2	2	2	1	3	2	3	3	2	3	3	2
CO4: Explain the working of hydroelectric power plant and renewable power system	3	3	1	2	2	1	3	2	1	2	-	3	3	3
CO5: Explain the economics involved in Power Plant and identify the factors related to selection of plant	3	3	3	1	1	1	3	2	1	2	3	3	3	3

Legend: 1 – Low, 3 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO 1,3,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO1:** Discuss various components of steam power plan and the factors influencing the site selection for the plant.	SO1.1 SO1.2 SO1.3 SO1.4		**Unit-1.0** **Introduction and Coal based Thermal Power Plants** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	1,2
PO 1,3,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO2:** Illustrate the working of gas turbine and combined power plant and its components.	SO3.1 SO3.3 SO3.3 SO3.4		**Unit-2** **Gas Turbine and Combined Cycle Power Plants** 2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9	1
PO 1,3,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO3:** Explain the components, principles and working of nuclear power plant	SO3.1 SO3.3 SO3.3 SO3.4		**Unit-3 :** **Nuclear Power Plants** 3.1, 3.3,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1,2
PO 1,3,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO4:** Explain the working of hydroelectric power plant and renewable power system	SO4.1 SO4.3 SO4.3 SO4.4		**Unit-4** **Hydroelectric Power Plants and Renewable Power Systems** 4.1, 4.3,4.3,4.4,4.5,4.6,4.7,4.8,4.9	1
PO 1,3,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO5:** Explain the economics involved in Power Plant and identify the factors related to selection of plant	SO5.1 SO5.3 SO5.3 SO5.4		**Unit 5:** **Energy Economics and Environment** 5.1,5.3,5.3,5.4,5.5,5.6,5.7,5.8,5.9	1

Semester-VI

Course Code: **OEC307**

Course Title: **Strength of Materials**

Pre-requisite: Students must have knowledge of Calculus, linear algebra, physics (classical mechanics), differential equations, materials science basics, and mechanics of materials concepts.

Rationale: The study of Mechanics of Deformable Bodies is crucial for understanding structural behavior, enabling design, analysis, and optimization in engineering applications.

Course Outcomes:

OEC307.1 Apply elasticity principles to analyze and design structures, understanding stress-strain relationships, deformations, and temperature effects for practical engineering solutions."

OEC307.2 Analyze plane stresses using principal stresses, Mohr's circle, and transformations. Understand plain strain, principal strains, and combined loading in structures and pressure vessels.

OEC307.3 Develop shear force and bending moment diagrams for beams, understanding loading rate relationships and identifying maximum moments and contraflexure points.

OEC307.4 Derive flexural and shear formulas, analyze stress distribution, calculate slope and deflection using double integration method for standard cases.

OEC307.5 Analyze strain energy in axial loads, bending, torsion, determine torsion stresses, and study buckling of columns using Euler's and Rankine's formulas.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Open Elective (OEC)	OEC307	Strength of Materials	3	0	1	1	5	3

Legend: **CI:** Class room Instruction (Includes different instructional strategies i.e. Lecture(L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Course Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment**	**Total Marks**
			Class/ Home Assignment 5number 3marks each (CA)	Class Test 2 (2 best out Of 3) 10 marks each(CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	**(ESA)**	(PRA+ ESA)
Open Elective (OEC)	OEC307	Strength of Materials	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

OEC307.1: Apply elasticity principles to analyze and design structures, understanding stress-strain relationships, deformations, and temperature effects for practical engineering solutions."

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Define stress, strain, elastic constants, and material behavior principles. SO1.2 Interpret stress-strain diagrams for ductile and brittle materials, ensuring safety factors. SO1.3 Evaluate stresses and strains in determinate, indeterminate, homogeneous, and composite bars. SO1.4 Analyze temperature-induced stresses in simple structural members. SO1.5 Understand and apply interrelations between various elastic constants.		1.1 Introduction 1.2 Stresses and strain, Hooke's law 1.3 Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity 1.4 Modulus of Rigidity, Bulk Modulus. Interrelation between elastic constants, 1.5 Stress-strain diagram for ductile and brittle materials, factor of safety 1.6 Stresses and strains in determinate and indeterminate bars under self weight 1.7 Stresses and strains in determinate and indeterminate under concentrated loads. 1.8 Stresses and strains in homogeneous and composite bars under self weight. 1.9 Stresses and strains in homogeneous and composite bars under concentrated loads. Temperature stresses in simple members.	1. Explore the components and interpretation of stress-strain diagrams, including elastic deformation, yield point, ultimate strength, and fracture point.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Explain the concept of modulus of elasticity and how it relates to Hooke's Law in the context of engineering materials. Provide a real-life example to illustrate the practical application of these concepts.

OEC307.2: Analyze plane stresses using principal stresses, Mohr's circle, and transformations. Understand plain strain, principal strains, and combined loading in structures and pressure vessels.

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Apply Mohr's circle to analyze principal stresses and maximum shear stresses. **SO2.2** Understand Mohr's circle for plain strain, principal strains, and maximum shear strain. **SO2.3** Evaluate components under bending, torsion, and axial loads. **SO2.4** Analyze stresses in thin-walled pressure vessels. **SO2.5** Integrate knowledge to solve complex stress and strain scenarios.		2.1 Principal stresses and strain 2.2 Transformation of plane stresses, Principal stresses 2.3Maximum shear stresses, 2.4 Numerical solving 2.5 Mohr's circle for plane stresses 2.6 Plain strain and its Mohr's circle representation 2.7 Principal strains, Maximum shear strain. 2.8 Combined Loading: Components subjected to bending, torsion & axial loads. 2.9 Analysis of thin pressure vessels.	1. Learn how to apply Mohr's circle to transform stresses from one coordinate system to another, particularly focusing on plane stress conditions.

SW-2 Suggested Sessional Work(SW):

a. Assignments:

i. Explain the concept of Mohr's circle for plane stresses.

ii. Construct the Mohr’s circle for a given set of plane stress components and determine the principal stresses.

OEC307.3: Develop shear force and bending moment diagrams for beams, understanding loading rate relationships and identifying maximum moments and contraflexure points.

Approximate Hours

Item	AppXHrs
Cl	8
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO3.1 Construct shear force and bending moment diagrams for various loads. **SO3.2** Understand the connection between loading rates, shear force, and bending moments. **SO3.3** Identify and calculate maximum bending moments in statically determinate beams. **SO3.4** Determine positions of points of contraflexure in beam structures.		3.1 Types of Beam 3.2 Shear force and bending moment 3.3 Shear force and bending moment diagrams for statically determinate beam due to concentrated load 3.4 Shear force and bending moment diagrams for statically determinate beam due to uniformly distributed load 3.5 Shear force and bending moment diagrams for statically determinate beam due to uniformly varying load 3.6 Shear force and bending moment diagrams for statically determinate beam due to couple	1. Enhance problem-solving skills by solving numerical exercises related to the analysis of beams and the construction of shear force and bending moment diagrams.

		3.7 Relationship between rate of loading, shear force and bending moment. 3.8 Maximum bending moment and position of points of contra flexure	

SW-3 Suggested Sessional Work(SW):

a. **Assignments:**

i. Explain how shear force and bending moment are related to the internal forces and moments experienced by a beam

OEC307.4: Derive flexural and shear formulas, analyze stress distribution, calculate slope and deflection using double integration method for standard cases.

Approximate Hours

Item	AppX Hrs
Cl	10
LI	0
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Derive flexural formula, stress distribution, moment of resistance. SO4.2 Derive distribution formula, analyze common sections. SO4.3 Relate bending moment, analyze determinate beams using integration.		**UNIT-4.0** 4.1 Theory of simple bending, assumptions, Derivation of flexural formula 4.2 Second moment of area of common cross sections (rectangular, I,T,C) with respect to centroidal and parallel axes 4.3Bending stress distribution diagrams, moment of	1. Explore the concepts of maximum and average shear stresses and their significance in beam design.

SO4.4 Calculate second moment for various cross sections, stress diagrams. SO4.5 Explore shear stresses, connections between flange and web.		resistance and section modulus. 4.4 Shear stresses: Concept, derivation of shear stress distribution formula, 4.5 shear stress distribution diagrams for common symmetrical sections, 4.6 maximum and average shears stresses, 4.7 shear connection between flange and web. 4.8 Slope and deflection of beams: Relation between bending moment and slope 4.9 Slope and deflection of determinate beams, 4.10 Double integration method (Macaulay's method), Derivation of formula for slope and deflection for standard cases.	

SW-4 Suggested Sessional Work(SW):

Assignments:

i. Sketch the bending stress distribution diagram for a beam subjected to a uniformly distributed load.

OEC307.5 Analyze strain energy in axial loads, bending, torsion, determine torsion stresses, and study buckling of columns using Euler's and Rankine's formulas.

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 Analyze gradual, sudden, and impact scenarios. SO5.2 Examine stresses, strains, and deformations in determinate shafts. SO5.3 Derive Euler's formula, evaluate safe loads, consider end conditions. SO5.4 Investigate torsion, bending, and axial force interactions. SO5.5 Understand energy aspects in bending, torsion.		5.1 Strain energy: Strain energy due to gradual load 5.2 Strain energy due to sudden load, Strain energy due to impact load, 5.3 Strain energy due to bending and torsion. Stresses, strain and deformations in determinate shafts of solid and hollow, homogeneous and composite circular cross section subjected to twisting moment, 5.4 derivation of torsion equation, 5.5 stresses due to combined torsion, bending and axial force on shafts. 5.6 Buckling of columns: Concept of buckling of columns, 5.7 derivation of Euler's formula for buckling load for column with hinged ends, 5.8 Concept of equivalent length for various end conditions, 5.9 limitations of Euler's formula, Rankine's formula, safe load on columns.	1. Understand the concept of buckling in columns and its implications for structural stability.

SW-5 Suggested Sessional Work(SW):

a. Assignments:

1. Discuss the stresses induced in structural elements subjected to combined loading, including torsion, bending, and axial forces.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
OEC307.1: Apply elasticity principles to analyze and design structures, understanding stress-strain relationships, deformations, and temperature effects for practical engineering solutions."	9	1	1	11
OEC307.2: Analyze plane stresses using principal stresses, Mohr's circle, and transformations. Understand plain strain, principal strains, and combined loading in structures and pressure vessels.	9	1	1	11
OEC307.3: Develop shear force and bending moment diagrams for beams, understanding loading rate relationships and identifying maximum moments and contra flexure points.	8	1	1	10
OEC307.4: Derive flexural and shear formulas, analyze stress distribution, calculate slope and deflection using double integration method for standard cases.	10	1	1	12
OEC307.5: Analyze strain energy in axial loads, bending, torsion, determine torsion stresses, and study buckling of columns using Euler's and Rankine's formulas.	9	1	1	11
Total Hours	45	5	5	55

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Simple stresses and strains	03	01	01	05
CO-2	Principal stresses and strains	02	06	02	10
CO-3	Shear Force and Bending Moment Diagrams	03	07	05	15
CO-4	Stresses in Machine Elements, Slope and deflection of beams	-	10	05	15
CO-5	Strain energy and Buckling of columns:	03	02	-	05
Total		11	26	13	50

Legend: R:Remember, U:Understand, A:Apply

The end of semester assessment for Strength of Materials s it will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course-wise teachers for above tasks. Teachers can also design different tasks as per requirement , for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role-play
6. ICT Based Teaching Learning (VideoDemonstration/Tutorials CBT, Blog , Facebook, Twitter, Whats-app, Mobile, Online sources)
7. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher
1	Strength of Materials	Gere &Timoshenko	CBS Publication
2	Strength of Materials	Ramamurtham	Dhanpat Rai Publication.
3	Strength of Material	S.S. Rattan	Tata McGraw Hill Publication Co. Ltd.
4	Strength of Materials- 3rd Edition	G. H. Ryder	Macmillan Pub, India
5	Strength of Material	Beer and Johnston	CBS Publication
6	Introduction to Mechanics of Solids	E.P. Popov	Prentice Hall Publication
7	Introduction to Mechanics of Solids	Singer and Pytel	Harper and row Publication.
8	Strength of Material	B.K. Sarkar	Tata McGraw Hill New Delhi

****

Curriculum Development Team

1. **Mr. S.S. Parihar, Head of Deptt. Mech. Engg., AKS University**
2. **Mr. Alok Ranjan Tiwari , Assistant Professor, Dept. of Mechanichal Engg.**
3. **Mr Deepak Pandey , Assistant Professor , Dept. of Mechanichal Engg**
4. **Mr.,Keshav Pratap Singh, Assistant Professor , Dept. of Mechanichal Engg**
5. **Mr.Amar Soni , Assistant Professor , Dept of Mechanichal Engg**
6. **Mr K.P Tiwari , Assistant Professor , Dept. of Mechanichal Engg**
7. **Mr. Ketan Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
8. **Mr. K.C. Kori, Faculty, Assistant Professor , Dept. of Mechanichal Engg**
9. **Mr,Lokesh Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
10. **Mr. Ram Narayan Shukla, Assistant Professor , Dept. of Mechanichal Engg**
11. **Mr. Rishi Kumar Sharma, Assistant Professor , Dept. of Mechanichal Engg**
12. **Mr. Naveen Kumar Soni, Assistant Professor , Dept. of Mechanichal Engg**

Cos, POs and PSOs Mapping

Programme Title: B.Tech. Electrical Engineering
Course Code: OEC307
Course Title: Strength of Materials

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO 1: Apply elasticity principles to analyze and design structures, understanding stress-strain relationships, deformations, and temperature effects for practical engineering solutions."	1	1	2	2	3	2	3	2	2	1	3	2	2	3
CO 2: Analyze plane stresses using principal stresses, Mohr's circle, and transformations. Understand plain strain, principal strains, and combined loading in structures and pressure vessels.	1	1	2	2	1	2	3	2	1	1	2	2	2	2
CO 3: Develop shear force and bending moment diagrams for beams, understanding loading rate relationships and identifying maximum moments and contraflexure points.	2	2	1	1	1	2	2	2	1	2	1	2	1	1
CO 4: Derive flexural and shear formulas, analyze stress distribution, calculate slope and deflection using double integration method for standard cases.	3	2	2	2	3	2	3	2	2	1	2	3	3	3
CO 5: Analyze strain energy in axial loads, bending, torsion, determine torsion stresses, and study buckling of columns using Euler's and Rankine's formulas.	-	-	-	1	1	3	3	3	1	1	2	2	3	3

Legend:1–Low,2–Medium,3– High

Course Curriculum Map:

Pos &PSOs No.	Cos No. &Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	CO 1: Apply elasticity principles to analyze and design structures, understanding stress-strain relationships, deformations, and temperature effects for practical engineering solutions."	SO1.1, SO1.2 SO1.3, SO1.4 SO1.5		**Unit-1.0 Simple stresses and strains** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	1
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	CO 2: Analyze plane stresses using principal stresses, Mohr's circle, and transformations. Understand plain strain, principal strains, and combined loading in structures and pressure vessels.	SO2.1, SO2.2 SO2.3, SO2.4 SO2.5		**Unit-2.0 Principal stresses and strains** 2.1,2.2,2.3,2.4,2.5,2.6,2.7, 2.8,2.9	1
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	CO 3: Develop shear force and bending moment diagrams for beams, understanding loading rate relationships and identifying maximum moments and contraflexure points.	SO3.1, SO3.2 SO3.3, SO3.4		**Unit-3.0 : Shear Force and Bending Moment Diagrams** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8	1
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	CO 4: Derive flexural and shear formulas, analyze stress distribution, calculate slope and deflection using double integration method for standard cases	SO4.1, SO4.2 SO4.3, SO4.4 SO4.5		**Unit-4.0 : Stresses in Machine Elements, Slope and deflection of beams** 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10	1
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	CO 5: Analyze strain energy in axial loads, bending, torsion, determine torsion stresses, and study buckling of columns using Euler's and Rankine's formulas.	SO5.1, SO5.2 SO5.3, SO5.4 SO5.5		**Unit 5.0 Strain energy and Buckling of columns:** 5.1, 5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	1

Semester-VI

Course Code: **OEC308**

Course Title : **Fluid Machinery**

Pre-requisite: Students are expected to know the fundamentals of engineering mechanics, resolving of forces, Statics, Dynamics and flow kinematics.

Rationale: Fluid mechanics and hydraulics are core to engineering, offering vital insights into liquid and gas behavior for efficient system design across industries like power generation, aerospace, and infrastructure. Understanding fluid dynamics drives innovation, impacting energy, transportation, and environmental sectors globally, with applications reaching into fields like medicine and meteorology.

Course Outcomes:

OEC308.1: Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).

OEC308.2: Analyze fluid motion using Lagrangian/Eulerian methods, study flow lines and particle acceleration.

OEC308.3: Apply Euler's/Bernoulli's equations, understand Venturi meter, Orifice meter, and implications of momentum equations.

OEC308.4: Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena.

OEC308.5: Master boundary layer theory, friction factors, and separation control, plus dimensional analysis methods and model laws in fluid dynamics.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Open Elective OEC	OEC308	Fluid Machinery	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks (PRA+ ESA)**
			Class/ Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT+AT)		
OEC	OEC308	Fluid Machinery	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

OEC308.1: Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	01
SL	01
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Understand fluid characteristics like density, viscosity, and surface tension. SO1.2 Master pressure laws, buoyancy, and equilibrium in liquids. SO1.3 Apply fluid knowledge to solve real-world engineering challenges. SO1.4 Develop problem-solving skills in fluid statics scenarios. SO1.5 Use fluid principles for efficient system design across industries.		1.1 Introduction to fluid mechanics 1.2 Properties of fluid: Mass density, Weight density. Specific volume, Specific gravity, Viscosity, Surface tension. 1.3 Capillarity, Vapour pressure, Compressibility and bulk modulus. 1.4 Newtonian and non-Newtonian fluids. Fluid statics: Pressure, Pascal's law 1.5 Hydrostatic law, Pressure measurement 1.6Hydrostatic force on submerged plane 1.7 Hydrostatic force on curved surface 1.8 Buoyancy, Floatation, 1.9 Liquid in relative equilibrium.	1. Solve a set of practice problems related to hydrostatic law to reinforce your problem solving skills. 2. Explore Online simulations or Virtual labs related to Fluid Properties, Buoyancy and Floatation.

SW-1 Suggested Sessional Work(SW):

a. **Assignments:**

i. Explore and differentiate between Newtonian and non-Newtonian fluids. Provide real-world examples of each type and explain how their behavior diverges from conventional Newtonian fluid dynamics.

ii. Discuss the concept of pressure measurement in fluid systems. Explain at least three different methods of measuring fluid pressure and compare their advantages and limitations.

b. **Mini Project:**

i. Select diverse scenarios from everyday life where fluid dynamics play a crucial role (e.g., water flow in pipes, movement of liquids in different vessels, surface tension effects, etc.).

ii. Document and observe these scenarios, noting down relevant data such as fluid types, dimensions, and observed behaviors.

OEC308.2: Analyze fluid motion using Lagrangian/Eulerian methods, study flow lines and particle acceleration.

Approximate Hours

Item	AppX Hrs
Cl	09
LI	00
SW	01
SL	01
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Understand Lagrangian/Eulerian approaches, various flow types, and characteristics of flow lines. **SO2.2** Grasp continuity equations, fluid particle motion, accelerations, rotational flow, vorticity, and circulation. **SO2.3** Apply knowledge to create and analyze flow nets, understanding their utility in fluid systems. **SO2.4** Explore vortex dynamics and its significance in fluid systems.		2.1 Fluid Kinematics: Description of fluid motion, Langragian and Eulerian approach, 2.2 Type of fluid flow, Type of flow lines-path line, Streak line, Stream line, Stream tube 2.3 Continuity equation , Acceleration of a fluid particle 2.4 Motion of fluid particle along curved path 2.5 Normal and tangential acceleration 2.6 Rotational flow, Rotation 2.7 Vorticity, Circulation, 2.8 Stream and potential function, 2.8 Flow net, Its characteristics and utilities 2.9 Vortex motion.	1. Watch youtube videos on langragian and eulerian approach 2. Draw Stream Line pattern for various flows.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Explain the differences between the Langragian and Eulerian approaches in describing fluid motion. Provide examples to illustrate situations where each approach is more applicable and why.
   ii. Define laminar, turbulent, and transitional flow. Compare and contrast these types of flow, highlighting their characteristics and the factors influencing their occurrence. Provide real-world examples for each type of flow.

Mini Project:

i. Discuss the continuity equation and its significance in fluid dynamics.
ii. Explore the acceleration of a fluid particle, considering both normal and tangential components along curved paths. Provide examples to illustrate these concepts.

OEC308.3: Apply Euler's/Bernoulli's equations, understand Venturimeter, Orifice meter, and implications of momentum equations.

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Grasp Euler's and Bernoulli's equations and their practical applications in fluid dynamics. SO3.2 Explore Venturimeter, Orifice meter, Nozzle, and Pitot tube functionalities		3.1 Fluid dynamics: Euler's Equation 3.2 Bernoulli's equation and its practical application, 3.3 Venturimeter’ Orifice meter 3.4 Nozzle, Pitot tube 3.5 Impulse momentum equation	1. Choose a real life example and demonstrate how Bernoulli’s Equation can be applied to analyze the fluid mechanics. 2. Choose a fluid flow scenario and apply the

in measuring fluid flow. SO3.3 Apply impulse momentum and momentum of momentum equations for fluid behavior analysis. SO3.4 Understand kinetic energy and momentum correction factors in fluid systems' energy analysis. SO3.5 Apply Reynold's transport theorem to understand property transport in flowing fluids.		3.6 Momentum of Momentum equation 3.7 Kinetic energy 3.8 Momentum correction factor. 3.9 Reynold's transport theorem	Reynold's Transport Theorem to analyze the changes in mass, Momentum and energy with in the system.

SW-3 Suggested Sessional Work(SW):

a. Assignments:

i. Derive and explain the impulse momentum equation for a control volume. Discuss its significance in analyzing fluid flow problems and provide examples demonstrating its application.

Mini Project:

i. Collect and compile the data obtained from each flow measurement device.
ii. Analyze the data to calculate flow rates and compare the measurements obtained from different devices.

OEC308.4: Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO4:1 Understanding flow transitions from Reynold's experiment to viscous fluid behavior in pipes. SO4:2 Exploring shear stress and pressure gradient in Couette flow for parallel plate systems SO4:3 Grasping energy loss in pipes, hydraulic gradient, and optimizing pipe configurations. SO4:4 Applying equivalent pipe power transmission and managing water hammer effects in pipes.		4.1 Laminar & Turbulent flow: Reynold's experiment 4.2 F low of viscous fluids in circular pipe 4.3 Shear stress & velocity distribution for turbulent. 4.4 Shear stress and pressure gradient between two parallel plates 4.5 Couette flow 4.6 Flow through pipes: Loss of energy in pipes 4.7 Hydraulic gradient and total energy line 4.8 Pipe in series and parallel. 4.9 Equivalent pipe power transmission through pipe, Water hammer in pipes.	1. Explore the phenomenon of cavitation in fluid flow. Investigate the condition under which cavitation occurs, its effects on pipes and equipment, and methods to prevent or mitigate cavitation. 2. Explore the principles of Syphon Systems in Fluid Transport.

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Describe the characteristics of turbulent flow concerning shear stress and velocity distribution in a pipe. Compare and contrast these characteristics with those of laminar flow. Provide explanations supported by equations and graphical representations

Mini Project:

i. Study the behavior of pipe configurations in series and parallel, measuring flow rates and pressure differences.

ii. Simulate and analyze the occurrence and effects of water hammer in the pipe network.

OEC308.5: Master boundary layer theory, friction factors, and separation control, plus dimensional analysis methods and model laws in fluid dynamics.

Approximate Hours

Item	AppX Hrs
Cl	8
LI	0
SW	01
SL	2
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 Use Darcy-Weisbach and Moody's diagram for internal flow friction calculations. SO5.2 Differentiate laminar and turbulent layers, explore growth, and solutions for momentum layers. SO5.3 Solve equations, grasp momentum principles, and separation factors. SO5.4 Use Rayleigh's and Buckingham's methods for fluid behavior using dimensionless numbers. SO5.5 Explain Reynold's, Fraude's, Euler's, Weber's, and Mach's laws in predicting varied fluid behaviors.		5.1 Internal flows: Friction factor, Darcy- Weisbach friction factor, Moody's diagram, Boundary Layer theory 5.2 Boundary layer equation 5.3 Laminar and turbulent boundary layer and its growth over flat plat. 5.4 Momentum boundary layer and its solutions, separation of boundary layer and its control. 5.5 Dimensional analysis: Methods of dimensional analysis, Rayleigh's method 5.6 Buckingham's theorem, Limitations, Model analysis, Dimensionless number and their significance 5.7 Model laws, Reynolds model law, 5.8Fraud's model law, Euler's model law, Weber's model law, Mach's Model law.	1. Investigate methods to control and prevent boundary layer separation. 2. Investigate the limitations of dimensional analysis. 3. Choose a specific flow scenario and use Moody's Diagram to determine the friction Factor.

SW-5 Suggested Sessional Work(SW):

a. **Assignments:** Discuss real-world applications where understanding friction factors and boundary layer theory is crucial.

b. **Mini Project:** Construct a setup simulating flow over a flat plate using a wind tunnel or a controlled airflow system.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+LI+SW+SI)
OEC308.1: Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).	9	1	1	19
OEC308.2: Analyze fluid motion using Lagrangian/Eulerian methods, study flow lines and particle acceleration.	9	1	1	21
OEC308.3: Apply Euler's/Bernoulli's equations, understand Venturimeter, Orifice meter, and implications of momentum equations.	9	1	1	21
OEC308.4: Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena.	9	2	1	22
OEC308.5: Master boundary layer theory, friction factors, and separation control, plus dimensional analysis methods and model laws in fluid dynamics.	8	1	2	19
Total Hours	44	6	6	56

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Properties of Fluid and Fluid Statics	03	01	01	05
CO-2	Fluid Kinematics	02	06	02	10
CO-3	Fluid Dynamics	02	07	06	15
CO-4	Laminar and Turbulent Flow and Flow through Pipes	02	07	06	15
CO-5	Internal Flows and Dimensional Analysis	01	02	02	05
Total		10	23	17	50

Legend: R:Remember, U:Understand, A:Apply

The end of semester assessment for Fluid Machinery will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Onlinesources)
7. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Fluid Mechanics & Hydraulic Machines	S.S. Rattan	Khanna Book Publishing	2019
2	Introduction to Fluid Mechanics,	P.J. Pritchard, A.T. McDonald and R.W. Fox	Wiley India	2012
3	“Fluid Mechanics	F.M. White	Tata McGraw Hill	2011
4	“Introduction to Fluid Mechanics and Fluid Machines	S. K. Som, G. Biswas and S. Chakraborty	Tata McGraw Hill	2017
5	A Textbook of Fluid Mechanics and Hydraulic Machines	R. K. Bansal	Laxmi Publication	2005
6	Mechanics of Fluids	Shames	McGraw Hill Book Co. New Delhi	1988

****

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Curriculum Development Team

1. **Mr. S.S. Parihar, Head of Deptt. Mech. Engg., AKS University**
2. **Mr. Alok Ranjan Tiwari , Assistant Professor, Dept. of Mechanichal Engg.**
3. **Mr Deepak Pandey , Assistant Professor , Dept. of Mechanichal Engg**
4. **Mr.,Keshav Pratap Singh, Assistant Professor , Dept. of Mechanichal Engg**
5. **Mr.Amar Soni , Assistant Professor , Dept of Mechanichal Engg**
6. **Mr K.P Tiwari , Assistant Professor , Dept. of Mechanichal Engg**
7. **Mr. Ketan Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
8. **Mr. K.C. Kori, Faculty, Assistant Professor , Dept. of Mechanichal Engg**
9. **Mr,Lokesh Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
10. **Mr. Ram Narayan Shukla, Assistant Professor , Dept. of Mechanichal Engg**
11. **Mr. Rishi Kumar Sharma, Assistant Professor , Dept. of Mechanichal Engg**
12. **Mr. Naveen Kumar Soni, Assistant Professor , Dept. of Mechanichal Engg**

Cos, POs and PSOs Mapping

Programme Title: B. Tech Electrical Engineering

Course Code : OEC308

Course Title: Fluid Machinery

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Teamwork	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).	3	2	3	1	1	1	1	-	3	2	1	3	2	2
CO2: Analyze fluid motion using Lagrangian/Eulerian methods, study flow lines and particle acceleration.	3	2	2	1	1	2	1	2	2	1	2	3	2	2
CO3: Apply Euler's/Bernoulli's equations, understand Venturimeter, Orifice meter, and implications of momentum equations.	2	2	1	1	2	2	2	1	1	2	1	2	2	1
CO4: Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena.	3	2	2	1	3	1	3	1	2	1	-	2	3	3
CO5: Master boundary layer theory, friction factors, and separation control, plus dimensional analysis methods and model laws in fluid dynamics.	2	2	2	1	1	1	3	1	1	1	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning(SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO1:** Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 Properties of Fluid and Fluid Statics 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO2:** Analyze fluid motion using Lagrangian/Eulerian methods, study flow lines and particle acceleration.	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2 Fluid Kinematics 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO3:** Apply Euler's/Bernoulli's equations, understand Venturimeter, Orifice meter, and implications of momentum equations.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 : Fluid Dynamics 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO4:** Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena.	SO4.1 SO4.2 SO4.3 SO4.4		Unit-4 :laminar and turbulent flow and flow through pipes 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	**CO5:** Master boundary layer theory, friction factors, and separation control, plus dimensional analysis methods and model laws in fluid dynamics.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit 5: Internal flows and dimensional analysis 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	1,2,3

Semester-VI

Course Code:	**HSMC05**
Course Title:	**PROJECT MANAGEMENT**
Pre-requisite:	Student should have basic knowledge of Geometry, Geometrical Shapes, basic knowledge of Computer, Mouse and keyboard use, navigating menus and dialogs, managing files and directories, etc.
Rationale:	The rationale of measurement and metrology lies in ensuring precision, accuracy, and reliability across various fields. It is crucial for quality control, scientific research, safety, innovation, and international standards. Measurement and metrology contribute to efficiency, standardization, and progress in technology and society.

Course Outcomes:

HSMC05.1: Students will demonstrate an understanding of fundamental project management principles, including project lifecycle, stakeholders, constraints, and success criteria.
HSMC05.2: Students will be able to apply various project management methodologies
HSMC05.3: Students will develop comprehensive project plans that include scope definition, scheduling, resource allocation, budgeting, risk management, and communication strategies
HSMC05.4: Students will gain hands-on experience with project management tools and software
HSMC05.5: Students will assess project performance using key performance indicators (KPIs), metrics, and benchmarks, and make data-driven decisions to optimize project outcomes.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
HSMC	HSMC05	Project Management	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self-Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks (PRA+ ESA)**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+ CT+SA+CAT+AT)		
HSMC	HSMC 05	Project Management	15	20	5	5	5	50	50	100

Course- Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should show case their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

HSMC05.1: Students will demonstrate an understanding of fundamental project management principles, including project lifecycle, stakeholders, constraints, and success criteria

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	02
SL	02
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Define basic project management terms and concepts. SO1.2. Explain the purpose and importance of project management. SO1.3. Apply project management principles to analyze and solve basic project scenarios. SO1.4. Develop a project plan for a hypothetical project, integrating elements such as scope, schedule, budget, and risk management.		Unit 1: Introduction to Project Management 1.1 Introduction 1.2 Concept of Project 1.3 Meaning, 1.4 Characteristics, 1.5 Classification of Projects, 1.6 Project Life Cycle and Phases 1.7 Project Selection criteria, 1.8 Project Management 1.9 Line Management 1.10 Project Manager: 1.11 Roles and Responsibilities, 1.12 Project Management as a Profession	1What are the Basic element of measurement system 2.What are the different technique used for the measurement of displacement.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Explain the Project Life Cycle

ii. Explain characteristic of Project Manager

HSMC05.2: Students will be able to apply various project management methodologies

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	03
SL	02
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Recall the key activities involved in project execution and monitoring. SO2.2 Explain the purpose and importance of project execution and monitoring in achieving project objectives. SO2.3. Apply project management methodologies to execute project tasks effectively. SO2.4. Design a project communication plan to keep stakeholders informed about project progress and changes.		Unit-II: Project Execution and Monitoring 2.1 Generating and Screening Ideas 2.2 Steps, Monitoring the Environment, 2.3 Scouting for Project Ideas, 2.4 Preliminarily Screening 2.5 Project Rating Index. 2.6 Feasibility Studies 2.7 Technical, Financial Managerial 2.8 Economic Managerial 2.9 Social, Legal and Managerial. 2.10 Team formation and roles 2.11 Communication and leadership in project management 2.12 Resource allocation and management	1.Explain types of monitoring 2. Explain the objective of communication

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Explian the Project Rating Index.
2. Explain the function of Financial Managerial.
3. Write the principle of leadership in project management

HSMC05.3: Students will develop comprehensive project plans that include scope definition, scheduling, resource allocation, budgeting, risk management, and communication strategies

Approximate Hours

Item	AppX Hrs
Cl	09
LI	0
SW	02
SL	03
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Recall the basic financial terms and concepts related to estimates and projections. SO3.2. Explain the purpose and importance of financial estimates and projections in project planning and decision-making. SO3.3. Evaluate the financial viability of a project based on projected costs, revenues, and expected returns. SO3.4. Develop a comprehensive financial plan for a project, including cost estimates, revenue projections, and cash flow forecasts.		Unit 3: Financial Estimates and Projections 3.1 Project cost estimation & working capital requirements, 3.2 Sources of funds 3.3 Equity, debentures, term loans & their Cost of Capital. 3.4 Projected Cash Flow Statement & fund flow statement, 3.5 Projected Income statement and Balance sheet 3.6 Capital budgeting decisions 3.7 Payback Period, Accounting Rate of Return 3.8 NPV, Internal Rate of Return and BCR Method 3.9 project financing,	1. Write the short note on term loans. 2. Write the steps to make balance sheet.

SW-3 Suggested Sessional Work (SW):

a. **Assignments**:
   1. What are the sources of funds?
   2. Explain the Capital budgeting decisions

HSMC05.4: Students will gain hands-on experience with project management tools and software

Approximate Hours

Item	AppX Hrs
Cl	06
LI	0
SW	02
SL	02
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Memorize the types of risks commonly encountered in project management. SO4.2. Explain the purpose and importance of project appraisal in evaluating project feasibility and investment decisions. SO4.3. Utilize risk management tools and techniques, such as risk assessment matrices and probability impact grids, to identify, assess, and prioritize project risks.		**Unit 4: Project Appraisal and Risk Management techniques** 4.1 Project Appraisal Techniques 4.2 Objectives 4.3 Types and Method 4.4 Environmental appraisal, 4.5 Market appraisal 4.6 market survey for forecasting future demand and sales	1.Explain the following a. Risk management b. Market appraisal

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**

1. Explain the future demand and sales.
2. Write short note on risk management tools and techniques.

HSMC05.5: Students will assess project performance using key performance indicators (KPIs), metrics, and benchmarks, and make data-driven decisions to optimize project outcomes.

Approximate Hours

Item	AppX Hrs
Cl	06
LI	0
SW	02
SL	02
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1. Explain the Agile approach to project management and its differences from traditional waterfall methodologies. SO5.2. Evaluate Agile project metrics and performance indicators to assess project progress and identify areas for improvement. SO5.3. Develop an Agile project plan that includes iteration planning, sprint goals, and release planning.		Unit 5: Agile techniques in Project Management 5.1 Introduction to Agile, principles, 5.2 Scrum, Kanban, 5.3 other Agile methodologies, 5.4 Agile project management tools 5.5 Traditional project management 5.6 Agile vs. Traditional project management	1. What do you mean by project planning? 2. Write the short note on agile projects.

SW-5 Suggested Sessional Work(SW):

a. **Assignments:**

1. Explain Agile project metrics and performance indicators.
2. Explain the Traditional project management

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Lecture (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+LI+SW+SI)
HSMC05.1: Students will demonstrate an understanding of fundamental project management principles, including project lifecycle, stakeholders, constraints, and success criteria.	12	0	02	02	16
HSMC05.2: Students will be able to apply various project management methodologies	12	0	03	02	17
HSMC05.3: Students will develop comprehensive project plans that include scope definition, scheduling, resource allocation, budgeting, risk management, and communication strategies	09	0	02	03	14
HSMC05.4: Students will gain hands-on experience with project management tools and software	06	0	02	02	10
HSMC05.5: Students will assess project performance using key performance indicators (KPIs), metrics, and benchmarks, and make data-driven decisions to optimize project outcomes.	06	0	02	02	10
Total Hours	45	0	11	11	67

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction to Project Management	03	01	01	05
CO-2	Project Execution and Monitoring	02	06	02	10
CO-3	Financial Estimates and Projections	03	07	05	15
CO-4	Project Appraisal and Risk Management techniques	-	10	05	15
CO-5	Agile techniques in Project Management	03	02	-	05
Total		11	26	13	50

Legend: R:Remember, U:Understand, A:Apply

The end of semester assessment for Measurement and Metrology will be held with written examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

(a) **Books:**

S. No.	Title	Author	Publisher	Edition& Year
1	Project Management	Choudhary	Tata Mcgraw Hill	2017
2	Project Management: The Managerial Process	Clifford F Gray	Visionias	2023
3	Project Management: Planning and Control Techniques	R. L. Srivastava	New Age International Publishers	2021
4	Lecture notes provided by Dept. of Electrical Engineering, AKS University, Satna.			

Curriculum Development Team

1. **Mr. S.S. Parihar, Head of Deptt. Mech. Engg., AKS University**
2. **Mr. Alok Ranjan Tiwari , Assistant Professor, Dept. of Mechanichal Engg.**
3. **Mr Deepak Pandey , Assistant Professor , Dept. of Mechanichal Engg**
4. **Mr.,Keshav Pratap Singh, Assistant Professor , Dept. of Mechanichal Engg**
5. **Mr.Amar Soni , Assistant Professor , Dept of Mechanichal Engg**
6. **Mr K.P Tiwari , Assistant Professor , Dept. of Mechanichal Engg**
7. **Mr. Ketan Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
8. **Mr. K.C. Kori, Faculty, Assistant Professor , Dept. of Mechanichal Engg**
9. **Mr,Lokesh Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
10. **Mr. Ram Narayan Shukla, Assistant Professor , Dept. of Mechanichal Engg**
11. **Mr. Rishi Kumar Sharma, Assistant Professor , Dept. of Mechanichal Engg**
12. **Mr. Naveen Kumar Soni, Assistant Professor , Dept. of Mechanichal Engg**

Cos, Pos and PSOs Mapping

Programme Title: B.tech. Electrical Engineering

Course Code: HSMC05

Course Title: Project management

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Students will demonstrate an understanding of fundamental project management principles, including project lifecycle, stakeholders, constraints, and success criteria.	3	3	2	3	3	2	1	2	3	2	2	3	3	2
CO2: Students will be able to apply various project management methodologies	3	3	3	2	2	2	1	2	1	2	2	2	2	2
CO3: Students will develop comprehensive project plans that include scope definition, scheduling, resource allocation, budgeting, risk management, and communication strategies	3	3	2	2	3	1	2	2	1	2	2	3	2	2
CO4: Students will gain hands-on experience with project management tools and software	3	3	2	2	2	1	1	3	2	2	2	2	3	3
CO5: Students will assess project performance using key performance indicators (KPIs), metrics, and benchmarks, and make data-driven decisions to optimize project outcomes.	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend:1–Low,2–Medium,3–High

Course Curriculum Map:

Pos & PSOs No.	Cos No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	**CO1:** Students will demonstrate an understanding of fundamental project management principles, including project lifecycle, stakeholders, constraints, and success criteria.	SO1.1 SO1.2 SO1.3 SO1.4		**Unit 1: Introduction to Project Management** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10, 1.11,1.12	1,2
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	**CO2:** Students will be able to apply various project management methodologies	SO2.1 SO2.2 SO2.3 SO2.4		**Unit-II: Project Execution and Monitoring** 2.1,2.2,2.3,2.4,2.5,2.6,2.7, 2.8,2.9,2.10,2.11,2.12	1,2
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	**CO3:** Students will develop comprehensive project plans that include scope definition, scheduling, resource allocation, budgeting, risk management, and communication strategies	SO3.1 SO3.2 SO3.3 SO3.4		**Unit 3: Financial Estimates and Projections** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8.3.9	1,2
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	**CO4:** Students will gain hands-on experience with project management tools and software	SO4.1 SO4.2 SO4.3		**Unit 4: Project Appraisal and Risk Management techniques** 4.1,4.2,4.3,4.4,4.5,4.6	1
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	**CO5:** Students will assess project performance using key performance indicators (KPIs), metrics, and benchmarks, and make data-driven decisions to optimize project outcomes.	SO5.1 SO5.2 SO5.3		**Unit 5: Agile techniques in Project Management** 5.1,5.2,5.3,5.4,5.5,5.6	1,2

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-VII

Course Code: **EE407**

Course Title: **Electrical Energy Conservation and Auditing**

Pre- requisite: Student should have basic knowledge of Electricity, Electrical Circuits, Method Electrical Power Generation, Losses and basic mathematical operations.

Rationale: The requirement of energy has increased manifolds in last two decades due to rapid urbanization and growth in industrial/service sector. It has become challenging task to meet ever increasing energy demands with limited conventional fuels and natural resources. Due to fast depletion of fossil fuels and a tremendous gap between supply and demand of energy, it is essential to adopt energy conservation techniques in almost every field like industries, commercial and residential sectors etc. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This course covers the concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in general industry and details out energy audit methodology and energy audit instruments.

Course Outcomes: After undergoing this course, the students will be able to:

EE407.1: Define principles and objectives of energy management and energy audit.
EE407.2: Understand Energy Conservation Act 2001 and its features. Understand various forms & elements of energy.
EE407.3: Identify electrical and thermal utilities. Understand their basic principle of operation and assess performance of various equipment.
EE407.4: Identify areas of energy conservation and adopt conservation methods in various systems.
EE407.5: Evaluate the techno economic feasibility of the energy conservation technique adopted.

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PEC)	EE407	Electrical Energy Conservation and Auditing	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Couse Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment**	**Total Marks**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	**(ESA)**	(PRA+ ESA)
PEC	EE407	Electrical Energy Conservation and Auditing	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE407.1: Understanding of Energy Scenario and environmental issues in an industry

Approximate Hours

Item	Approx Hrs
Cl	08
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the Graph of Energy **SO1.2** Forming Incident Matrix for Energy consumption **SO1.3** Analysis the economic growth linked to energy consumption **SO1.4** Analysis sector-wise energy Consumption **SO1.5** Solving problem related to Environmental impact Assessment	.	**Unit-1:** Energy Scenario 1. Commercial and Non-commercial energy 2. primary energy resources, commercial 3. energy production, final energy consumption 4. energy needs of growing economy, long term energy scenario, energy pricing 5. energy sector reforms, energy and environment, energy security, energy conservation and its importance 6. , restructuring of the energy supply sector, energy strategy for the future 7. air pollution, climate change 8. Energy Conservation Act-2001 and its features	1. Electrical energy generation process 2. Global environment issue

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
b. **Survey: Health and Safety in the Plant**

EE407.2: Apply different energy saving potential in each technology.

Approximate Hours

Item	Approx Hrs
Cl	10
LI	0
SW	2
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understanding of different Electricity tariff **SO2.2** Analysis potential of each technology**.** **SO2.3** To understand the significance of thermal energy.		**Unit-2** Basics of Energy and its various forms 1. Electricity tariff, 2. load management and maximum demand control 3. power factor improvement, selection & location of capacitors 4. Thermal Basics-fuels, thermal energy contents of fuel, temperature 5. pressure, heat capacity, sensible and	1. Basic of Power factor calculation according to load

		latent heat, evaporation, 6. condensation, steam, moist air and humidity & heat transfer, units and conversion 7. Maximum demand controllers 8. automatic power factor controllers 9. Maximum demand controllers, automatic power factor controllers 10. electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.	

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Analysis the tariff, load management

EE407.3: Ability to do Energy management (audit) approach and understanding energy costs

Approximate Hours

Item	Approx Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 To Understand the energy audit instruments **SO3.2** to calculate the energy costs **SO3.3** to draw the material and energy balance diagrams	.	**Unit-3 : Energy Management & Audit** 1 Definition, energy audit, need, types of energy audit. Energy management (audit) 2. Approach understanding energy costs, 3. bench marking, energy performance, matching energy use to requirement 4. maximizing system efficiencies, optimizing the input energy requirements, 5. fuel & energy substitution 6. energy audit instruments. Material and Energy balance 7. Facility as an energy system, methods for preparing process flow 8. material and energy balance diagrams. 9. Energy monitoring techniques	1. energy consumption in KW and unit

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. To draw the material and energy balance diagrams for our university

EE407.4: Analyze Energy Efficiency in Electrical Systems
Approximate Hours

Item	Approx Hrs
Cl	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 To Understand the concept of electrical load management **SO4.2** to Analysis the factors affecting motor **SO4.3** Analysis the Electricity billing	.	**Unit-4: Energy Efficiency in Electrical Systems** 1. Electrical system: Electricity billing, 2. electrical load management and maximum demand control 3. power factor improvement and its benefit, selection 4. location of capacitors, 5. performance assessment of PF capacitors 6. distribution and transformer losses. 7. Electric motors: Types, losses in induction motors, 8. motor efficiency, factors affecting motor 9. performance Rewinding and motor replacement issues	1. motor Losses

SW-4 Suggested Sessional Work (SW):

a. **Assignments:** Bill Calculation

Mini Project:

i. Design a smart meter

EE407.5: Understanding of the concept of positive real function, their characteristics, filters and their different types

Approximate Hours

Item	Approx Hrs
Cl	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 To Understand the Energy conservation in thermal System **SO5.2** Selection of equipment **SO5.3** Fuel saving Calculation	.	**Unit-5 : Energy Efficiency in Industrial Systems** 1. Types of air compressors, compressor efficiency 2. efficient compressor operation 3. Compressed air system components, capacity assessment, leakage test, factors affecting the performance 4. , efficient system operation, flow control strategies and energy conservation opportunities. 5. Pumps and Pumping System: Types, performance evaluation, efficient system operation 6. flow control strategies and energy conservation opportunities 7. Cooling Tower: Types and performance evaluation, efficient system operation 8. flow control strategies and energy 9. saving opportunities, assessment of cooling tower	1.star rating

SW-5 Suggested Sessional Work (SW):

a. **Assignments:** Discuss energy conservation in Thermal System

b. **Mini Project:**

   i. To study a energy Audit Report.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE407.1: Understand the current energy scenario and importance of energy conservation.	8	2	1	11
EE407.2: Understand the concepts of energy management.	10	2	1	13
EE407.3: Understand the methods of improving energy efficiency in different electrical systems	9	1	1	11
EE407.4: Understand the concepts of different energy efficient devices.	9	2	1	12
EE407.5: To Understand the Energy conservation in thermal System	9	2	1	12
Total Hours	45	9	5	59

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Energy Scenario	02	03	05	10
CO-2	Basics of Energy and its various forms	02	04	04	10
CO-3	Energy Management & Audit	02	02	06	10
CO-4	Energy Efficiency in Electrical Systems	03	07	05	15
CO-5	Energy Efficiency in Industrial Systems	01	02	02	05
Total		10	18	22	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Electrical Energy Conservation and Auditing will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Design Demonstration
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Guide books forNational Certification Examination for Energy Manager	Auditors Book-1	/ General Aspects (available online)	2013
2	Guide books forNational Certification Examination for Energy Manager /	Auditors Book-3	Electrical Utilities (available online)	2014
3	Utilization of Electrical Energy and Conservation‖,	S. C. Tripathy	McGraw Hill, 1991. .	Eighth, 2023
4	Success stories of Energy Conservation by	BEE, New Delhi	(www.bee-india.org)	

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

CO<u>s, POs and PSOs Mapping</u>

Programme Title: B. Tech. Electrical Engineering
Course Code: EE407
Course Title: Electrical Energy Conservation and Auditing

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Understand the current energy scenario and importance of energy conservation.	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO2: Understand the concepts of energy management.	2	3	3	2	2	2	1	3	2	2	2	3	3	2
CO3: Understand the methods of improving energy efficiency in different electrical systems	3	2	3	2	1	1	2	2	2	2	2	3	3	3
CO4: Understand the concepts of different energy efficient devices.	2	3	2	2	2	1	2	3	2	2	2	2	2	3
CO5: To Understand the Energy conservation in thermal System	3	3	3	2	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO1:** Understand the current energy scenario and importance of energy conservation.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**UNIT 1:** Energy Scenario 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO2:** Understand the concepts of energy management.	SO2.1 SO2.2 SO2.3		**Unit-2:** Basics of Energy and its various forms 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9,2.10	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO3:** Understand the methods of improving energy efficiency in different electrical systems	SO3.1 SO3.2 SO3.3		**UNIT 3:** Energy Management & Audit 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO4:** Understand the concepts of different energy efficient devices.	SO4.1 SO4.2 SO4.3		**UNIT 4:** Energy Efficiency in Electrical Systems 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8, 4.9	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO5:** To Understand the Energy conservation in thermal System	SO5.1 SO5.2 SO5.3		**UNIT 5:** Energy Efficiency in Industrial Systems 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	1

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-VII

Course Code: **EE408**

Course Title : **Electrical Machine Design**

Pre-requisite: Students should have basic knowledge of construction, and working of various electrical machines.

Rationale: A process of introducing formal knowledge of electrical machine construction appropriately to design the machine for suitable working conditions and getting knowledge about various parts of different machines and their requirement for any specific purpose.

Course Outcomes:

EE408.1: Understand the construction and performance characteristics of electrical machines.

EE408.2: Understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines

EE408.3: Understand the principles of electrical machine design and carry out a basic design of an Induction machine.

EE408.4: Understand the principles of electrical machine design and carry out a basic design of a Synchronous machine.

EE408.5: Use software tools to do design calculations.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Professional Elective (PEC)	EE408	Electrical Machine Design	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L), and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field, or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project, etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL have to be planned and performed under the teacher's continuous guidance and feedback to ensure the Learning outcome.

Scheme of Assessment:

Theory

Course Category	Course Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PEC	EE408	Electrical Machine Design	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE408.1: Understand the construction and performance characteristics of electrical machines.

Approximate Hours

Item	AppX Hrs
Cl	08
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Reviewing the major considerations in electrical machine design. **SO1.2** Determining the concepts of electrical engineering materials, space factor, choice of specific electrical and magnetic loadings. **SO1.3** Understand the thermal considerations. **SO1.4** Determine heat flow and temperature rise. **SO1.5** Understanding the ratings of machines.	.	**Unit-1: INTRODUCTION** 1.1 Major considerations in electrical machine design. 1.2 Electrical engineering materials. 1.3 Space factor 1.4 Choice of specific electrical and magnetic loadings. 1.5 Thermal considerations 1.6 Heat flow 1.7 Temperature rise 1.8 Rating of machines	1. Understand the various concepts of Machine Design.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Make a tabular list of factors affecting the design.

b. **Mini Project:**
   i. Draw the basic diagrams of various parts with theory.

EE408.2: Understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines

.Approximate Hours

Item	AppX Hrs
Cl	8
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Take a look at sizing of transformer. **SO2.2** Determine the KVA rating of single-phase and three-phase transformer. **SO2.3** Calculate the overall dimensions. **SO2.5** To understand winding design. **SO2.6** Analyze the operating characteristics and no-load current. **SO2.7** Calculate the temperature rise. **SO2.8** Understand the design and method of cooling.	.	**Unit-2 Design of Transformers** 2.1 Sizing of a transformer 2.2 Main dimensions 2.3 kVA output for single- and three-phase transformers. 2.4 Window space factor 2.5 Overall dimensions, Operating characteristics 2.6 Regulation, No load current 2.7 Temperature rise in transformers, Design of cooling tank 2.8 Methods for cooling of transformers.	1. Learn and gain knowledge of the design of the Transformer.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Make Proper Notes of all design concepts for the Transformer.

b. Mini Project:

i. Draft the Transformer Construction.

EE408.3: Understand the principles of electrical machine design and carry out a basic design of an Induction machine.

Approximate Hours

Item	AppX Hrs
Cl	10
LI	0
SW	2
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Evaluation of the sizing of Induction Motor. **SO3.2** Determine the main dimensions and length of air gap. **SO3.3** To Study the design of squirrel cage rotor. **SO3.4** Knowledge of rules for selecting rotor slots. **SO3.5** Understand the design of wound rotor. **SO3.6** Understand the operating characteristics. **SO3.7** Understand the concept of leakage reactance. **SO3.8** Factors Affecting the Machine Design.	.	**Unit-3: Design of Induction Motors.** 3.1 Sizing of an induction motor 3.2 Main dimensions, Length of air gap 3.3 Rules for selecting rotor slots of squirrel cage machines. 3.4 Design of rotor bars & slots, Design of end rings. 3.5 Design of wound rotor, Magnetic leakage calculations 3.6 Leakage reactance of poly-phase machines. 3.7 Magnetizing current 3.8 Short circuit current 3.9 Circle diagram 3.10 Operating characteristics	1. To ensure all the concepts of the design of the Induction Motor should be understood.

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Make proper notes of the design of the three-phase induction machine.

b. **Mini Project:**
   i. Evaluate the Tabular form of design of the three-phase Induction machine.

EE408.4: Understand the principles of electrical machine design and carry out a basic design of a Synchronous machine.

Approximate Hours

Item	AppX Hrs
Cl	09
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 To Understand the Sizing of Synchronous Machine. **SO4.2** To Understand the Main Dimensions. **SO4.3** To Study the Salient Pole Machines. **SO4.4** To Understand the Design of rotor. **SO4.5** To Study the Short Circuit Ratio. **SO4.6** Study the design of damper windings. **SO4.7** Study the design of turbo alternators.		**Unit 4: Design of Synchronous Machine** 4.1 Sizing of a synchronous machine, Main dimensions 4.2 Design of salient pole machines 4.3 Short circuit ratio, Shape of pole face 4.4 Armature design, Armature parameters 4.5 Estimation of air gap length, Design of rotor 4.6 Design of damper winding 4.7 Determination of full load field MMF 4.8 Design of field winding 4.9 Design of turbo alternators	1. To ensure Complete notes of the chapter related to the Design of Alternators.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**

Make the notes on Design of Synchronous Machine.

b. **Mini Project:**

i. Draw the chart of different types of Designs of Components of Synchronous Machine.

EE408.5: Use software tools to do design calculations

Approximate Hours

Item	AppX Hrs
Cl	07
LI	0
SW	1
SL	1
Total	09

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 To Understand the limitations of previous designs. **SO5.2** To analyze the need of CAD. **SO5.3** To Study the various methods. **SO5.4** Formulate the Problem. **SO5.5** To Study the FEM based machine design. **SO5.6** Study the complex structures.		**Unit 4: Computer Aided Design (CAD)** 5.1 Limitations (assumptions) of traditional designs. 5.2 Need for CAD analysis 5.3 Synthesis and hybrid methods 5.4 Design optimization methods, variables 5.5 Constraints and objective function Problem formulation 5.6 Introduction to FEM based machine design 5.7 Introduction to complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.	1. To ensure Complete notes of the chapter.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:** Make the notes of CAD.
b. **Mini Project:** Review Complex Structures.

Brief of Hours Suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE408.1: Understand the concepts of introduction of Machine Design.	08	1	1	10
EE408.2: Understand the Design of Transformers.	08	1	1	10
EE408.3: Understand the Design of Induction Motor.	10	2	1	13
EE408.4: Understand the concept of the design of Synchronous Machine.	09	2	1	12
EE408.5: To Study the Computer Aided Design (CAD).	07	1	1	09
Total Hours	42	07	5	54

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction to Machine Design	03	02	03	08
CO-2	Design of Transformer	02	06	02	10
CO-3	Design of Induction Motor	03	05	04	12
CO-4	Design of Synchronous Machine	03	04	05	12
CO-5	Computer Aided Design	02	03	03	08
Total		13	20	17	50

Legend: R: Remember, U: Understand, A: Apply

The end-of-semester assessment for Electrical Machine Design will be held with the written examination of 50 marks.

Note. Detailed Assessment rubrics need to be prepared by the course-wise teachers for the above tasks. Teachers can also design different tasks as per requirement, for end-semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to the electrical power plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, WhatsApp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

Books :

S. No.	Title	Author	Publisher	Edition & Year
1	The performance and design of D.C. Machines	Clayton A.E.		2007
2	The performance and design of A.C. Machines	M.G. Say	Pitman & Sons	First-2005
3	Electrical Machine Design	Sawhney A.K.	Dhanpat Rai & Sons	2011
4	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE408
Course Title: Electrical Machine Design

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
	Engineering knowledge	**Problem Solving**	**Design Skills**	**Laboratory Skills**	**Team work**	**Communication Skills**	**Ethical and Professional Behavior**	**Lifelong Learning**	**Global and Societal Impact**	**Project Management**	**Adaptability**	**Professional Development**	**Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society**	**Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services**
CO1: Understand the concepts of introduction of Machine Design.	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO2: Understand the Design of Transformers.	3	3	3	3	2	2	1	3	2	2	2	3	3	2
CO3: Understand the Design of Induction Motor.	3	2	3	2	1	1	2	2	2	2	2	3	2	3
CO4: Understand the concept of the design of Synchronous Machine.	3	3	2	2	2	1	2	3	2	2	2	2	2	3
CO5: To Study the Computer Aided Design (CAD).	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO1:** Understand the concepts of introduction of Machine Design.	SO1.1,,SO1.2 SO1.3,SO1.4 SO1.5		**UNIT 1:** Introduction to Machine Design 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO2:** Understand the Design of Transformers.	SO2.1,SO2.2 SO2.3,SO2.4 SO2.5,SO2.6 SO2.7,SO2.8		**Unit-2:** Design of Transformer 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO3:** Understand the Design of Induction Motor.	SO3.1SO3.2 SO3.3,SO3.4 SO3.5, SO3.6 SO3.7, SO3.8		**UNIT 3:** Design of Induction Motor 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO4:** Understand the concept of the design of Synchronous Machine.	SO4.1SO4.2 SO4.3,SO4.4 SO4.5,SO4.6 SO4.7		**UNIT 4:** Design of Synchronous Machine 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8, 4.9	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	**CO5:** To Study the Computer Aided Design (CAD).	SO5.1SO5.2 SO5.3,SO5.4 SO5.5,SO5.6		**UNIT 5:** Computer Aided Design 5.1,5.2,5.3,5.4,5.5,5.6,5.7	1

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-VII

Course Code:	**EE409**
Course Title :	**Computational Electromagnetics**
Pre- Requisite:	Engineering Mathematics, Engineering Physics and Electromagnetic field theory.
Rationale:	The purpose of this course is to familiarize the students with different computational methods to solve problems related to electric and magnetic fields and their applications.

Course Outcomes: Students will be able to

EE409.1: understand basic fundamentals of Electrostatics, Electromagnetics and energy transformer vectors.
EE409.2: Apply analytical methods to solving field equations.
EE409.3: Understand and apply finite difference method (FDM) and finite element method (FEM).
EE409.4: analyze and understand different experimental methods.
EE409.5: gain the knowledge of various applications of computational electromagnetics.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Professional Elective course (PEC)	EE409	Computational Electromagnetics	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Scheme of Assessment:
Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PEC	EE409	Computational Electromagnetics	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE409.1: understand basic fundamentals of Electrostatics, Electromagnetics and energy transformer vectors.

. **Approximate Hours**

Item	Approx. Hrs.
Cl	8
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Lab Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO1.1** understand basic fundamentals of electrostatics and electromagnetics. **SO1.2** understand and derive Helmholtz equation. **SO1.3** understand the concept of energy transformer vectors		1.1 **UNIT 1: Introduction** Conventional design methodology. 1.2 Computer aided design aspects – Advantages. 1.3 Review of basic fundamentals of Electrostatics and Electromagnetics-I. 1.4 Review of basic fundamentals of Electrostatics and Electromagnetics-II. 1.5 Development of Helmholtz equation. 1.6 energy transformer vectors-Poynting vector 1.7 Slepian transformer vectors 1.8 Magnetic Diffusion-transients and time-harmonic.	1. Basic concept of electrostatics and electromagnetics. 2. Energy transformation

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

i. Based on Helmholtz equation

ii. Based on energy transformation vectors.

EE409.2: Apply analytical methods to solving field equations.

Approximate Hours

Item	Approx. Hrs.
Cl	8
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
Students will be able to **SO2.1** understand and apply analytical methods to solve field problems. **SO2.2** understand and apply method of separation of variables. **SO2.3** understand and apply Roth's method. .		**Unit-2: Analytical Methods** 2.1 Analytical methods of solving field equations, 2.2 Method of separation of variables-I. 2.3 method of separation of variables-II 2.4 Roth's method-I. 2.5 Roth's method-II. 2.6 integral methods- 2.7 Green's function, 2.8 Method of images.	1. Concept of solution of differential equations.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Numerical Problems based on method of separation of variables.
   ii. Numerical Problems based on Roth's method.

EE409.3: Understand and apply finite difference method (FDM) and finite element method (FEM).

Approximate Hours

Item	Approx. Hrs.
Cl	10
LI	0
SW	2
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
Students will be able to **SO3.1** understand and apply finite difference method to solve given problem. **SO3.2** understand and apply finite Element method to solve given problem. **SO3.3** understand and apply Variational and Galerk in Methods.	.	**UNIT 3: Finite Difference Method (FDM) & Finite Element Method (FEM)** 3.1 FDM: Finite Difference schemes, 3.2 treatment of irregular boundaries, 3.3 accuracy and stability of FD solutions, 3.4 Finite-Difference Time-Domain (FDTD) method- Uniqueness and convergence. 3.5 FEM: Overview of FEM, 3.6 Variational and Galerk in Methods, 3.7 shape functions, lower and higher order elements, 3.8 vector elements, 3.9 2D and 3D finite elements, 3.10Efficient finite element computations.	1. Practice of Numerical problems based on FDM and FEM method. 2. Practice of Numerical problems based on Variational and Galerk in Methods.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Numerical problems based on FDM and FEM method
   ii. Numerical problems based on Variational and Galerk in Methods.

EE409.4: analyze and understand different experimental methods

Approximate Hours

Item	Approx. Hrs.
Cl	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Lab Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO4.1** understand about various experimental methods. **SO4.2** do Experimental analysis of different circuits and systems	.	**UNIT 4: Special Topics** 4.1 Background of experimental methods. 4.2 Electrolytic tank. R-C network solution, 4.3 Field plotting (graphical method), 4.4 hybrid methods, 4.5 coupled circuit - field computations, 4.6 electromagnetic - thermal and 4.7 electromagnetic - structural coupled computations, 4.8 solution of equations, 4.9 method of moments, Poisson's fields.	

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Based upon different experimental methods.

ii. Based on Electromagnetic thermal and structural coupled computation.

EE409.5: gain the knowledge of various applications of computational electromagnetics.

Approximate Hours

Item	Approx. Hrs.
Cl	6
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO5.1** understand Static and time-harmonic, problems in transformers **SO5.2 understand and analyze** Transient problems in transformers, Rotating machines and Actuators		**UNIT 5: Application** 5.1 Low frequency electrical devices. 5.2 Static and time-harmonic, problems in transformers. 5.3 Transient problems in transformers. 5.4 Transient problems in rotating machines. 5.5 Transient problems in Actuators. 5.6 CAD packages.	**1.** Concept of harmonics' **2.** Concept of transient and steady state.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Based on Static and time-harmonic, problems in transformers.
   ii. Based on Transient problems in transformers, machines and actuators.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE409.1: understand basic fundamentals of Electrostatics, Electromagnetics and energy transformer vectors.	8	2	1	11
EE409.2: Apply analytical methods to solving field equations.	8	1	1	10
EE409.3: Understand and apply finite difference method (FDM) and finite element method (FEM).	10	2	1	13
EE409.4: analyze and understand different experimental methods.	9	2	1	12
EE409.5: gain the knowledge of various applications of computational electromagnetics.	6	1	1	8
Total Hours	41	8	5	54

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction	02	03	05	10
CO-2	Analytical Methods	02	03	05	10
CO-3	Finite Difference Method (FDM) & Finite Element Method (FEM)	02	05	05	12
CO-4	Special Topics	02	05	05	12
CO-5	Applications	02	02	02	6
Total		10	18	18	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Computational Electromagnetics will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Demonstration of Instruments.
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, WhatApp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) **Books** :

S. No.	Title	Author	Publisher	Edition & Year
1	Finite Element for Electrical Engineers	P. P. Silvester and R. L. Ferrari	Cambridge University press	1996
2	Numerical Techniques in Electromagnetics	M. N. O. Sadiku	CRC press	2001
3	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE409
Course Title: Computational Electromagnetics

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: understand basic fundamentals of Electrostatics, Electromagnetics and energy transformer vectors	3	3	2	2	2	-	1	2	2	1	2	2	2	3
CO 2: Apply analytical methods to solving field equations	3	3	3	3	2	-	1	3	2	2	1	3	3	2
CO3: Understand and apply finite difference method (FDM) and finite element method (FEM).	3	2	3	2	1	-	2	2	2	2	2	3	2	3
CO 4: analyze and understand different experimental methods	3	3	2	3	2	-	2	3	2	2	2	2	2	3
CO 5: gain the knowledge of various applications of computational electromagnetics	3	3	3	3	1	-	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO1: understand basic fundamentals of Electrostatics, Electromagnetics and energy transformer vectors	SO1.1 SO1.2 SO1.3		**UNIT 1: Introduction** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 2: Apply analytical methods to solving field equations	SO2.1 SO2.2 SO2.3		**Unit-2: Analytical Methods** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO3: Understand and apply finite difference method (FDM) and finite element method (FEM).	SO3.1 SO3.2 SO3.3		**UNIT 3: Finite Difference Method (FDM) & Finite Element Method (FEM)** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 4: analyze and understand different experimental methods	SO4.1 SO4.2		**UNIT 4: Special Topics** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8, 4.9	
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 5: gain the knowledge of various applications of computational electromagnetics	SO5.1 SO5.2		**UNIT 5: Application** 5.1,5.2,5.3,5.4,5.5,5.6	1,2,3

Semester-VII

Course Code:	**EE410**
Course Title :	**Power system dynamics and control**
Pre- requisite:	Student should have the knowledge of Electrical Machine and Power system.
Rationale:	The Purpose of this subject is to develop the understanding of power system stability, operations and analysis of power system dynamics, modeling of different power systems components and its stability analysis.

Course Outcomes: At the end of this course, students will demonstrate the ability

EE410.1: to be able to know about the power system stability, operations and analysis of power system dynamics
EE410.2: to learn about the modeling of Synchronous Machines and Associated Controllers
EE410.3: to understand the modeling of different power systems components
EE410.4: to be able to understand how to accomplish the stability analysis of the power system
EE410.5: to be able to know about the techniques to improve the system stability.

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl (L+T)	LI	SW	SL	Total Study Hour (CI+LI+SW+SL)	
Professional Elective course (PEC)	EE410	Power system dynamics and control	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop,field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback ofteacher to ensure outcome of Learning.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Sem. Asses s-ment (ESA)	Total Marks (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Atten - dance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PEC	EE410	Power system dynamics and control	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE410.1: Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation**.**

Approximate Hours:

Item	AppX Hrs
Cl	8
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 to understand about the power system stability. **SO1.2** study the stability issues and its impact on power system operation **SO1.3** to be able to analyze the complex dynamics in power system **SO1.4** to learn Modal analysis and numerical methods		**Unit-1.0 Introduction to Power System Operations and Analysis of Linear Dynamical System** 1.1 Introduction to Power System stability, operation Control. 1.2 Stability problems in Power System 1.3 Impact of stability issue on Power System Operations and control. 1.4 Analysis of dynamical System, 1.5 Concept of Equilibrium, Small and Large Disturbance Stability. 1.6 Modal Analysis of Linear System. Analysis using Numerical Integration Techniques. 1.7 Issues in Modeling: 1.8 Slow and Fast Transients, Stiff System.	**1.** numerical

SW-1 Suggested Sessional Work (SW):

a. assignments
   i. enumerate different stability issues in the power system and its impact
   ii. Define and discuss the modal analysis.

EE410.2: to learn about the modeling of Synchronous Machines and Associated Controllers

Approximate Hours:

Item	AppX Hrs
Cl	11
LI	0
SW	2
SL	2
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 to learn about the modeling and characteristics of synchronous machines **SO2.2.** to learn about the steady state analysis of the synchronous machines **SO2.3** to be able to understand about modeling and control of prime movers, and excitation system **SO2.4** to be able to understand about the Automatic		**Unit-2.0 Modeling of Synchronous Machines and Associated Controllers** 2.1 Modeling of synchronous machine 2.2 Physical Characteristics. Rotor position dependent model. 2.3 D-Q Transformation. Model with Standard Parameters. 2.4 Steady State Analysis of Synchronous Machine. 2.5 Short Circuit Transient Analysis of a Synchronous Machine. 2.6 Synchronization of Synchronous Machine to an Infinite Bus.	**1.** numerical

Voltage Regulator, Prime Mover Control Systems and Speed Governors.		2.7 Modeling of Excitation and Prime Mover Systems. 2.8 Physical Characteristics and Models. 2.9 Excitation System Control. 2.10 Automatic Voltage Regulator. 2.11 Prime Mover Control Systems. , Speed Governors.	

SW-2 Suggested Sessional Work

a. Assignment work
   i. Discuss the D-Q transformation and modeling of the synchronous machine with standard parameters
   ii. Discuss the different types of prime movers and excitation systems. With Neat diagram explain the working.

EE410.3: to understand the modeling of different power systems components

Approximate Hours:

Item	AppX Hrs
Cl	10
LI	0
SW	1
SL	2
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 to be able to understand the Modeling of Transmission Lines **SO3.2** to be able to understand the Modeling of Loads **SO3.3** to understand the modeling and analysis the transmission line. **SO3.4** to understand the modeling of the Induction machine **SO3.5** to be able to understand the Frequency and Voltage Dependency of Loads. **SO3.6** to be able to understand the working and operation of the HVDC and FACTS **SO3.7** to be able to understand the wind energy generation system.		**Unit-3.0 Modelling of other Power System Components** 3.1 Modeling of Transmission Lines 3.2 Modeling of Loads. 3.3 Transmission Line Physical Characteristics. 3.4 Transmission Line Modeling. 3.5 Load Models 3.6 Induction machine model. 3.7 Frequency and Voltage Dependence of Loads. 3.8 Other Subsystems – HVDC and 3.9 FACTS controllers, 3.10 Wind Energy Systems.	**1.** numerical

SW-3 Suggested Sessional work

a. Assignments

EE410.4 to be able to understand how to accomplish the stability analysis of the power system

Approximate Hours:

Item	AppX Hrs
Cl	11
LI	0
SW	1
SL	2
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 to learn Angular stability analysis in Single Machine Infinte Bus **SO4.2** to learn Angular Stability in Multi-machine Systems. **SO4.3** to learn about the frequency stability. **SO4.4** to learn aboutsingle MachineLoad Bus. **SO4.5** to learn about the voltage oscillation and stability analysis tools. **SO4.6** transient stability and small signal analysis		**Unit-4.0 Stability Analysis** 4.1 Angular stability analysis in Single Machine Infinite Bus System. 4.2 Angular Stability in multi-machine systems – Intra-plant, Local and Inter-area modes. 4.3 Frequency Stability: 4.4 Centre of Inertia Motion. 4.5 Load Sharing: Governor droop. 4.6 Single Machine Load Bus System: 4.7 Voltage Stability. 4.8 Introduction to Torsional Oscillations and SSR phenomenon. 4.9 Stability Analysis Tools: 4.10 Transient Stability Programs, 4.11 Small Signal Analysis Programs.	1. numerical

SW-4 Suggested Sessional work

a. assignments
   i. Angular stability analysis in Single Machine Infinite Bus System.
   ii. Discuss the small signal analysis and transient analysis.

EE410.5 to be able to know about the techniques to improve the system stability

Approximate Hours:

Item	AppX Hrs
Cl	5
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 be able to know about the different planing measures **SO5.2** be able to study about to stabilizing controllers for power system **SO5.3** understand the working and operation of Power System Stablizers **SO5.4** be familiar with Operational Measures **SO5.5** be able to know about Preventive and emergency Control		**Unit-5.0 Enhancing the System Stability** **5.1** Study the Planning Measures. **5.2** Understand the Stabilizing Controllers **5.3** Understand the operation of Power System Stabilizers **5.4** Understand the Operational Measures **5.5** Learn Preventive & Emergency Control.	1. numerical

SW-5 Suggested sessional work

a. Assignment

i. discuss the Stabilizing Controllers

ii. discussed the working and operation with diagram the Power System Stabilizers

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+LI+SW+Sl)
EE410.1: to be able to know about the power system stability, operations and analysis of power system dynamics	8	1	1	10
EE410.2: to learn about the modeling of Synchronous Machines and Associated Controllers	11	2	2	15
EE410.3: to understand the modeling of different power systems components	10	2	1	13
EE410.4: to be able to understand how to accomplish the stability analysis of the power system	11	2	1	14

EE410.5: to be able to know about the techniques to improve the system stability.	5	1	1	7
Total Hours	**45**	**8**	**6**	**59**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction to Power System Operations and Analysis of Linear Dynamical System	01	03	01	05
CO-2	Modelling of Synchronous Machines and Associated Controllers	02	10	03	15
CO-3	Modelling of other Power System Components	03	07	05	15
CO-4	Stability Analysis	02	03	-	05
CO-5	Enhancing the System Stability	02	06	02	10
Total		**10**	**29**	**11**	**50**

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Power System Dynamics and Control will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested Materials: Text/Reference Books

S. No.	Name	Author	Publication	Year/Edition
1	Power System Dynamics, Stability and Control‖,	K.R. Padiyar,	B. S. Publications	2002
2	Power System Stability and Control‖	P. Kundur	McGraw Hill	1995
3	Power System Dynamics and Stability.	P. Sauer and M. A. Pai,	Prentice Hall	1997.

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos,POs and PSOs Mapping

Course Title: B. Tech Electrical Engineering

Course Code : EE410

Course Title: Power System Dynamics and Control

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Moden tool usage	The engineer and society	Environment and sustainability:	Ethics	Individual and team work:	Communication:	Project management and finance:	Life-long learning	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1. To be able to know about the power system stability, operations and analysis of power system dynamics	3	3	2	3	1	1	3	2	3	3	2	3	3	3
CO2. To learn about the modeling of Synchronous Machines and Associated Controllers	2	3	3	3	1	1	3	2	3	2	3	3	3	3
CO3. To understand the modeling of different power systems components	3	3	2	2	2	1	3	2	3	3	2	3	3	2
CO4. To be able to understand how to accomplish the stability analysis of the power system	3	3	1	2	2	1	3	2	1	2	-	3	3	3
CO5. To be able to know about the techniques to improve the system stability.	3	3	3	1	1	1	3	2	1	2	3	3	3	3

Legend: 1 – Low, 3 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (L I)	Classroom Instruction (CI)	Self-Learning (SL)
PO 1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO1.**To be able to know about the power system stability, operations and analysis of power system dynamics	SO 1.1, 1.2,1.3, 1.4		Unit-1.0 Introduction to Power System Operations and Analysis of Linear Dynamical System 1.1,1.3,1.3,1.4,1.5,1.6,1.7,1.8	1
PO 1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO1.**To be able to know about the power system stability, operations and analysis of power system dynamics	SO 2.1, 2.2, 2.3, 2.4		Unit-2 Modeling of Synchronous Machines and Associated Controllers 2.1, 2.3, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9,2.10,2.11	1
PO 1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO3.** To understand the modeling of different power systems components	SO 3.1, 3.2,3.3, 3.4, 3.5, 3.6, 3.7		Unit-3 Modelling of other Power System Components 3.1, 3.3, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10	1
PO 1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO4.** To be able to understand how to accomplish the stability analysis of the power system	SO 4.1, 4.2, 4.3, 4.4, 4.5, 4.6		Unit-4 : Stability Analysis 4.1, 4.3, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10,4,11	1
PO 1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO5.** To be able to know about the techniques to improve the system stability.	SO5.1, 5.2,5.3, 5.4, 5.5		Unit 5: Enhancing the System Stability 5.1,5.3,5.3,5.4,5.5	1

Semester – VII

Course Code:	**EE411**
Course Title :	**Electrical and Hybrid Vehicle**
Pre- requisite:	Students should have basic knowledge of batteries, AC/DC system and Power economics in vehicles.
Rationale:	A process of introducing formal knowledge of electrical vehicles including design and working process using electrical drives with BMS/EMS studies and also analyzing the changing problems with their solution and future aspects.

Course Outcomes:

EE411.1 Understand the basic constructional feature and design components.
EE411.2 Understand the Motor Torque Calculations For Electric Vehicle.
EE411.3 Understand the working of Electric Drive and controller.
EE411.4 Understand the Energy Storage Solutions (ESS) and Battery Management System (BMS)/Energy Management System (EMS).
EE411.5 Understand the working of control unit and Electric Vehicles charging station with Indian and Global scenario.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Elective (PEC)	EE411	Electrical and Hybrid Vehicle	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Scheme of Assessment:
Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PEC	EE411	ELECTRICAL and HYBRID VEHICLE	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE411.1: Understand the basic constructional feature and design components**.**

Approximate Hours

Item	AppX Hrs
Cl	08
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Historical Analysis. **SO1.2** Understand the Electrical Vehicle Components. **SO1.3** Classify the electrical vehicles with their electrification levels. **SO1.4** Understand the Architecture of Electric Vehicles. **SO1.5** Understand the working of electric vehicles with renewable energy. .	.	**Unit-1: Basic constructional feature and design components.** 1.1 History, Components of electric vehicle 1.2 Comparison with Internal Combustion Engine: Technology, Benefits and Challenges 1.3 EV Classification and their Electrification levels, EV Terminology, Types of electrical vehicles and components. 1.4 Electrical Protection and System Requirement, Photovoltaic Solar Based EV System 1.5 Battery Electric Vehicle, Hybrid Electric Vehicle 1.6 Plug-in Hybrid Vehicle, Fuel Cell Electric Vehicle 1.7 Electrification level of EV, Comparison of Fuel vs Electric and Solar Power 1.8 Solar Power operated Electric Vehicles	1. Understand the concept of electrical power in vehicles.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Classify the vehicle operation with different sources.

b. **Mini Project:**
   i. Draw the schematic diagram of electrical vehicle designs.

EE411.2: Understand the Motor Torque Calculations For Electric Vehicle.
Approximate Hours

Item	AppX Hrs
Cl	5
LI	0
SW	2
SL	1
Total	08

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 To Understand the different type of resistance associated with electric vehicles. **SO2.2** Calculation of force of acceleration. **SO2.3** To understand the torque applied.	.	**Unit-2: Motor Torque Calculations For Electric Vehicle.** 2.1 Calculating the rolling resistance. 2.2 Calculating the grade resistance. 2.3 Calculating the acceleration force. 2.4 Finding the total tractive efforts. 2.5 Torque required on the drive wheel.	1. Apply detail study of the chapter.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Identify different resistance associated with electrical vehicles.

Mini Project:
   i. Verify the torque on the drive wheel.

EE411.3: Understand the working of Electric Drive and controller.

Approximate Hours

Item	AppX Hrs
Cl	07
LI	0
SW	2
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 To Understand the selection and sizing of different types of motors. **SO3.2** Calculate the speed and torque of the motor. **SO3.3** To Understand the different types of connection. **SO3.4** To Understand the working of controllers.	.	**Unit-3 : Electric Drive and controller** 3.1 Types of motors 3.2 Selection and Sizing of motors. 3.3 RPM and Torque calculation of motor. 3.4 Motor Controllers. 3.5 Compact Sizing, Physical Locations 3.6 Mechanical Connections of motor. 3.7 Electrical Connections of motor.	1. Understand the basic concept of drives.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Make the list of the different type of connections of motor.

EE411.4: Understand the Energy Storage Solutions (ESS) and Battery Management System (BMS)/Energy Management System (EMS).

Approximate Hours

Item	AppX Hrs
Cl	13
LI	0
SW	2
SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand the different types of cells. **SO4.2** Calculation of charging and discharging of cells. **SO4.3** Understand the constructional details and working of batteries. **SO4.4** Understand the different control strategies. **SO4.5** Understand the advance features.	.	**Unit-4 : Energy Storage Solutions (ESS) and Battery Management System (BMS)/Energy Management System (EMS)** 4.1 Cell Types (Lead Acid/Li/NiMH) 4.2 Battery charging and discharging calculation 4.3 Cell Selection and sizing 4.4 Battery lay outing design 4.5 Battery Pack Configuration 4.6 Battery Pack Construction 4.7 Battery selection criteria 4.8 Need of BMS 4.9 Rule based control and optimization based control 4.10 Software-based high level supervisory control 4.11 Mode of power 4.12 Behavior of motor 4.13 Advance Features	1. Prepare different types of battery details note. 2. Prepare the notes on software used in electric vehicles.

SW-4 **Suggested Sessional Work (SW):**

a. **Assignments:**
   i. Classify the batteries based on construction and working.

b. **Mini Project:**
   i. Draw a chart of Flow Calculations.

EE411.5: Understand the working of control unit and Electric Vehicles charging station with Indian and Global scenario.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	2
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand the working of control unit. **SO5.2** Understand the function of hardware and software. **SO5.3** Evaluation of charging stations. **SO5.4** Understanding the Indian and Global scenarios.		**Unit 5: Control unit and Electric Vehicles charging station with Indian and Global scenario.** 5.1 Function of CU, Development Process 5.2 Software & Hardware 5.3 Data Management, GUI/HMI 5.4 Type of Charging station 5.5 Selection and Sizing of charging station 5.6 Components of charging station 5.7 Single line diagram of charging station 5.8 Technology Scenario, Market Scenario 5.9 Policies and Regulations 5.10 Payback and commercial model	1. Remember the Enthalpy changes accompanying chemical reactions such as heat of reaction, heat of formation and heat of combustion.

		5.11 Payback and commercial model 5.12 Polices in India	

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**

Make the list of requirements to establish a charging station.

Mini Project:

Discuss about the future aspects of EV.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE411.1: Understand the basic constructional feature and design components.	08	1	1	10
EE411.2: Understand the Motor Torque Calculations For Electric Vehicle.	05	2	1	08
EE411.3: Understand the working of Electric Drive and controller.	07	2	1	10
EE411.4: Understand the Energy Storage Solutions (ESS) and Battery Management System (BMS)/Energy Management System (EMS).	13	2	1	16
EE411.5: Understand the working of control unit and Electric Vehicles charging station with Indian and Global scenario.	12	2	1	15
Total Hours	45	9	5	59

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Basic constructional feature and design components.	03	02	02	07
CO-2	Understand the Motor Torque Calculations For Electric Vehicle.	02	06	02	10
CO-3	Understand the working of Electric Drive and controller.	02	03	03	08
CO-4	Understand the Energy Storage Solutions (ESS) and Battery Management System (BMS)/Energy Management System (EMS).	03	07	05	15
CO-5	Understand the working of control unit and Electric Vehicles charging station with Indian and Global scenario.	03	04	03	10
Total		13	22	15	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Electric and Hybrid Vehicles will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

(a) **Books** :

S. No.	Title	Author	Publisher	Edition & Year
1	Hybrid Electric vehicles	Dr. S. Vijaya Kumar	Iterative International Publisher	2023
2	Electrical Vehicle Engineering	Stephen Zoepf	McGraw-Hill	2020
3	Electric and Hybrid Vehicles	Iqbal Hussain	McGraw-Hill	2003
4	Electric and Hybrid Vehicles	A.K. Babu	Khanna Publishing House	2003
5	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE411
Course Title: Electric and Hybrid Vehicles

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering Knowledge	Problem Solving	Design Skills	Laboratory Skills	Teamwork	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: Understand the basic constructional feature and design components	3	2	3	2	2	2	1	1	3	1	2	2	2	3
CO 2: Understand the Motor Torque Calculations For Electric Vehicle.	2	3	3	2	1	2	1	3	1	1	2	2	2	3
CO3: Understand the working of Electric Drive and controller.	2	3	2	1	3	2	2	2	1	1	2	3	1	2
CO 4: Understand the Energy Storage Solutions (ESS) and Battery Management System (BMS)/Energy Management System (EMS).	3	2	2	2	3	2	1	3	2	1	2	2	3	3
CO 5: Understand the working of control unit and Electric Vehicles charging station with Indian and Global scenario.	2	3	3	1	1	3	2	3	1	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO-1: Understand the basic constructional featureand design components.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**Unit-1:** Basic constructional feature and design components. 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO-2: Understand the Motor Torque Calculations For Electric Vehicle.	SO2.1 SO2.2 SO2.3		**Unit-2**: Motor Torque Calculations For Electric Vehicle. 2.1, 2.2, 2.3, 2.4, 2.5	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO-3: Understand the working of Electric Drive and controller.	SO3.1SO3.2 SO3.3 SO3.4		**Unit-3:** Electric Drive and controller. 3.1,3.2,3.3,3.4,3.5,3.6,3.7	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO-4: Understand the Energy Storage Solutions (ESS) and Battery Management System (BMS)/Energy Management System (EMS).	SO4.1 SO4.2 SO4.3SO4.4 SO4.5		**Unit-4:** Energy Storage Solutions (ESS) and Battery Management System (BMS)/Energy Management System (EMS). 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13	1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO-5: Understand the working of control unit and Electric Vehicles charging station with Indian and Global scenario.	SO5.1 SO5.2 SO5.3 SO5.4		**Unit 5:** Control unit and Electric Vehicles charging station with Indian and Global scenario. 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5,8, 5.9, 5.10, 5.11, 5.12	1

Semester – VII

Course Code: **EE412**

Course Title : **Advanced Electric Drives**

Pre- requisite: Electrical Machines, Power electronics

Rationale: Electric motor is important part of industries. Precise Control of the electric motors for various industrial applications are required. Electric drive using power electronic converters with suitable control strategy can control the speed and torque of electric motor precisely. This course deals various strategies to control torque and speed of motors,

Course Outcomes: At the end of this course, students will demonstrate the ability to

EE412.1 Understand the operation of power electronic converters and their control strategies.
EE412.2 Understand the scalar and vector control strategies for induction motor drives
EE412.3 Understand the scalar and vector control strategies for synchronous motor drives
EE412.4 Understand the construction and control scheme of permanent magnet BLDC, PMSM motor and switched Reluctance Motor (SRM) drives
EE412.5 Understand the implementation of the control strategies using digital signal Processors

Course Category	**Course Code**	**Course Title**	**Scheme of studies(Hours/Week)**					**Total Credits (C)**
			Cl (L+T)	**LI**	**SW**	**SL**	**Total Study Hours (CI+LI+SW+SL)**	
Professional Elective (PEC)	EE412	Advanced Electric Drives	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop,field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self-Learning,
C: Credits.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT +SA+ CAT+AT)		
PEC	EE412	Advanced Electrical Drive	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminatingin the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE412.1 Understand the operation of power electronic converters and their control strategies.
Approximate Hours:

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 understand the PWM control & SHE **SO1.2** learn the Space vector modulation and current control **SO1.3** understanding three level Inverters and different topologies **SO1.4** study of PWM Rectifiers **SO1.5** study of inverters and H bridges using self-commutated devices.		**Unit-1.0 Power Electronics Converters and their Control Strategies** 1.1 Introduction of Pulse width modulation 1.2 selective harmonic Elimination 1.3 Space vector modulation and different strategies 1.4 SVM for 3 level Inverters 1.5 Diode rectifier with boost chopper 1.6 PWM converter as line side rectifier 1.7 current fed inverters with self-commutated devices 1.8 Control of CSI 1.9 H bridge as a 4-Q drive.	**1.** Numericals

EE412.2 Understand the scalar and vector control strategies for induction motor drives
Approximate Hours:

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Different transformations, reference frame theory **SO2.2** modeling of induction machines **SO2.3** voltage fed inverter control-v/f control **SO2.4** vector control **SO2.5** direct torque **SO2.6** flux control (DTC).		**Unit-2.0 Induction motor drives** 2.1 Different transformations 2.2 reference frame theory 2.3 modeling of induction machines 2.4 voltage fed inverter control 2.5 v/f control, 2.6 vector control, 2.7 direct torque 2.8 flux control (DTC). 2.9 Numericals on above topics	**1.** numericals

EE412.3 Understand the scalar and vector control strategies for synchronous motor drives
Approximate Hours:

Item	AppX Hrs
Cl	8
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Modelling of synchronous motors **SO3.2** v/f control **SO3.3** direct torque control **SO3.4** vector control **SO3.5** CSI fed Synchronous machine		**Unit-3.0 Modeling and Control of Synchronous Machines** 3.1 parameter and circuit equations 3.2 Modeling of synchronous machines, 3.3 open loop control 3.4 v/f control 3.5 vector control 3.6 direct torque control 3.7 CSI fed synchronous motor drives. 3.8 numerical	1. numericals

EE412.4 Understand the construction and control scheme of permanent magnet BLDC, PMSM motor and switched Reluctance Motor (SRM) drives

Approximate Hours:

Item	AppX Hrs
Cl	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 be able to know various PM motors **SO4.2** to know the configurations of BLDC, PMSM and SRM motors **SO4.3** Close Loop speed and torque control of PMSM motors, BLDC motor and SRM Drives		**Unit-4.0 Permanent Magnet Motors and Switched Reluctance Motors** 4.1 Introduction to various PM motors 4.2 BLDC configuration 4.3 PMSM drive configuration 4.4 comparison, 4.5 block diagrams 4.6 Speed control in BLDC and PMSM 4.7 torque control in BLDC and PMSM 4.8 Evolution of switched reluctance motors, 4.9 various topologies for SRM drives, 4.10 Comparison of topologies 4.11 Closed loop speed control of SRM 4.12 Torque control of SRM.	1. numericals

EE412.5 Understand the implementation of the control strategies using digital signal processors.

Approximate Hours:

Item	AppX Hrs
Cl	6
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 to be able know about the digital signal processors **SO5.2** To know about the various uses and applications of DSPs **SO5.3** to be able to know the realization and structure of DSPs **SO5.4** Motion control and drive automation with DSPs.		**UNIT 5: DSP based motion control** 5.1 Use of DSPs 5.2 various DSPs available 5.3 realization of some basic blocks in DSP 5.4 detailed Structure of DSP 5.5 implementation of DSP 5.6 DSP based motion control.	1 Numericals

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+LI+SW+Sl)
EE412.1 Understand the operation of power electronic converters and their control strategies.	9	1	1	11
EE412.2 Understand the scalar and vector control strategies for induction motor drives	9	1	1	11
EE412.3 Understand the scalar and vector control strategies for synchronous motor drives	8	1	1	10
EE412.4 Understand the construction and control scheme of permanent magnet BLDC, PMSM motor drives, And Switched Reluctance motors	12	1	1	14
EE412.5 Understand the implementation of the control strategies using digital signal Processors.	6	1	1	8
Total Hours	44	09	6	54

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Various power electronics converters and their control strategies	03	01	01	05
CO-2	Scalar and Vector control strategies for Induction motors	02	06	02	10
CO-3	Modeling and control strategies of synchronous Motors	03	07	05	15
CO-4	Construction, modelling and control permanent magnet BLDC, PMSM and SRM motors.	-	10	05	15
CO-5	Digital signal processors and their implementation for Power Electronics and Drives Control	03	02	-	05
Total		11	26	13	50

Legend: **R: Remember,** **U: Understand,** **A: Apply**

The end of semester assessment for Advanced Electric Drives will be held with writtenexamination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) **Books** :

S. No.	Title	Author	Publisher	Edition & Year
1	Modern Power Electronics and AC Drives	B. K. Bose	Pearson Education, Asia	2003
2	Analysis of Electric Machinery and Drive Systems	P.C. Krause, O. Wasynczuk and S.D. Sudhoff	John Wiley & Sons	2013
3	DSP based Electromechanical Motion Control	H. A. Taliyat and S. G. Campbell	CRC press,	2003
4	Permanent Magnet Synchronous and Brushless DC motor Drives	R. Krishnan	CRC press	2009
5	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE412
Course Title: Advanced Electric Drives

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering Knowledge	Problem Solving	Design Skills	Laboratory Skills	Teamwork	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1 Understand the operation of power electronic converters and their control strategies.	3	2	3	2	2	2	1	1	3	1	2	2	2	3
CO 2 Understand the scalar and vector control strategies for induction motor drives	3	3	3	2	1	2	1	3	1	1	2	2	2	3
CO 3 Understand the scalar and vector control strategies for synchronous motor drives	3	3	2	1	3	2	2	2	1	1	2	3	1	2
CO 4 Understand the construction and control scheme of permanent magnet BLDC, PMSM motor drives and Switched Reluctance motors	3	2	2	2	3	2	1	3	2	1	2	2	3	3
CO 5 Understand the implementation of the control strategies using digital signal Processors.	2	3	3	1	1	3	2	3	1	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	**CO1** Understand the operation of power electronic converters and their control strategies.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**Unit-1:** Various power electronics converters and their control strategies 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9	1
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	**CO 2** Understand the scalar and vector control strategies for induction motor drives	SO2.1, SO2.2 SO2.3, SO2.4 SO2.5, SO2.6		**Unit-2**: Scalar and Vector control strategies for Induction motors 2.1, 2.2, 2.3, 2.4, 2.5,2.6,2.7,2.8,2.9	1
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	**CO 3** Understand the scalar and vector control strategies for synchronous motor drives	SO3.1SO3.2 SO3.3 SO3.4 SO3.5		**Unit-3:** Modeling and control strategies of synchronous Motors 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8	1
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	**CO 4** Understand the construction and control scheme of permanent magnet BLDC, PMSM motor drives and Switched Reluctance motors	SO4.1 SO4.2 SO4.3		**Unit-4:** Construction, Modelling and control permanent magnet BLDC, PMSM and SRM motors. 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12	1
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	**CO 5** Understand the implementation of the control strategies using digital signal Processors.	SO5.1 SO5.2 SO5.3 SO5.4		**Unit 5:** Digital signal processors and their implementation for Power Electronics and Drives Control. 5.1, 5.2, 5.3, 5.4, 5.5, 5.6	1

Semester VII

Course Code:	**EE413**
Course Title :	**Industrial Electrical Systems**
Pre- requisite:	Student should have basic knowledge of Electricity, Electrical Circuits, Method Electrical Power transmission and distribution, Losses and basic mathematical operations.
Rationale:	Industrial Electrical Power involves various sub electrical systems, involving HVAC, energy management, building automation, fire and life safety systems, communications and security. This leads to the idea of integrated building electrical systems. This course covers the concepts of residential, commercial and wiring systems. It gives the insight to energy conservation opportunities in general industry and Introduce various methods of effectively and efficiently utilizing electrical energy for different and desired applications

Course Outcomes: After undergoing this course, the students will be able to:

EE413-1 Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD.

EE413-2 Understand various components of industrial electrical systems.

EE413-3 Analyze and select the proper size of various electrical system components.

EE413-4 Analyze and select the proper size of various electrical system components.

EE413-5 understand the Automation system

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Electice (PEC)	**EE413**	Industrial Electrical Systems	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self-Learning,
C: Credits

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks (PRA+ ESA)**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PEC	EE413	Industrial Electrical Systems	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE413.1: Understanding of Energy Scenario and environmental issues in an industry

Approximate Hours

Item	Approx Hrs
Cl	08
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the size of cable **SO1.2** Forming Incident Matrix for Fuses **SO1.3** Analysis the economic growth linked to energy consumption **SO1.4** Analysis Electrical safety practices **SO1.5** Solving problem related to Environmental impact Assessment	.	**Unit-1: Electrical System Components** 1. LT system wiring components 2. selection of cables, wires, switches, distribution box 3. Fuse, MCB 4. MCCB, ELCB 5. protection components 6. inverse current characteristics 7. symbols, single line diagram (SLD) of a wiring system, Contactor, 8. Isolator, MPCB, Electric shock and Electrical safety practice, Relays,	1. Electrical Component

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
b. **Case study: Electric Safety case in the Plant**

EE413.2: Apply different energy saving potential in Residential and Commercial Electrical Systems

Approximate Hours

Item	Approx Hrs
Cl	10
LI	0
SW	2
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understanding the wiring system **SO2.2** Analysis potential of each technology**.** **SO2.3** To understand the significance of lighting system. **SO2.4** Able to install earthing		**Unit-2 Residential and Commercial Electrical Systems** **1.** Types of residential and commercial wiring systems**.** 2. General rules and guidelines for installation 3. load calculation and sizing of wire 4. rating of main switch, distribution board and protection devices 5. earthing system calculations 1 6. earthing system calculations 2 7. requirements of commercial installation 8. deciding lighting scheme and number of lamps 9. earthing of commercial installation 10. selection and sizing of components	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

Draw wiring diagram for 3 phase induction motor.
Draw wiring diagram for residential building

EE413.3: Ability to do Energy management (audit) approach and understanding energy costs

Item	Approx Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 To Understand the Illumination system **SO3.2** To calculate the energy costs in lighting system **SO3.3** To draw lighting scheme commercial premises	.	**Unit-3 : Illumination Systems** 1. Understanding various terms regarding light (, lumen, intensity, candle power, lamp efficiency, specific consumption, glare) 2. space to height ratio, 3. waste light factor, 4. depreciation factor 5. Various illumination schemes (Incandescent lamps and modern luminaries like CFL, LED and their operation) 6. energy saving in illumination systems 7. design of a lighting scheme for a residential 1 8. design of a lighting scheme for a residential 2 9. Design of a lighting scheme commercial premises, flood lighting	1. Energy consumption in KW and unit

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**

Case study on 5 star and 3 star rating equipment energy Consumption

EE413.4: Analyze Industrial Electrical Systems.

Approximate Hours

Item	Approx Hrs
Cl	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 To Understand Industrial Substation **SO4.2** to Analysis the Switchgear selection factors **SO4.3** Analysis type LT Panel components	.	**Unit-4:** Industrial Electrical Systems I 1. HT connection 2. industrial substation, Transformer selection 3. Industrial loads, motors, starting of motors 4. SLD, Cable and Switchgear selection 5. SLD, Cable and Switchgear selection, Lightning Protection 6. , Earthing design, Power factor correction – kVAR calculations 7. type of compensation, 8. Introduction to PCC, MCC panels 9. Specification of LT Breakers, MCB and other LT panel components.	1. Rating of LT panel

SW-4 Suggested Sessional Work (SW):

a. **Substation Visit -Prepare a report**

EE413.5: Understanding of the concept of positive real function, their characteristics, filters and their different types

Approximate Hours

Item	Approx Hrs
Cl	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 To Understand the Industrial Automation System **SO3.2** Selection of all Storage system **SO3.3** Fuel saving Calculation	.	**Unit-5 : Industrial Electrical System Automation** 1. Study of basic PLC, Role of PLC in automation, 2. advantages of process automation 3. PLC based control system design, Panel Metering 1 4. PLC based control system design, Panel Metering 2 5. Communication Between PLC and SCADA 1 6. Communication Between PLC and SCADA 2 7. Introduction to SCADA system for distribution automation. 8. DG Systems, UPS System, Battery banks 9. Selection of UPS and Battery Banks	1.star rating

SW-5 Suggested Sessional Work (SW):

a. **Assignments:** Design a automation model using Arduino

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE413-1 Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD.	8	2	1	11
EE413-2 Understand various components of industrial electrical systems.	10	2	1	13
EE413-3 Analyze and select the proper size of various electrical system components.	9	1	1	11
EE413-4 Analyze and select the proper size of various electrical system components.	9	2	1	14
EE413-5 understand the Automation system	9	2	1	11
Total Hours	45	9	5	60

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Electrical System Components	02	03	05	10
CO-2	Residential and Commercial Electrical Systems	02	04	04	10
CO-3	Illumination Systems	02	02	06	10
CO-4	Industrial Electrical Systems I	03	07	05	15
CO-5	Industrial Electrical System Automation	01	02	02	05
Total		10	18	22	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Industrial electrical system will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Design Demonstration
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) **Books** :

S. No.	Title	Author	Publisher	Edition & Year
1	Modern Power Electronics and AC Drives	B. K. Bose	Pearson Education, Asia	2003
2	Analysis of Electric Machinery and Drive Systems	P.C. Krause, O. Wasynczuk and S.D. Sudhoff	John Wiley & Sons	2013
3	DSP based Electromechanical Motion Control	H. A. Taliyat and S. G. Campbell	CRC press,	2003
4	Permanent Magnet Synchronous and Brushless DC motor Drives	R. Krishnan	CRC press	2009
5	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE413
Course Title: Industrial Electrical Systems

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD	3	3	2	3	3	2	1	2	3	2	2	3	3	2
CO2 Understand various components of industrial electrical systems.	3	3	3	3	2	2	1	2	1	2	2	2	2	2
CO3: Analyze and select the proper size of various electrical system components	3	3	2	2	3	1	2	2	1	2	2	3	2	2
CO4: Analyze and select the proper size of various electrical system components.	3	3	2	2	2	1	1	3	2	2	2	2	3	3
CO5 understand the Automation system	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO1:** Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**Unit-1 Electrical System Components** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,	1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO2** Understand various components of industrial electrical systems.	SO2.1 SO2.2 SO2.3 SO2.4		**Unit-2 Residential and Commercial Electrical Systems** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9,2.10	1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO3:** Analyze and select the proper size of various electrical system components	SO3.1 SO3.2 SO3.3		**Unit-3 : Illumination Systems** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO4:** Analyze and select the proper size of various electrical system components	SO4.1 SO4.2 SO4.3		**Unit-4 :** Industrial Electrical Systems I 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9	1
PO:1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2	**CO5:** understand the Automation system.	SO5.1 SO5.2 SO5.3		**Unit 5: Industrial Electrical System Automation** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	1

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-VII

Course Code:	**EE414**
Course Title :	**Digital Control System**
Pre- requisite:	Student should have basic knowledge of mathematics, Specially Z Transform, there properties and its Application.
Rationale:	The Purpose of this subject is to introduce the basic concept, stability analysis, its State space representation and Design procedure of Digital Control System.

Course Outcomes: At the end of this course, students will be able to

EE414.1: Obtain and analyze discrete representation of LTI systems.
EE414.2: Obtain Z-Transform and Inverse Z Transform for analyzing discrete time systems
EE414.3: Analyze stability of open loop and closed loop discrete-time systems.
EE414.4: Obtain State space Model of Digital Control system.
EE414.5: Design and analyze different types of digital controllers

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Professional Elective course (PEC)	EE414	Digital Control System	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self-Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Course Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment**	**Total Marks**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	**(ESA)**	(PRA+ESA)
PEC	EE414	Digital Control System	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE414.1: Obtain and analyze discrete representation of LTI systems.

Approximate Hours

Item	Approx. Hrs.
Cl	8
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Lab Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO1.1** Understand the concept of Digital Control Systems **SO1.2** find the Discrete representation of continuous systems **SO1.3** Develop the Mathematical Model of sample and hold circuit		**UNIT-1: Discrete Representation of Continuous Systems** 1.1 Basics of Digital Control Systems. 1.2 Discrete representation of continuous systems-I 1.3 Discrete representation of continuous systems-I 1.4 Sample and hold circuit. 1.5 Mathematical Modeling of sample and hold circuit. 1.6 Effects of Sampling and Quantization. 1.7 Choice of sampling frequency. 1.8 ZOH equivalent.	1. Sample and Hold Circuit 2.Practice of numerical problems based on discrete representation of Continuous systems.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

i. numerical problems based on Discrete representation of Continuous systems.

ii. Numerical Problems Related to numerical problems based on Discrete representation of Continuous systems

EE414.2: Obtain Z-Transform and Inverse Z Transform for analyzing discrete time systems

Approximate Hours

Item	Approx. Hrs.
Cl	8
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO2.1** Obtain Pulse transfer function of given system. **SO2.2** Map the function from s plane to z plane. **SO2.3** Obtain Time response of given discrete time system.		**UNIT-2: Discrete System Analysis** 2.1 Z-Transform 2.2 Inverse Z Transform 2.3 Pulse Transfer function. 2.4 Pulse transfer function of closed loop systems. 2.5 Mapping from s-plane to z plane. 2.6 Solution of Discrete time systems. 2.7 Time response of discrete time system-I 2.8 Time response of discrete time system-II	1. Z transform and its properties 2. Practice of numerical problems related to Pulse transfer function of closed loop systems. 3. Practice of numerical problems related to Time response of discrete time system.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Numerical problems related to Pulse transfer function of closed loop systems.
   ii. Numerical problems related to Time response of discrete time system.

EE414.3: Analyze stability of open loop and closed loop discrete-time systems.

Approximate Hours

Item	Approx. Hrs.
Cl	7
LI	0
SW	2
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO3.1** Determine the stability of given system using jury test. **SO3.2** Determine the stability of given system using bilinear Transformation. **SO3.3** Design of digital control system with dead beat response.		**Unit-3: Stability of Discrete Time System** 3.1 Stability analysis by Jury test-I 3.2 Stability analysis by Jury test-II 3.3 Stability analysis using bilinear transformation-I 3.4 Stability analysis using bilinear transformation-II 3.5 Design of digital control system with dead beat response-I. 3.6 Design of digital control system with dead beat response-II 3.7 Practical issues with dead beat response design	1. Concept of stability 2. Practice of numerical problems related jury test and bilinear transformation.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Numerical problems related jury test.
   ii. Numerical problems related to bilinear transformation.

EE414.4: Obtain State space Model of Digital Control system.

Approximate Hours

Item	Approx. Hrs.
Cl	12
LI	0
SW	2
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO4.1** develop state space model of given system. **SO4.2** Understand the concept of controllability and test it for a given system. **SO4.3** Understand the concept of Reach-ability and test it for a given system **SO4.4** Understand the concept of Reconstruct-ability and test it for a given system. **SO4.5** Understand the concept of Observability and test it for a given system		**UNIT-4: State Space Approach for discrete time systems** 4.1 State space models of discrete systems. 4.2 State space analysis. 4.3 Lyapunov's Stability criterion. 4.4 Controllability analysis-I 4.5 Controllability analysis-II 4.6 Reach-ability analysis-I 4.7 Reach-ability analysis-II 4.8 Reconstruct ability analysis-I 4.9 Reconstruct ability analysis-II 4.10 Observability analysis-I 4.11 Observability analysis-II 4.12 Effect of pole zero cancellation on the controllability & observability.	1. Practice of Numerical Problems Related to Controllability and Reach-ability analysis. 2. Practice of Numerical Problems Related to reconstruct ability analysis. 3. Practice of Numerical Problems Related to observability analysis.

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Numerical Problems Related to Controllability and Reach-ability analysis.
   ii. Numerical Problems Related to reconstruct-ability and observability analysis.

EE414.5: Design and analyze different types of digital controllers

Approximate Hours

Item	Approx. Hrs.
Cl	10
LI	0
SW	2
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
Students will be able to **SO5.1** Design Discrete PID Controller **SO5.2** Design discrete state feedback controller **SO5.3** Design set point tracker **SO5.4** Design Discrete Observer for LTI System **SO5.5** Design Discrete compensator		**UNIT-5: Design of Digital Control System** **5.1** Design of Discrete PID Controller-I **5.2** Design of Discrete PID Controller-I I **5.3** Design of discrete state feedback controller-I. **5.4** Design of discrete state feedback controller-II. **5.5** Design of set point tracker-I. **5.6** Design of set point tracker-II. **5.7** Design of Discrete Observer for LTI System-I. **5.8** Design of Discrete Observer for LTI System-II. **5.9** Design of Discrete compensator-I. **5.10** Design of Discrete compensator-II	1. Practice of Numerical problems related to Design of Discrete PID Controller. 2. Practice of Numerical problems related to Design of discrete state feedback controller. 3. Practice of Numerical problems related to Design of Discrete compensator. 4. Practice of Numerical problems related to Design of set point tracker

SW-5 Suggested Sessional Work (SW):

a. Assignments:

Numerical problems related to Design of Discrete PID Controller.

i. Numerical problems related to Design of discrete state feedback controller.
ii. Numerical problems related to Design of Discrete compensator.
iii. Numerical problems related to Design of set point tracker.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE414.1: Obtain and analyze discrete representation of LTI systems.	8	2	1	11
EE414.2: Obtain Z-Transform and Inverse Z Transform for analyzing discrete time systems	8	2	1	11
EE414.3: Analyze stability of open loop and closed loop discrete-time systems.	7	2	1	10
EE414.4: Obtain State space Model of Digital Control system.	12	2	1	15
EE414.5: Design and analyze different types of digital controllers	10	2	1	13
Total Hours	45	10	5	60

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Discrete Representation of Continuous Systems	02	03	05	10
CO-2	Discrete System Analysis	02	05	03	10
CO-3	Stability of Discrete Time System	02	02	06	10
CO-4	State Space Approach for discrete time systems	02	04	04	10
CO-5	Design of Digital Control System	02	03	05	10
Total		10	17	23	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Digital control system will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Demonstration of Control Actions.
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, WhatApp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) **Books** :

S. No.	Title	Author	Publisher	Edition & Year
1	"Control System Engg"	G. F. Franklin, J. D. Powell and M. L. Workman	Addison-Wesley	1998
2	Digital Control Engineering	M.Gopal	Wiley Eastern	1998
3	Digital Control Engineering	K. Ogata	PHI.	1995
4	Digital Control System	B.C. Kuo	Holt, Rinehart and Winston	1980
5	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs,POs and PSOs Mapping

Course Title: B. Tech. Electrical Engineering
Course Code: EE414
Course Title: Digital Control System

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Obtain and analyze discrete representation of LTI systems.	3	3	2	2	2	1	1	2	2	1	2	2	3	3
CO 2: Obtain Z-Transform and Inverse Z Transform for analyzing discrete time systems	3	3	3	2	2	1	1	3	2	2	2	3	3	3
CO3: Analyze stability of open loop and closed loop discrete-time systems.	3	3	3	2	2	1	2	2	2	2	2	3	3	3
CO 4: Obtain State space Model of Digital Control system	3	3	3	2	2	1	2	3	2	2	2	2	3	3
CO 5: Design and analyze different types of digital controllers	3	3	3	2	2	1	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO1: Obtain and analyze discrete representation of LTI systems.	SO1.1 SO1.2 SO1.3		**UNIT-1: Discrete Representation of Continuous Systems** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	1,2
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO 2: Obtain Z-Transform and Inverse Z Transform for analyzing discrete time systems	SO2. 1 SO2. 2 SO2. 3		**UNIT-2: Discrete System Analysis** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8	1,2,3
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO3: Analyze stability of open loop and closed loop discrete-time systems.	SO3. 1 SO3. 2 SO3. 3		**Unit-3: Stability of Discrete Time System** 3.1,3.2,3.3,3.4,3.5,3.6,3.7.	1,2
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO 4: Obtain State space Model of Digital Control system	SO4.1 SO4.2 SO4. 3 SO4. 4 SO4. 5		**UNIT-4: State Space Approach for discrete time systems** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8, 4.9,4.10,4.11,4.12	1,2,3
PO:1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2	CO 5: Design and analyze different types of digital controllers	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		**UNIT-5: Design of Digital Control System** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10	1,2,3,4

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-VII

Course Code:	**EE415**
Course Title :	**Digital signal processing**
Pre- requisite:	Student should have basic knowledge of Electrical signals, systems, Basic Electrical Laws, Z- Transform, Fourier transform and basic mathematical operations.
Rationale:	This course is designed to provide the knowledge to student's about Digital signal Processing besides the basic topics. It includes advanced topics of signals processing and its parameters, This course would help students to understand more advanced concepts of modern communication system

Course Outcomes:

EE415.1: Understanding of Discrete time signals and systems, significance of sampling and reconstruction.

EE415.2: Applications of Z-transform in Digital signals and systems.

EE415.3: Identify the properties and characteristics of discrete Fourier Transform along with their Mathematical representation and analysis.

EE415.4: Understanding the basic concepts designing of different types of filters.

EE415.5: Analyzing the Applications of Digital Signal Processing

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Elective (PEC)	EE415	Digital Signal Processing	3	0	1	1	6	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self Learning,

C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
PEC	EE415	Digital Signal Processing	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

EE415.1: Understanding of Discrete time signals and systems, significance of sampling and reconstruction.

Approximate Hours

Item	Approx Hrs
Cl	08
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the concept of discrete time signals and systems **SO1.2** Understand the different methods of representation of discrete time signals and systems **SO1.3** Significance of sampling and reconstruction of signals and systems **SO1.4** Importance and explanation of aliasing method sampling theorem and Nyquist rate.	.	**Unit-1: Discrete-time signals and systems** 1.1 Definition of discrete time signals and systems 1.2 Sequences representation of discrete time signals and systems 1.3 Representation of signals on orthogonal basis. 1.4 Representation of discrete systems using difference equations 1.5 Numerical of difference equations 1.6 Sampling and reconstruction of signals and systems 1.7 Explanation of aliasing 1.8 Sampling theorem and Nyquist rate.	1. Basics of signal and systems 2. Difference between Analog signals and discrete time signals 3. Differential equations

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

i. Numerical Problems of sampling theorem and Nyquist rate

EE415.2: Applications of Z-transform in Digital signals and systems.

Approximate Hours

Item	Approx Hrs
Cl	10
LI	0
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understanding of Z-transform **SO2.2** Solve different signals and systems using Z transform **SO2.3** To understand the significance of Region of convergence. **SO2.4** Basic knowledge of inverse Z-Transform.		**Unit-2: Z-Transform** 2.1 Introduction to Z-transform. 2.2 Region of Convergence 2.3 Analysis of linear shift invariant systems using Z-Transform 2.4 Numerical of Z-transform 2.5 Different properties of Z-Transform for Causal signals 2.6 Numerical on properties of Z-Transform 2.7 Interpretation of stability in z-domain 2.8 Inverse z-transforms. 2.9 Properties of Inverse Z-Transform 2.10 Numerical of Inverse Z-Transform	1. Basics of Z-Transform 2. Properties of signals and systems

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Numerical Problems on Z-Transform.

ii. Numerical Problems based on Inverse Z-Transform.

EE415.3: Identify the properties and characteristics of discrete Fourier Transform along with their Mathematical representation and analysis.

Approximate Hours

Item	Approx Hrs
Cl	8
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 To Understand the concept of Discrete time Fourier Transform **SO3.2** Significance of properties of discrete Fourier transform **SO3.3** To Understand the concept of fast Fourier Transform	.	**Unit-3 : Discrete Fourier Transform** 3.1 Introduction to Discrete Fourier Transform 3.2 Properties of discrete Fourier transform 3.3 Numericals 3.4 Convolution of signals 3.5 Fast Fourier Transform Algorithm 3.6 Parseval's Identity 3.7 Implementation of Discrete Time systems 3.8 Numericals	1. Basics of Fourier transform. 2. Discrete time signals

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   - i. Numerical Problems based on Discrete Fourier transform.
   - ii. Numerical Problems of Fast Fourier Transform.

EE415.4: Understanding the basic concepts designing of different types of filters.

Approximate Hours

Item	Approx Hrs
Cl	11
LI	0
SW	1
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understanding the basic concepts of digital filters **SO4.2** Significance of design of digital filters and its types **SO4.3** to illustrate the different methods involve in designing of digital filters	.	**Unit-4 : Design of Digital filters** 4.1 Introduction to digital filters and its significance in digital signal processing. 4.2 Window method for filter designing 4.3 Park-McClellan's method for filter designing 4.4 Introduction to Design of IIR Digital Filters 4.5 Butterworth method 4.6 Chebyshev method 4.7 Elliptic Approximations 4.8 Low-pass,band pass,band stop and high pass filters 4.9 Effect of finite register length in FIR filter design. 4.10 Parametric and non-parametric spectral estimation. 4.11 Introduction to multi-rate signal processing	1. Filters and types of filters 2. Difference between analog and digital filters

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Explanation of designing of FIR and IIR filters

ii. Numerical problems based on window method.

Mini Project:

i. Draw a chart of Different types of filters.

EE415.5: Analyzing the Applications of Digital Signal Processing.

Approximate Hours

Item	Approx Hrs
Cl	8
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 To understand the correlation functions **SO5.2** To understand the significance of power spectra **SO5.3** Importance of linear mean square estimation.		**Unit 5: Applications of Digital Signal Processing** 5.1 Correlation Functions 5.2 Examples of correlation functions. 5.3 Power Spectra 5.4 Stationary Processes 5.5 Optimal filtering using ARMA Model 5.6 Linear Mean-Square Estimation 5.7 Examples of Linear mean square Estimation 5.8 Wiener Filter.	1. Remember the properties of filters 2. Types of correlation function.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**

Numerical Problem based on correlation function

i. Numerical Problem based on linear mean square Estimation.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
EE415.1: Understanding of Discrete time signals and systems. Significance of sampling and reconstruction.	8	1	1	10
EE415.2: Applications of Z-transform in Digital signals and systems.	10	1	1	12
EE415.3: Identify the properties and characteristics of discrete Fourier Transform along with their Mathematical representation and analysis.	8	1	1	10
EE415.4: Understanding the basic concepts designing of different types of filters.	11	1	1	13
EE415.5: Analyzing the Applications of Digital Signal Processing	8	1	1	10
Total Hours	45	5	5	55

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Discrete-time signals and systems	02	03	05	10
CO-2	Z-transform	02	04	04	10
CO-3	Discrete Fourier Transform	02	02	06	10
CO-4	Design of Digital filters	03	07	05	15
CO-5	Applications of Digital Signal Processing	01	02	02	05
Total		10	18	22	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Digital Signal Processing will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Design Demonstration
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) **Books** :

S. No.	Title	Author	Publisher	Edition & Year
1	Digital Signal Processing: A computer based approach	S. K. Mitra	McGraw Hill	2011
2	Discrete Time Signal Processing‖	A.V. Oppenheim and R. W. Schafer,	Prentice Hall	1989
3	Digital Signal Processing: Principles, Algorithms and Applications	J. G. Proakis and D.G. Manolakis	Prentice Hall	1997
4	Theory and Application of Digital Signal Processing	L. R. Rabiner and B. Gold	Prentice Hall,	1992.
5	Introduction to digital Signal Processing‖,	J. R. Johnson	Prentice Hall,	1992.
6.	Digital Signal Processing‖,	D. J. DeFatta, J. G. Lucas and W. S. Hodgkiss	John Wiley & Sons,	1988.
7	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: EE415
Course Title: DIGITAL SIGNAL PROCESSING

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Understanding of Discrete time signals and systems. Significance of sampling and reconstruction.	3	3	2	2	2	1	1	2	2	1	2	2	2	3
CO 2: Applications of Z-transform in Digital signals and systems.	3	3	3	3	2	2	1	3	2	2	2	3	3	2
CO3: Identify the properties and characteristics of discrete Fourier Transform along with their Mathematical representation and analysis	3	2	3	2	2	1	2	2	2	2	2	3	3	2
CO 4: Understanding the basic concepts designing of different types of filters.	3	3	2	2	2	2	2	3	2	2	2	2	2	3
CO 5: Analyzing the Applications of Digital Signal Processing	3	3	3	3	2	3	2	3	2	2	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO1: Understanding of Discrete time signals and systems. Significance of sampling and reconstruction.	SO1. 1 SO1. 2 SO1.3 SO1.4		**UNIT-1: Discrete-time signals and systems** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	1,2,3
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 2: Applications of Z-transform in Digital signals and systems.	SO2.1 SO2.2 SO2.3 SO2.4		**UNIT-2**: **Z-Transform** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9,2.10	1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO3: Identify the properties and characteristics of discrete Fourier Transform along with their Mathematical representation and analysis	SO3. 1 SO3. 2 SO3. 3		**Unit-3: Discrete Fourier Transform** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8	1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 4: Understanding the basic concepts designing of different types of filters.	SO4. 1 SO4. 2 SO4. 3		**UNIT-4: Design of Digital filters** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8, 4.9,4.10,4.11	1,2
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1,2	CO 5: Analyzing the Applications of Digital Signal Processing	SO5.1 SO5.2 SO5.3		**UNIT-5: Applications of Digital Signal Processing** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	1,2

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-VII

Course Code:	**OEC409**
Course Title:	**ELECTRICAL MATERIALS**
Pre- requisite:	Student should have knowledge of various electrical materials used for design and fabrication of different types of electrical circuits.
Rationale:	In current scenario we see the different types of electrical systems. Such systems are required to design and maintain by engineer. Therefore, the goal of this course is for students to become competent to understand fundamental of such type of materials used to design different types of electrical circuits.

Course Outcomes:

OEC409.1: Learn the various properties of conducting materials used in electrical engineering.
OEC409.2: Realize the dielectric properties of different insulators in static and alternating fields.
OEC409.3: Realize the magnetic properties of magnetic materials used in electrical engineering.
OEC409.4: Learn the various properties of semiconducting materials used in electrical engineering.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Open Elective Core (OEC)	OEC409	ELECTRICAL MATERIALS	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA + ESA)
OEC	OEC409	ELECTRICAL MATERIALS	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

OEC409.1: Learn the various properties of conducting materials used in electrical engineering.

Approximate Hours

Item	Approx Hrs
Cl	11
LI	0
SW	2
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the conductivity in metals. **SO1.2** Understand the effect of temperature on conducting materials. **SO1.3** Understand the various types of conducting materials and their properties.		**UNIT-1: CONDUCTIVITY OF METALS** 1.1 Conductivity of Metal: Introduction 1.2 Factors affecting the resistivity of electrical materials 1.3 Motion of an electron in an electric field 1.4 Equation of motion of an electron, current carried by electrons, mobility 1.5 Thermionic emission 1.6 Photo electric emission 1.7 Field emission 1.8 Effect of temperature on electrical conductivity of metals 1.9 Electrical conducting materials. 1.10 Thermal properties, thermal conductivity of metals 1.11 Thermoelectric effects.	1. Fundamental of conducting materials.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Classify the different types of electrical materials.
   ii. Discuss the effect of temperature on conducting materials.

OEC409.2: Realize the dielectric properties of different insulators in static and alternating fields.

Approximate Hours

Item	Approx Hrs
Cl	10
LI	0
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Understanding the dielectric material. **SO2.2** Understanding various properties of dielectric materials. **SO2.3** Understanding frequency and temperature dependence of the dielectric constant.		**Unit-2: DIELCTRIC MATERIALS** 2.1 Dielectric properties: introduction 2.2 Effect of a dielectric on the behaviour of a capacitor 2.3 Polarization 2.4 The dielectric constant of monatomic gases 2.5 Dielectric losses, significance of the loss tangent 2.6 Frequency and temperature dependence of the dielectric constant 2.7 Dielectric properties of polymeric system 2.8 Ionic conductivity in insulators 2.9 Insulating materials 2.10 Ferro electricity, piezoelectricity	1. Fundamental of insulating materials.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Explain effect of a dielectric on behavior of capacitor.

OEC409.3: Realize the magnetic properties of magnetic materials used in electrical engineering.

Approximate Hours

Item	Approx Hrs
Cl	8
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Understand the magnetic properties of materials. **SO3.2** Understand the effect of temperature on magnetic materials. **SO3.3** Understand the different types of magnetic materials and their properties.		**Unit-3: MAGNETIC MATERIALS** 3.1 Magnetic properties of Materials: Introduction 3.2 Classification of magnetic materials 3.3 Diamagnetism, Para magnetism, Ferromagnetism 3.4 Magnetization curve 3.5 The hysteresis loop 3.6 Factors affecting permeability and hysteresis loss 3.7 Common magnetic materials 3.8 Magnetic resonance	1. fundamental of magnetic materials.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Explain how will you classify different types of magnetic materials.
   ii. Discuss some common magnetic materials and their properties used in electrical circuits.

OEC409.4: Learn the various properties of semiconducting materials used in electrical engineering.

Approximate Hours

Item	Approx. Hrs
Cl	8
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand the semiconductor its types and various properties. **SO4.2** Understand the effect of temperature on semiconductor.		**Unit-4: SEMICONDUCTOR MATERIALS** 4.1 Semiconductors: Introduction 4.2 energy band in solids, conductors, semiconductors and insulators 4.3 types of semiconductors, Intrinsic semiconductors 4.4 impurity type semiconductor, diffusion 4.5 the Einstein relation 4.6 hall effect 4.7 thermal conductivity of semiconductors 4.8 electrical conductivity of doped materials	1. Difference between conductor, semiconductor and insulator.

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Explain the effect of temperature on semiconductors.

ii. Draw the energy band diagram of conductor, semiconductor and insulator.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
OEC409.1: Learn the various properties of conducting materials used in electrical engineering.	11	2	1	14
OEC409.2: Realize the dielectric properties of different insulators in static and alternating fields.	10	1	1	12
OEC409.3: Realize the magnetic properties of magnetic materials used in electrical engineering.	8	2	1	11
OEC409.4: Learn the various properties of semiconducting materials used in electrical engineering.	8	2	1	11
Total Hours	37	7	5	48

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Conductivity of metals	07	05	01	13
CO-2	Dielectric materials	05	04	02	11
CO-3	Magnetic materials	06	04	01	11
CO-4	Semiconductor materials	08	05	02	15
Total		26	18	6	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Electrical Materials will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Practical Design Demonstration
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Engineering Materials	Kenneth G. Budinski	Pearson	2009
2	An Introduction to Electrical Engineering materials	C.S.Indulkar and S. Thiruvengadam, S.,	S Chand & Company	2006
3	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

****

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

COs, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: OEC409
Course Title: Electrical Materials

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
	Engineering knowledge	**Problem Solving**	**Design Skills**	**Laboratory Skills**	**Team work**	**Communication Skills**	**Ethical and Professional Behavior**	**Lifelong Learning**	**Global and Societal Impact**	**Project Management**	**Adaptability**	**Professional Development**	**Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society**	**Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services**
CO1: Learn the various properties of conducting materials used in electrical engineering.	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**2**	**2**	**2**	**3**
CO2: Realize the dielectric properties of different insulators in static and alternating fields.	**3**	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**2**	**2**	**2**	**3**	**3**	**2**
CO3: Realize the magnetic properties of magnetic materials used in electrical engineering.	**3**	**2**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**1**	**2**	**3**	**2**	**2**
CO4: Learn the various properties of semiconducting materials used in electrical engineering.	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**3**

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO1:** Learn the various properties of conducting materials used in electrical engineering.	SO1.1 SO1.2 SO1.3		**UNIT-1:** Conductivity of metals 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11	1
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO2:** Realize the dielectric properties of different insulators in static and alternating fields.	SO2.1 SO2.2 SO2.3		**UNIT-2**: Dielectric materials 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9,2.10	1
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO3:** Realize the magnetic properties of magnetic materials used in electrical engineering.	SO3.1 SO3.2 SO3.3		**Unit-3:** Magnetic materials 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8	1
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	**CO4:** Learn the various properties of semiconducting materials used in electrical engineering.	SO4.1 SO4.2		**UNIT-4:** Semiconductor materials 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	1

Semester-VII

Course Code: **OEC410**

Course Title : **Modern Manufacturing Process.**

Pre- requisite: Basic knowledge of mathematical skill with some scientific temperament
Rationale: Manufacturing Processes is the course used to introduce the basic concepts of materials and manufacturing technology to the student. Upon completing the course the student should have basic knowledge of classes of materials and the achievement of their service characteristics developed by the manufacturing process and the follow on heat treatments and other surface treatments.

Course Outcomes:

OEC410.1: Understand various manufacturing processes, selecting appropriate methods for different material, optimizing manufacturing efficiency and ensuring product quality
OEC410.2: Acquire fundamental knowledge and design widely used and very important primary manufacturing processes such as casting, forming ,forging rolling, extrusion
OEC410.3: *A*cquire knowledge about the various tools, equipment, machinery and operations required for material removal processes
OEC410.4: understand the unconventional machining processes ,like EDM,EBM,LBM etc.
OEC410.5: Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application.

Scheme of Studies:

Course Category Study	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Open Elective Core (OEC)	OEC410	Modern Manufacturing Process.	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop,field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self-Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Category	Course Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks (PRA + ESA)**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
OEC	OEC 410	Modern Manufacturing Process	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminatingin the overall achievement of Course Outcomes (COs) upon the course's conclusion.

OEC410.1: Understand various manufacturing processes, selecting appropriate methods for different material, optimizing manufacturing efficiency and ensuring product quality

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Define key concepts and applications of additive, subtractive, and shaping manufacturing processes. **SO1.2** Analyze and compare the strengths and weaknesses of each process, considering factors like speed, flexibility, and material compatibility. **SO1.3** Examine how design choices in geometry and material affect the selection of manufacturing processes. **SO1.5** Learn criteria for selecting manufacturing processes, including considerations for volume, materials, and cost-effectiveness.		**SUnit-1.0 Manufacturing processes an classification:** Introduction of manufacturing processes 1.1 Define manufacturing And various methods 1.2 introduction of additive, subtractive process, shaping processes 1.3 Advantages of additives, subtractive and shaping processes 1.4 Limitations of additives, subtractive and shaping processes 1.5 Effect of material on product quality and cost 1.6 Effect of process on product quality 1.7 Effect of process on cost 1.8 Part design for manufacturability; 1.9 Process selection criteria, Inter-dependency of geometry	1. Introduction to Inter-dependency of geometry

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Explain part design for manufacturability

OEC410.2: Acquire fundamental knowledge and design widely used and very important primary manufacturing processes such as casting, forming, forging rolling, extrusion

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	2
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understand metal casting methods (sand, die, investment) and bulk forming techniques (forging, rolling, extrusion, drawing), including their applications and limitations. **SO2.2** Grasp the distinctions between thermoplastic and thermoset plastics; comprehend injection molding and blow molding principles; and evaluate their suitability for different applications. **SO2.3** Define powder metallurgy, comprehend its steps, and understand the advantages of metal injection molding for complex component production. **SO2.4** Identify glass shaping processes (layup) and grasp the fundamentals of composite materials, exploring their applications and challenges. **SO2.5** Integrate knowledge from previous sessions to solve manufacturing problems, analyze case studies, and discuss current trends in material shaping technologies		Unit-2.0 Material Shaping Processes 2.1 Introduction of Material Shaping Processes 2.2 Introduction of metal casting process, Types of metal casting process 2.3 Introduction of forming process, Metal rolling processes 2.4 Metal forging processes, Metal drawing processes 2.5 Metal extrusion processes. 2.6 sheet forming (shearing, deep drawing, bending) processes 2.7 Thermoplastic processes, Thermo set plastic processes 2.8 Introduction of Power metallurgy, Metal injection molding 2.9 Glass and composite processes (layup).	1 Metal extrusion processes 2 Metal injection molding

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Thermoplastic processes

OEC410.3: Acquire knowledge about the various tools, equipment, machinery and operations required for material removal processes.

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	2
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Understand key material removal processes, cutting tools, materials, and the role of cutting fluids. **SO3.2** Demonstrate expertise in turning and drilling, considering material removal rates, surface finish, accuracy, and integrity. **SO3.3** Describe milling operations, assess machining parameters, and understand machinability for various materials. **SO3.4** Explain grinding principles, surface finish requirements, and the impact of parameters on material removal rates and accuracy. **SO3.5** Integrate knowledge for optimizing material removal processes, analyze case studies, and discuss current trends in machining technologies.		**Unit-3.0 Material Removal Processes** 3.1 Introduction of material removal processes and Turning process 3.2Introduction of Drilling process 3.3 Milling process, grinding process 3.4 finishing processes 3.5 Single and multi-point cutting tools, Cutting tool materials 3.6 Cutting fluids 3.7 Material removal rate, 3.8 surface finish, accuracy 3.9 integrity and machinability	1. Milling process 2 surface finish, accuracy

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Explain single and multi-point cutting tools

OEC410.4: understand the unconventional machining processes, like EDM,EBM,LBM etc

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand key unconventional manufacturing processes, including abrasive jet machining, water jet machining, ultrasonic machining, EDM, wire EDM, ECM, laser beam machining, plasma arc machining, and electron beam machining. **SO4.2** Explore diverse applications of unconventional machining techniques in different industries. **SO4.3** Develop the ability to choose the most suitable process based on material properties, design requirements, and project constraints. **SO4.4** Learn strategies to optimize efficiency and quality in unconventional machining. **SO4.5**Learn how to integrate unconventional processes with		Unit-4.0 Other (unconventional) Manufacturing Processes 4.1 Introduction of unconventional manufacturing processes 4.2 Abrasive Jet Machining, Water Jet Machining 4.3 Ultrasonic Machining, Electrical Discharge Machining 4.4 Wire EDM, Electro-Chemical Machining 4.5 Laser Beam Machining 4.6, Plasma Arc Machining, 4.7 Electron Beam Machining;	1. Micro and nano manufacturing

traditional manufacturing for a comprehensive approach.		4.8 Micro manufacturing 4.9 Nano manufacturing	

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Explain the procedure of water Jet Machining

OEC410.5: Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application.

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 -understand various welding methods, including arc welding, gas welding, shielded metal arc welding, GMAW (MIG), and GTAW (TIG).. **SO5.2 -** Students will learn the process of in arc welding, focusing on safety, electrode selection, and basic welding techniques. **SO5.3 -** learn advanced GMAW (MIG) and GTAW (TIG) welding techniques, focusing on electrode selection and welding parameters.. **SO5.4** acquire skills in gas welding and brazing, mastering equipment		**Unit-5.0 Joining and Fastening Processes** 5.1 Introduction of joining and fastening processes 5.2 Arc welding 5.3 Gas welding 5.4Shielded metal arc welding 5.5 GMAW (MIG) 5.6 GTAW (TIG) 5.7 Brazing 5.8 soldering	1. GTAW (TIG

usage, safety, and application techniques **SO5.5** learn about different types of adhesives, surface preparation, and bonding considerations		5.9 Solid state joining, Adhesive	

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Explain shielded metal arc welding

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+LI+SW+SI)
OEC410.1: Understand various manufacturing processes, selecting appropriate methods for different material, optimizing manufacturing efficiency and ensuring product quality	9	01	01	11
OEC410.2: Acquire fundamental knowledge and design widely used and very important primary manufacturing processes such as casting, forming, forging rolling, extrusion.	9	01	02	12
OEC410.3: Acquire knowledge about the various tools, equipment, machinery and operations required for material removal processes	9	01	02	12
OEC410.4: understand the unconventional machining processes ,like EDM,EBM,LBM etc.	9	01	01	11
OEC410.5: Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application.	9	01	01	11
Total Hours	45	05	07	57

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Manufacturing processes and classification	03	01	01	05
CO-2	Material shaping processes	02	06	02	10
CO-3	Material removal processes	03	07	05	15
CO-4	Unconventional manufacturing processes	03	05	07	15
CO-5	Joining and Fastening processes.	03	02	-	05
Total		14	21	15	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Manufacturing Process will be held with writtenexamination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
7. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Manufacturing Science	Amitabha Ghosh and A.K. Mallick	Affiliated East-West Press Pvt Ltd.	Revised edition 2010
2	Manufacturing Processes for Engineering Materials	Kalpakjian and Schmid	Pearson India	2014
3	Manufacturing process	H.N. Gupta R.C.Gupta Arun Mittal	New Age International Publisher	Second edition 2009
4	Manufacturing Technology	R.K. Rajput	Laxmi Publisher Ltd.	2007
5	Training Manual			
6	Training Manual			
7	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna .			

****

Curriculum Development Team

1. **Mr. S.S. Parihar, Head of Deptt. Mech. Engg., AKS University**
2. **Mr. Alok Ranjan Tiwari , Assistant Professor, Dept. of Mechanichal Engg.**
3. **Mr Deepak Pandey , Assistant Professor , Dept. of Mechanichal Engg**
4. **Mr.,Keshav Pratap Singh, Assistant Professor , Dept. of Mechanichal Engg**
5. **Mr.Amar Soni , Assistant Professor , Dept of Mechanichal Engg**
6. **Mr K.P Tiwari , Assistant Professor , Dept. of Mechanichal Engg**
7. **Mr. Ketan Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
8. **Mr. K.C. Kori, Faculty, Assistant Professor , Dept. of Mechanichal Engg**
9. **Mr,Lokesh Agrawal, Assistant Professor , Dept. of Mechanichal Engg**
10. **Mr. Ram Narayan Shukla, Assistant Professor , Dept. of Mechanichal Engg**
11. **Mr. Rishi Kumar Sharma, Assistant Professor , Dept. of Mechanichal Engg**
12. **Mr. Naveen Kumar Soni, Assistant Professor , Dept. of Mechanichal Engg**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: OEC410
Course Title: Manufacturing Process

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1 Understand various manufacturing processes, selecting appropriate methods for different material, optimizing manufacturing efficiency and ensuring product quality	3	1	2	2	2	2	3	1	2	2	1	2	2	2
CO 2 Acquire fundamental knowledge and design widely used and very important primary manufacturing processes such as casting, forming ,forging rolling, extrusion.	2	2	3	2	1	2	2	1	1	1	2	3	2	2
CO3 : *A*cquire knowledge about the various tools, equipment, machinery and operations required for material removal processes	2	2	1	1	2	2	2	1	1	2	1	2	2	1
CO 4: understand the unconventional machining processes ,like EDM,EBM,LBM etc.	3	2	2	2	3	1	3	1	2	1	2	2	3	3
CO 5: Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application**.**	2	2	2	2	1	1	3	1	1	1	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self Learning(SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO1 : Understand various manufacturing processes, selecting appropriate methods for different material, optimizing manufacturing efficiency and ensuring product quality	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 Manufacturing Processes and Classification 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	1
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 2 : Acquire fundamental knowledge and design widely used and very important primary manufacturing processes such as casting, forming ,forging rolling, extrusion.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2 Material Shaping Processes 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9,2.10,2.11,2.12,2.13,2.14	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO3 : *A*cquire knowledge about the various tools, equipment, machinery and operations required for material removal processes	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 : Material Removal Processes 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	1
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 4 **:** understand the unconventional machining processes ,like EDM,EBM,LBM etc.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 : Other (unconventional) Manufacturing Processes 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9	1
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 5: Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application**.**	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit 5: Joining and Fastening Processes 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	1

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-VII

Course Code: OEC411

Course Title : **Internet of Things**

Pre-requisite: Student should know basic knowledge of computer & digital electronics.

Rationale: IoT is the super set of information technology driven by the sensors and cloud to make the real things like smart things for your network. The object of this course is to understand the concepts of web of Things, Cloud of Things and emphasis on Mobile cloud.

Course Outcomes:

OEC411.1: Learn the basics of databases and data management.

OEC411.2: Understand various theoretical and practical principles involved in the design and use of databases systems with the help of database.

OEC411.3: Learn the Transaction management with grant and revoke.

OEC411.4: Design and implement databases for various scenarios.

OEC411.5: Design a database scenario for handling any organizations centralized data.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Open Elective (OEC)	OEC411	Internet of Things	3	0	0	0	3	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e., Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self-Learning,

C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
OEC	OEC 411	Internet of Things	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

OEC411.1: Introduction to IoT, Definition, Characteristics of IoT, IoT Conceptual framework, IoT Architectural view, Physical design of IoT, Logical design of Io, Application of IoT.

Approximate Hours

Item	AppX Hrs.
Cl	8
LI	0
SW	0
SL	0
Total	8

Session Outcomes (SOs)	Laboratory Instructions (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO1.1 Understand the Definition and concept of Internet of Things. **SO1.2** Understand the concept of Characteristics of IoT **SO1.3** Understand the IoT Conceptual framework. **SO1.4** Preparation of Physical design, Logical design of IoT with Architectural view. **SO1.5** Preparation of Application of IoT.		**Unit-1.0 Theoretical Framework of IoT** 1.1. Introduction to IoT 1.2 Definition of IoT 1.3 Characteristics of IoT 1.4 IoT Conceptual framework 1.5 IoT Architectural view 1.6 Physical design of IoT 1.7 Logical design of IoT 1.8 Application of IoT	

OEC411.2: Machine-to-Machine (M2M), SDN (Software defined networking) and NFV (Network function virtualization) for IoT, Data Storage in IoT, IoT cloud Based Services

Approximate Hours

Item	Appx Hrs
Cl	4
LI	0
SW	0
SL	0
Total	4

Session Outcomes (SOs)	Laboratory Instructions (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO2.1 Concept of Machine-to-Machine (M2M) **SO2.2** Understanding about the SDN (Software defined networking). **SO2.3** Concept of NFV (Network function virtualization) for IoT. **SO2.4** Understanding the Data Storage in IoT. **SO2.5** Preparation of IoT cloud Based Services.	.	**Unit 2.0** Machine-to-Machine (M2M) 2.1 SDN (Software defined networking) and 2.2 NFV (Network function virtualization) for IoT 2.3 Data Storage in IoT 2.4 IoT cloud Based Services.	

OEC411.3: Design principles for web connectivity, Web communication Protocols for connected devices, Message communication Protocols for connected devices, SOAP, REST, HTTP Restful and web Sockets, Internet Connectivity Principles: Internet Connectivity, Internet based communication, IP addressing in IoT, Media Access Control.

Approximate Hours

Item	Appx Hrs
Cl	8
LI	0
SW	0
SL	0
Total	8

Session Outcomes (SOs)	Laboratory Instructions (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO3.1 concept of Design principles for web connectivity **SO3.2** Understanding Web communication Protocols for connected devices **SO3.3** Understanding the Message communication Protocols for connected devices. **SO3.4** Understanding about SOAP, REST, HTTP Restful and web Sockets. **SO3.5** Concept of Internet Connectivity, Internet based communication, IP addressing in IoT and Media Access Control.	.	**Unit-3.0** : Design principles for web connectivity 3.1 Web communication Protocols for connected devices 3.2 Message communication Protocols for connected devices. 3.3 SOAP, REST, HTTP Restful and web Sockets. 3.4 Internet Connectivity Principles: 3.5 Internet Connectivity 3.6 Internet based communication 3.7 IP addressing in IoT 3.8 Media Access Control	

OEC411.4: Sensor Technology, Participatory Sensing, Industrial IoT and Automotive IoT Actuator, Sensor data Communication Protocols, Radio Frequency Identification Technology Wireless sensor Network Technology.

Approximate Hours

Item	Appx Hrs
Cl	8
LI	0
SW	0
SL	0
Total	8

Session Outcomes (SOs)	Laboratory Instructions (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO4.1 Understanding about the Sensor Technology **SO4.2** Preparation of Participatory Sensing **SO4.3** Understanding about the Industrial IoT and Automotive IoT **SO4.4** Actuator, Sensor data Communication Protocols **SO4.5** Understanding about the Radio Frequency Identification Technology and Wireless Sensor Network Technology.	.	Unit 4.0 Sensor Technology 4.1 Participatory Sensing 4.2 Industrial IoT 4.3 Automotive IoT 4.4 Actuator 4.5 Sensor 4.6 Data Communication Protocols 4.7 Radio Frequency Identification Technology 4.8 Wireless Sensor Network Technology.	

OEC411.5: IoT Design methodology: Specification- Requirement, Process, Model, service Functional & Operational View, IoT Privacy and security solutions, Raspberry Pi & Arduino devices. **IoT Case Studies: Smart City Streetlights control & monitoring.**

Approximate Hours

Item	Appx Hrs
Cl	7
LI	0
SW	0
SL	0
Total	7

Session Outcomes (SOs)	Laboratory Instructions (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO5.1 Understand about the concept of oT Design methodology: **SO5.2** Preparation of Specification-Requirement, Process, Model, service. **SO5.3** Preparation of necessary Functional & Operational View **SO5.4** Understanding about the IoT Privacy and security solutions, Raspberry Pi & Arduino devices **SO5.5** Understanding about the **IoT Case Studies**: Smart City Streetlights control & monitoring.		**Unit 5.0:** IoT Design methodology: 5.1Specification-Requirement 5.2 Process, Model, service 5.3Functional & Operational View 5.4IoT Privacy and security solutions 5.5Raspberry Pi 5.6 Arduinodevices. 5.7**IoT Case Studies:** Smart City Streetlights control & monitoring.	

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
OEC411.1: Acquire the knowledge of IoT concept and its Architecture.	8	0	0	8
OEC411.2: Acquire the basic concept of Software defined networking and Machine-to-Machine (M2M).	4	0	0	4
OEC411.3: Exposed to various web communication Protocols for connected devices & Message communication Protocols for connected devices.	8	0	0	8
OEC411.4: Familiarize and understand the basic Sensor data Communication Protocols.	8	0	0	8
OEC411.5: Smart City Streetlights control & monitoring.	7	0	0	7
Total Hours	35	00	00	35

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Theoretical Framework of IoT.	01	01	03	05
CO-2	Machine-to-Machine (M2M)	01	01	03	05
CO-3	Design principles for web connectivity	-	03	10	13
CO-4	Sensor Technology	-	03	10	13
CO-5	IoT Design methodology:	01	03	10	14
Total		03	12	36	50

Legend: **R:Remember,** **U:Understand,** **A:Apply**

The end of semester assessment for 'Internet of things' will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition &Year
1	"Internet of Things (A Hand book approach)	Vijay Madisetti & Arshdeeep Bahga	Universa l Press	First Edition
2	"The Internet of Things: Connecting Objects"	Hakima Chaouchi	Wiley publication	2017
3	"MySQL for The Internet of Things"	Charless Bell	A Press publication.	2016
5	Lecture note provided by Department of Computer Engineering, AKS University, Satna			

****

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Curriculum Development Team

1. **Dr. Akhilesh K. Waoo, HOD, Department of Computer Science and Engineering.**
2. **Dr. Pramod Singh, Assistant Professor, Department of Computer Science and Engineering.**
3. **Ms. Shruti Gupta, Assistant Professor, Department of Computer Science and Engineering.**
4. **Ms. Pragya Shrivastava, Assistant Professor, Department of Computer Science and Engineering.**
5. **Mr. Lokendra Gaur, Assistant Professor, Department of Computer Science and Engineering.**
6. **Mr. Vinay Kumar Dwivedi, Assistant Professor, Department of Computer Science and Engineering.**
7. **Ms. Pinki Sharma, Assistant Professor, Department of Computer Science and Engineering.**
8. **Ms. Pushpa Kushwaha, Assistant Professor, Department of Computer Science and Engineering.**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: OEC411
Course Title: Internet of Things.

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1: Acquire the knowledge of IoT concept and its Architecture.	3	1	2	2	2	2	3	1	2	2	1	2	2	2
CO2: Acquire the basic concept of Software defined networking and Machine-to-Machine (M2M).	2	2	3	2	1	2	2	1	1	1	2	3	2	2
CO3: Exposed to various web communication Protocols for connected devices & Message communication Protocols for connected devices.	2	2	1	1	2	2	2	1	1	2	1	2	2	1
CO4: Familiarize and understand the basic Sensor data Communication Protocols.	3	2	2	2	3	1	3	1	2	1	2	2	3	3
CO5: Smart City Streetlights control & monitoring.	2	2	2	2	1	1	3	1	1	1	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO1:** Acquire the knowledge of IoT concept and its Architecture.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 Theoretical Framework of IoT 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO2:** Acquire the basic concept of Software defined networking and Machine-to-Machine (M2M).	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2 Machine-to-Machine (M2M) 2.1, 2.2, 2.3, 2.4	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO3:** Exposed to various web communication Protocols for connected devices & Message communication Protocols for connected devices.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 : Design principles for web connectivity 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO4:** Familiarize and understand the basic Sensor data Communication Protocols.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 : Sensor Technology 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO5:** Smart City Streetlights control & monitoring.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit 5: IoT Design methodology: 5.1,5.2,5.3,5.4,5.5,5.6,5.7	

Semester-VII

Course Code: **OEC412**

Course Title: **Big Data Analytics**

Pre- requisite: Student should have a basic understanding of data mining, statistics, data visualization and a degree of programming knowledge.

Rationale: Big data analytics is important because it helps organizations use data to identify new opportunities.

Course Outcome: After completion of this course the students will be able to

OEC412.1: Understand and apply big data flow to actual projects as well as apply data analytics life cycle to big data projects.
OEC412.2: Apply appropriate techniques and tools to solve big data problems
OEC412.3: Describe big data and use cases from selected business domains
OEC412.4: Explain NoSQL big data management
OEC412.5: Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
OEC	OEC412	Big Data Analytics	3	2	1	1	7	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e., Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop,field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback ofteacher to ensure outcome of Learning.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Scheme of Assessment:

Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA + CT + SA + CAT + AT)		
OEC	OEC412	Big Data Analytics	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

OEC412.1. Understand and apply big data flow to actual projects as well as apply data analytics life cycle to big data projects.

Approximate Hours:

Item	AppX Hrs
Cl	7
LI	0
SW	2
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand about concept of Big data **SO1.2** Understand about Traits of Big data **SO1.3** Understand about Challenges of Conventional Systems **SO1.4** Web Data, Evolution of Analytic, Scalability. **SO1.5** Understand about Analysis vs Reporting **SO1.**6 use of Statistical Concepts **SO1.7** Learn about Re-Sampling, Statistical Inference, Prediction Error		**Module 1: Introduction to big data** 1.1 Introduction to Big data Platform 1.2 Traits of Big data, 1.3 Challenges of Conventional Systems 1.4 Web Data, Evolution of Analytic, Scalability 1.5 Analysis vs Reporting 1.6 Statistical Concepts: Sampling Distributions 1.7 Re-Sampling, Statistical Inference, Prediction Error.	1. Learn about different source of data

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. What is difference between structure, unstructured and semi structure data.

ii Explain various challenge associated with big data.

b. Mini Project:

i. What is benefit you can derive from data analysis?

c. Other Activities (Specify):

i. Main problems in using Concurrency

OEC412.2. Apply appropriate techniques and tools to solve big data problems.

Approximate Hours:

Item	AppX Hrs
Cl	8
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Understand about Regression Modelling. **SO2.2** About Multivariate Analysis, Bayesian Modelling. **SO2.3** About Inference and Bayesian Networks **SO2.4** Understand about Vector and Kernel Methods **SO2.5** Analysis of Time Series. **SO2.6** understand Neural Networks **SO2.7** understand Fuzzy Logic		**Module 2: Basic data analysis and data analytic methods using R** 2.1 Regression Modelling 2.2 Multivariate Analysis, Bayesian Modelling 2.3 Inference and Bayesian Networks 2.4 Support Vector and Kernel Methods 2.5 Analysis of Time Series: Linear Systems Analysis, Nonlinear Dynamics, Rule Induction 2.6 Neural Networks: Learning and Generalization, Competitive Learning, Principal Component	1. Learn about basics of data analysis

SO2.8 about Introduction to R.		Analysis and Neural Networks 2.7 Fuzzy Logic: Extracting Fuzzy Models from Data Fuzzy Decision Trees, Stochastic Search Methods. 2.8 Introduction to R, Statistics for Model Building and Evaluation.	

SW-1 Suggested Sessional Work (SW):

a. Assignments:
- i. Explain Bayesian Networks.
- ii Explain challenges of Neural Networks

b. Mini Project:
- i. Read Dataset with Pandas

c. Other Activities (Specify):
- i. Explain Kernel Methods with example

OEC412.3. Describe big data and use cases from selected business domains

Approximate Hours:

Item	AppX Hrs
Cl	6
LI	0
SW	2
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Mining Frequent item sets: Market Based Model **SO3.2** Understand about Apriori Algorithm. **SO3.3** Understand about Handling Large Data Sets in Main Memory **SO3.4** Understand about Limited Pass Algorithm **SO3.5** Learn about Counting Frequent item sets in a Stream **SO3.6** understand about different Clustering Techniques		**Module-3.0** Frequent **item sets and clustering** 1.1 Mining Frequent item sets: Market Based Model 1.2 Apriori Algorithm 1.3 Handling Large Data Sets in Main Memory 1.4 Limited Pass Algorithm 1.5 Counting Frequent item sets in a Stream 1.6 Clustering Techniques: Hierarchical, K-Means, Frequent Pattern based Clustering Methods	1. various types of Locks in Detail.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. What are the Requirements of Clustering Data Mining Techniques?

b. **Mini Project:**
   i. Write a program to implement clustering in R programming.

c. **Other Activities (Specify):**
   i. Explain application of clustering.

OEC412.4. Explain NoSQL big data management

Approximate Hours:

Item	AppX Hrs
Cl	6
LI	0
SW	2
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand about Stream Data **SO4.2** About Stream Computing **SO4.3** understand about Sampling Data in a Stream: Filtering Streams, Counting Distinct Elements in a Stream **SO4.4** learn about Estimating Moments, Counting Oneness in a Window **SO4.5** learn about Decaying Window, Real time Analytics Platform (RTAP) Applications **SO4.6** Analysis and case studies		**Module-4.0** Mining data streams 4.1 Introduction to Streams Concepts: Stream Data Model and Architecture 4.2 Stream Computing 4.3 Sampling Data in a Stream: Filtering Streams, Counting Distinct Elements in a Stream. 4.4 Estimating Moments, Counting Oneness in a Window 4.5 Decaying Window, Real time Analytics Platform (RTAP) Applications 4.6 Case Studies, Real Time Sentiment Analysis, Stock Market Predictions	1. Source of data 2. About Unstructured text

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Explain REAL TIME ANALYTICS PLATFORM (RTAP) APPLICATION.

b. **Mini Project:**
   i. Why the rapid growth of unstructured data is putting greater pressure on businesses. Explain it.

c. **Other Activities (Specify):**
   i. CASE STUDIES - REAL TIME SENTIMENT ANALYSIS, STOCK MARKET PREDICTIONS.

OEC412.5: Design a database scenario for handling big data

. **Approximate Hours:**

Item	AppX Hrs
Cl	7
LI	0
SW	2
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand about Hadoop **SO5.2** Understand about MapR **SO5.3** Learn about NoSQL Database and Hadoop Distributes File System **SO5.4** Understand about Visual Data Analysis. **SO5.5** Learn about Interaction Techniques **SO5.6** Use of Statistical packages **SO5.7** Understand about Application of Analytics		**Module -5.0 Framework, technologies, tools and visualization** 5.1 Map Reduce: Hadoop 5.2 Hive, MapR, Sharding 5.3 NoSQL Databases: S3, Hadoop Distributed File Systems 5.4 Visualizations: Visual Data Analysis Techniques, 5.5 Interaction Techniques; Systems and Analytics Applications. 5.6 Analytics using Statistical packages 5.7 Industry challenges and application of Analytics	1.Big Data

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Create Word Count Map Reduce program to understand Map Reduce Paradigm

b. Mini Project:

i. To setup Hadoop.

ii. To run sample program using hadoop.

c. Other Activities (Specify):

i. Implementing Matrix Multiplication with Hadoop Map Reduce

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
OEC412.1. Understand and apply big data flow to actual projects as well as apply data analytics life cycle to big data projects.	7	2	1	10
OEC412.2. Apply appropriate techniques and tools to solve big data problems	8	2	2	12

OEC412.3. Describe big data and use cases from selected business domains	6	2	2	10
OEC412.4. Explain NoSQL big data management	6	2	1	9
OEC412.5. Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics	7	2	1	10
Total Hours	34	10	7	51

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO1	Introduction to big data	03	04	03	10
CO2	Basic data analysis and data analytic methods using R	05	03	02	10
CO3	Frequent item sets and clustering	05	03	02	10
CO4	Mining data streams	04	05	01	10
CO5	Framework, technologies, tools and visualization	03	05	2	10
Total		20	17	13	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Big data analytics will be held with writtenexamination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to IT Industry.
7. Demonstration

8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Analytics in a Big Data World: The Essential Guide to data Science and its Applications	Bart Baesens,	Wiley publications	2014
2	Big Data & Hadoop	V.K. Jain	Khanna Book Publishing Co., Delhi (ISBN 978-93-82609-131)	2017
3	Intelligent Data Analysis”,	Michael Berthold, David J. Hand	Springer	2003
4	Mining of Massive Datasets	Anand Rajaraman and Jeffrey David Ullman	Cambridge University Press, 2020.	2020
5	Beginner’s Guide for Data Analysis using R Programming	Jeeva Jose	Khanna Book Publishing House, 2019	2019

****

Curriculum Development Team

1. **Dr. Akhilesh K. Waoo, HOD, Department of Computer Science and Engineering.**
2. **Dr. Pramod Singh, Assistant Professor, Department of Computer Science and Engineering.**
3. **Ms. Shruti Gupta, Assistant Professor, Department of Computer Science and Engineering.**
4. **Ms. Pragya Shrivastava, Assistant Professor, Department of Computer Science and Engineering.**
5. **Mr. Lokendra Gaur, Assistant Professor, Department of Computer Science and Engineering.**
6. **Mr. Vinay Kumar Dwivedi, Assistant Professor, Department of Computer Science and Engineering.**
7. **Ms. Pinki Sharma, Assistant Professor, Department of Computer Science and Engineering.**
8. **Ms. Pushpa Kushwaha, Assistant Professor, Department of Computer Science and Engineering.**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: OEC412
Course Title: Big data analytics.

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services
CO1 Understand and apply big data flow to actual projects as well as apply data analytics life cycle to big data projects.	3	1	2	2	2	2	3	1	2	2	1	2	2	2
CO2 Apply appropriate techniques and tools to solve big data problems	2	2	3	2	1	2	2	1	1	1	2	3	2	2
CO3 Describe big data and use cases from selected business domains	2	2	1	1	2	2	2	1	1	2	1	2	2	1
CO4 Explain NoSQL big data management	3	2	2	2	3	1	3	1	2	1	2	2	3	3
CO5 Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics	2	2	2	2	1	1	3	1	1	1	2	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO1** Understand and apply big data flow to actual projects as well as apply data analytics life cycle to big data projects.	SO1.1, SO1.2 SO1.3, SO1.4 SO1.5, SO1.6 SO1.7		Unit-1. Introduction to big data 1.1,1.2,1.3,1.4,1.5,1.6,1.7	1
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO2** Apply appropriate techniques and tools to solve big data problems	SO2.1, SO2.2 SO2.3, SO2.4 SO2.5, SO2.6 SO2.7, SO2.8		Unit-2 Basic data analysis and data analytic methods using R 2.1, 2.2, 2.3, 2.4,2.5.2.6,2.7,2.8	1
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO3** Describe big data and use cases from selected business domains	SO3.1,SO3.2 SO3.3,SO3.4 SO3.5, SO3.6		Unit-3 : Frequent item sets and clustering 3.1, 3.2,3.3,3.4,3.5,3.6	1
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO4** Explain NoSQL big data management	SO4.1, SO4.2 SO4.3, SO4.4 SO4.5, SO4.6		Unit-4 : Mining data streams 4.1, 4.2,4.3,4.4,4.5,4.6	1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO5** Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics	SO5.1, SO5.2 SO5.3, SO5.4 SO5.5, SO5.6 SO5.7		Unit 5: Framework, technologies, tools and visualization 5.1,5.2,5.3,5.4,5.5,5.6,5.7	1

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester- VII

Course Code:	**HSMC06**
Course Title :	**Finance and Accounting**
Pre-requisite:	The primary objective of studying accounting is to facilitate transparent and accurate financial reporting.
Rationale:	Accounting provides a structured and standardized system for recording, summarizing, and analyzing financial transactions.. This transparency is crucial for stakeholders, including investors, creditors, and management, to make informed decisions. Accounting helps maintain the integrity and reliability of financial information, contributing to trust and accountability in business and financial management.

Course Outcomes: On successful completion of this course, the students will be able:

HSMC06.1: to understand and apply financial management principles in decision-making.
HSMC06.2: Analyze and determine optimal capital structures, assessing cost of capital. **HSMC06.3:** prepare financial statements and handling various aspects of company accounts.
HSMC06.4: handle debenture-related transactions and accounting entries.
HSMC06.5: Understand and comply with accounting standards, including Ind AS, IFRS, and internationalreporting standards.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours(CI+LI+SW+SL)	
HSMC	HSMC06	Finance and Accounting	3	0	2	1	6	3

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture(L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self-Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback teachers ensure outcome of Learning.

Scheme of Assessment:
Theory

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
HSMC	HSMC06	Finance and Accounting	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

HSMC06.1: to understand and apply financial management principles in decision-making.

Approximate Hours

Item	Appx Hrs.
Cl	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Financial Management: Ability to apply financial management principles for effective fund utilization. **SO1**.2 Risk-Return Analysis: Proficiency in evaluating risks and returns to enhance firm value. **SO1.3 S**kill in balancing profit maximization and wealth maximization as organizational objectives. **SO1.4** Competence in applying discounted and non-discounted cash flow methods for investment decisions.		**Unit I: Nature and Scope of Financial Management**: **1.1** Nature, Scope and Objectives of Financial Management **1.2** Risk-Return and Value of the Firm, Objectives of the firm **1.3** Profit Maximization vs. Wealth Maximization **1.4** Emerging roles of Finance Managers **1.5** Capital Budgeting: Compounding and Discounting techniques **1.6** Concepts of Annuity and Perpetuity **1.7** Capital Budgeting Process, Techniques of Capital Budgeting **1.8** Discounted and Non-Discounted, Cash Flow Methods	1. Engage in online simulations or case studies to self-learn risk evaluation and sensitivity analysis in financial decision-making.

		1.9 Capital Rationing, Risk Evaluation and Sensitivity Analysis.	

SW- 1 Suggested Sessional Work (SW):

a. **Assignments:** Calculate the Net Present Value (NPV) and Internal Rate of Return (IRR) for a given capital budgeting project using discounted cash flow methods.

b. **Mini project**: Develop a proposal for a capital budgeting project, including a brief description, estimated costs, and potential return.

c. **Other Activities (Specify):** Compare and contrast Profit Maximization and Wealth Maximization as objectives of the firm. Discuss their implications on long-term sustainability.

HSMC06.2: Analyze and determine optimal capital structures, assessing cost of capital.
Approximate Hours

Item	Appx Hrs.
Cl	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2. 1: Capability in determining optimal capital structure and analyzing its impact on risk and shareholder returns. **SO2.2** Skill in exploring diverse sources for raising long-term finance. **S02.3:** Cost of Capital Analysis: Proficiency in calculating and understanding the Weighted Average Cost of Capital (WACC). **SO2.4 :** Competence in analyzing the effects of leverage on shareholders' returns	.	**Unit 2: Capital Structure** **2.1** Introduction- Meaning and Significance **2.2** Optimal Capital Structure **2.3** Determinants of Capital Structure Theories of Capital Structure **2.4** EBIT – EPS Analysis **2.5** EBITDA Analysis; Risk and Leverage **2.6** Effects of Leverage on Shareholders' Returns. **2.7** Sources of raising long-term finance and Cost of Capital: **2.8** Sources, Meaning, Factors Affecting Cost of Capital; **2.9** Methods for Calculating cost of capital; Weighted Average Cost of Capital (WACC); Marginal Cost of Capital	**1.** Create a presentation outlining the capital budgeting process, incorporating concepts of annuity and perpetuity, discounted and non-discounted cash flow methods.

SW- 2 Suggested Sessional Work (SW):

a. **Assignments**: Calculate the Weighted Average Cost of Capital (WACC) for a given company. Discuss the implications of the WACC in the context of the company's capital structure and investment decisions.
b. **Mini project:** Assign a project where students assess the impact of the scope of supply on businesses in specific industries. This could involve considering how the definition affects pricing, tax liability, and compliance..
c. **Other Activities (Specify):**Compare and contrast Profit Maximization and Wealth Maximization as objectives of the firm. Discuss their implications on long-term sustainability.

HSMC06.3: prepare financial statements and handling various aspects of company accounts.

Approximate Hours

Item	Appx Hours
Cl	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Ability to prepare financial statements and manage various aspects of company accounts. **SO3.2** Competence in handling share capital, bonus shares, rights shares, and related journal entries. **SO3.3** Skill in understanding, issuing, and accounting for debentures, including conversion and interest payments.	.	**Unit 3: Introduction to Company Account** **3.1** Introduction, Meaning of Company, **3.2** Salient Features of a Company, **3.3** Types of Companies, Books of Account, **3.4** Preparation of Financial Statements. **3.5** Introduction, Issue, Forfeiture and Reissue of Shares **3.6** Share Capital, Types of Shares. **3.7** Bonus share, Right share, Issue of Shares for Cash, **3.8** Journal Entries for issue of shares for cash.	**1.** Formulate a buyback strategy for a real or hypothetical company.

SO3.4 Capability to understand and comply with accounting standards, including IndAS, IFRS, and international reporting standards.		**3.9** Forfeiture of Shares, Buy back of share.	

SW- 3 Suggested Sessional Work (SW):

a. **Assignments :**Investigate the company's share capital structure. Identify and explain the different types of shares issued by the company**.**
b. **Mini project :** Research and report if the company has issued bonus shares or rights shares in recent years.
c. **Other Activities (Specify):** Discuss the impact of these actions on the company's equity structure

HSMC06.4: handle debenture-related transactions and accounting entries.

Approximate Hours

Item	Appx Hours
Cl	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Ability to identify and explain features and types of debentures, along with understanding the issuance process. **SO4.2** Competence in detailing the process and accounting treatment for the conversion of debentures into shares. **ISO4.3**: Skill in accurately accounting for interest payments on debentures. **SO4.4** ability to perform accounting entries for the issuance and redemption of redeemable debentures.		**Unit 4:Issue of Debentures** **4.1** Introduction, Meaning, Features of Debentures **4.2** Distinction between Debentures and Shares **4.3** Types of Debentures, Issue of Debentures, **4.4** Accounting entries for issue of Redeemable Debentures **4.5** Debenture Redemption Reserve **4.6** Conversion of Debenture in to Share **4.7** Accounting for issue of Debentures payable in installments. **4.8** Issue of Debentures as collateral security. **4.9** Issue of Debentures in consideration other than for cash, Interest on Debentures.	**1.** How to gain skill on accurately accounting for interest payments on debentures.

SW- 4 Suggested Sessional Work (SW):

a. **Assignments:** Identify the types of debentures issued and elaborate on their terms and conditions. Explain how these terms align with the company's financial goals.
b. **Mini project:** Analyze the impact of the debenture issuance on the company's financial statements. Consider aspects like debt-equity ratios and interest coverage ratios.
c. **Other Activities (Specify):** Choose a publicly traded company that has recently issued debentures. Obtain relevant financial reports and announcements.

HSMC06.5: Understand and comply with accounting standards, including Ind AS, IFRS, and international reporting standards.

Approximate Hours

Item	Appx Hours
Cl	5
LI	0
SW	2
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
S**O5.1** Ability to comprehend the meaning and significance of corporate reporting **SO5.2** Proficiency in applying accounting standards, including Ind AS, IFRS, and understanding their applicability and scope. **SO5.3** Capability to ensure compliance with international accounting standards, including an overview of International Financial Reporting Standard **SO5.4** Skill in preparing comprehensive financial reports that adhere to the relevant accounting standards.		**UNIT-5 : Corporate Reporting -** **5.1** Meaning of Corporate Reporting; **5.2** Accounting Standards **5.3** Applicability, Scope and Compliance **5.4** Ind AS, IFRS, International Financial **5.5** Reporting Standard Overview (National and International accounting Authorities)	**1.** Review case studies or examples of companies that effectively demonstrate compliance with accounting standards.

SW-5 Suggested Sessional Work (SW):

a. **Assignments** : Analyze how the company's corporate reporting practices impact various stakeholders, including investors, creditors, and employees
b. **Mini project:** Examine the company's compliance with relevant accounting standards and regulatory requirements. Highlight any instances of non-compliance or areas of improvement.
c. **Other Activities (Specify):** Prepare a presentation on corporate reporting.

Brief of Hours suggested for the Course Outcome

Course Outcomes	**Class Lecture (Cl)**	**Sessional Work (SW)**	**Self-Learning (Sl)**	**Total hour (Cl+SW+Sl)**
HSMC06.1: Ability to understand and apply financial management principles in decision-making.	9	2	1	12
HSMC06.2: Analyzing and determining optimal capital structures, assessing cost of capital.	9	2	1	12
HSMC06.3: Proficiency in preparing financial statements and handling various aspects of company accounts.	9	2	1	12
HSMC06.4: Competence in handling debenture-related transactions and accounting entries.	9	2	1	12
HSMC06.5: Understanding and complying with accounting standards, including Ind AS, IFRS, and international reporting standards.	5	2	1	8
Total Hours	41	10	5	56

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Nature and Scope of Financial Management:	01	01	03	05
CO-2	Capital Structure	01	01	03	05
CO-3	Introduction to Company Account	-	03	10	13
CO-4	Issue of Debentures	-	03	10	13
CO-5	Corporate Reporting	01	03	10	14
Total		03	12	36	50

Legend: R: Remember, U: Understand, A:Apply

The end of semester assessment for Finance and Accounting will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Brainstorming

Suggested Learning Resources:

(a) Books:

S.No.	Title	Author	Publisher
1.	Principles of Corporate Finance" by Richard A. Brealey.	SInghaniVinod K. and Monica Singhania	Published by McGraw-Hill Education)
2.	"Fundamentals of Financial Management".	Eugene F. Brigham and Joel F. Housto	Published by Cengage Learning)
3.	"Financial Management: Theory & Practice"	Eugene F. Brigham and Joel F. Housto	Published by Cengage Learning)
4.	"Financial Management: Principles and Application.	Sheridan Titman, Arthur J. Keown, and John D. Martin.	Published by Pearson
5.	Lecture note provided by Dept. of Commerce AKS University, Satna		

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni,Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos, Pos and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: HSMC06
Course Title: Finance and Accounting

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering 835ctive 835 835ge	Problem Solving	Design Skills	Laboratory Skills	Teamwork	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1 : Ability to understand and apply financial management principles in decision-making.	1	2	1	1	2	2	2	2	3	3	2	2	1	1
CO2: Analyzing and determining optimal capital structures, assessing cost of capital.	1	2	1	1	2	2	1	2	2	2	2	2	1	2
CO3: Proficiency in preparing financial statements and handling various aspects of company accounts.	1	2	1	1	1	2	2	2	2	1	2	3	2	1
CO4: Competence in handling debenture-related transactions and accounting entries.	1	1	1	2	2	2	1	3	2	1	2	2	2	1
CO5: Understanding and complying with accounting standards, including Ind AS, IFRS, and international reporting standards.	1	1	1	1	2	3	2	3	1	2	2	2	1	2

Legend:1–Low,2–Medium, 3–High

Course Curriculum Map

Pos & PSOs No.	Cos No .&Titles	Sos No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1, 2	**CO1**: Ability to understand and apply financial management principles in decision-making.	SO1.1 SO1.2 SO1.3 SO1.4		**Unit-1:** Nature and Scope of Financial Management: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1, 2	**CO2:** Analyzing and determining optimal capital structures, assessing cost of capital.	SO2.1 SO2.2 SO2.3 SO2.4		**Unit-2**: Capital Structure 2.1,2.2,2.3,2.4,2.5,2.6, 2.7, 2.8, 2.9	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1, 2	**CO3:** Proficiency in preparing financial statements and handling various aspects of company accounts.	SO3.1 SO3.2 SO3.3 SO3.4		**Unit-3 :** Introduction to Company Account 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1, 2	**CO4**: Competence in handling debenture-related transactions and accounting entries.	SO4.1 SO4.2 SO4.3 SO4.4		**Unit-4:** Issue of Debentures 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9	1
PO:1,2,3,4,5,6,7,8 ,9,10,11,12 PSO 1, 2	**CO5:** Understanding and complying with accounting standards, including Ind AS, IFRS, and international reporting standards.	SO5.1 SO5.2 SO5.3 SO5.4		**Unit 5:** Corporate Reporting 5.1, 5.2, 5.3, 5.4, 5.5	1

Semester-VII

Course Code: **PROJ-EE401**

Course Title : **Project Work-I**

Pre-requisite: In depth Technical knowledge of various subjects of electrical engineering.

Rationale: Projects provide the chance to put the knowledge gained throughout the course of the degree in use. For successful completion of this course, a thesis must be submitted, a seminar presentation must be made, and the whole work must be shown in public. The projects undertaken span a diverse range of topics, including theoretical, simulation and experimental studies.

Course Outcomes: after the completion of this course the students will be able to

PROJ-EE401.1: Demonstrate a sound technical knowledge of their selected project topic.
PROJ-EE401.2: Analyze, design and implement solution methodologies.
PROJ-EE401.3: identify problem and formulate a solution for it.
PROJ-EE401.4: utilize system approach to provide engineering solutions.
PROJ-EE401.5: Demonstrate the knowledge, skills and attitudes of a professional engineer.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits I
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Projects	PROJ-EE401	Project Work-1	0	8	0	3	11	4

Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) andothers),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Scheme of Assessment:

Course category	838 ctiv e 838 Cod e	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			2 Progress Report number 5 marks each (PR)	Internal Viva (2) 5 marks each (IV)	Seminar one (SR)	Project 838ctivity (PAT)	Attendance (AT)	Total Marks (PR+IV+ SR+PAT+ AT)		
Projects	PROJ-EE401	Project Work-I	10	10	10	15	5	50	50	100

Project Assignment:

The goal of Project Work I's goal is to give the student the opportunity to engage in investigative study in the broad field of Electrical Engineering or its applied field. This can be done entirely theoretically or practically, or it can involve both. The Department will assign the work in two or three semesters. The work will be assigned by the Department on an individual basis or between the groups of two or three students under the guidance of project supervisor. It is anticipated that this will give the student or students a strong start in R&D work. Typically, the assignment will consist of:

1. Survey and study of published literature on the assigned topic.
2. Working out a preliminary Approach to the Problem relating to the assigned topic.
3. Conducting preliminary Analysis/ Modelling/ Simulation/ Experiment/ Design/ Feasibility.
4. Preparing a Written Report on the Study conducted for presentation to the Department.
5. Final Seminar, as oral Presentation before a departmental committee

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni,Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: PROJ-EE401
Course Title: Project Work-I

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Teamwork	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: Demonstrate a sound technical knowledge of their selected project topic.	3	3	3	2	2	2	2	3	3	3	3	2	3	3
CO2 : Analyze, design and implement solution methodologies	3	3	3	2	3	2	1	2	2	2	2	2	3	3
CO3 : identify problem and formulate a solution for it.	3	3	3	2	3	2	2	3	3	2	3	3	3	3
CO4: utilize system approach to provide engineering solutions.	3	3	3	2	2	2	1	3	2	2	2	2	3	3
CO5: Demonstrate the knowledge, skills and attitudes of a professional engineer	3	3	3	2	2	3	2	2	3	2	3	2	3	3

Legend:1–Low,2–Medium, 3–High

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Semester-VIII

Course Code: **PROJ-EE402**

Course Title : **Project work-II**

Pre-requisite: In-depth knowledge about selected research area.

Rationale: The objective of research project is to identify the Problems related to electrical engineering and develop a solution for respective problem. The students will be able to develop a technical mindset to deal different issues related to electrical engineering that directly or indirectly affects the society

Course Outcomes: after the completion of this course

PROJ-EE402.1: Identify the real world power system problems
PROJ-EE402.2: Analyze, design and implement solution methodologies
PROJ-EE402.3: Apply modern engineering tools for solution
PROJ-EE402.4: learn about different software development process models, software, engineering principles and develop an ability to apply them to software design of real life problems.
PROJ-EE402.5: Write technical reports following professional ethics

Scheme of Studies:

Course category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Projects	PROJ-EE402	Project work-II	0	24	0	6	30	12

Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) andothers),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Scheme of Assessment:

Course category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			2 Progress Report number 5 marks each (PR)	Internal Viva (2) 5 marks each (IV)	Seminar one (SR)	Project activity (PAT)	Attendance (AT)	Total Marks (PR+IV+SR+PAT+AT)		
Projects	PROJ-EE402	Project Work-II	10	10	10	15	5	50	50	100

Project Assignment:

The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under Project Work-I either entirely theoretical/practical, or combining both theoretical and practical work, and supervised by a department supervisor exclusively or in conjunction with a supervisor from an R&D lab or industry. It is anticipated that this will give the student an excellent training in technical leadership and R&D work. Typically, the assignment will consist of:

1. In depth study of the topic assigned in the light of the Report prepared under Project Work-I.
2. Review and finalization of the Approach to the Problem relating to the assigned topic.
3. Preparing an Action Plan for conducting the investigation, including team work.
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
5. Final development of product/process, testing, results, conclusions and future directions.
6. Preparing a paper for Conference presentation/Publication in Journals, if possible.
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: PROJ-EE402
Course Title: Project Work-II

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Teamwork	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO.**1:** Identify the real world power system problems	1	2	1	1	2	2	2	2	3	3	2	2	2	2
CO2 : Analyze, design and implement solution methodologies	3	3	3	3	3	2	3	2	2	3	2	3	3	3
CO3 : Apply modern engineering tools for solution	3	3	3	3	2	1	2	2	2	1	2	3	3	3
CO4: learn about different software development process models, software, engineering principles and develop an ability to apply them to software design of real life problems	3	3	3	3	2	2	1	3	2	3	2	3	2	3
CO5: Write technical reports following professional ethics	1	1	1	1	2	3	3	3	3	2	2	3	1	1

Legend:1–Low,2–Medium, 3–High

Semester-VIII

Course Code: **OJT-EE401**

Course Title : **On job plant training**

Pre-requisite: Knowledge of subjects of electrical engineering, PLC and SCADA, experience with analog and digital systems, and the ability to design and troubleshoot electrical equipment.

Rationale: Students get the chance to apply the abilities they have learnt in the classroom through internships. Students should also be given the chance to improve such abilities, get insight into the working world, and profit from the knowledge and counsel of mentors or supervisors.

Course Outcomes: after the completion of this course students will

OJT-EE401.1: Engage in industry initiatives as part of their internship.
OJT-EE401.2: Demonstrate how to use the sophisticated equipment and methods the used during their internship.
OJT-EE401.3: Engage with employees of the industry while maintaining the discipline and engineering processes that are required.
OJT-EE401.4: Gain knowledge of appropriate workplace conduct and strengthen their ability to operate in a team and with others.
OJT-EE401.5: Create expert work reports and presentations.

Scheme of Studies:

Course category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Projects	OJT-EE01	On job plant training	0	0	0	0	0	12

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) andothers),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Scheme of Assessment:

Course category	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks (PRA + ESA)**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
Projects	OJT-EE401	On job plant training	-	-	-	-	-	-	100	100

Evaluation Method:

The student will give a seminar based on his/her training report, before an expert committee constituted by the Department of Electrical Engineering. The evaluation will be based on the following criteria:

1. Quality of content presented.
2. Proper planning for presentation.
3. Effectiveness of presentation.
4. Depth of knowledge and skills.
5. Attendance record, daily diary, departmental reports shall also be analyzed along with the Internship Report.
6. Seminar presentation will enable sharing knowledge & experience amongst students & teachers and build communication skills and confidence in student

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: OJT-EE401
Course Title: On Job Training

Course Outcomes	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Apply Electrical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.
CO1: Engage in industry initiatives as part of their internship.	2	2	1	1	3	2	2	2	3	3	2	2	2	2
CO2: Demonstrate how to use the sophisticated equipment and methods the used during their internship.	3	2	1	2	2	2	1	2	2	2	2	2	2	2
CO3 : Engage with employees of the industry while maintaining the discipline and engineering processes that are required	2	2	1	1	3	2	2	2	2	1	2	3	2	1
CO4: **:** Gain knowledge of appropriate workplace conduct and strengthen their ability to operate in a team and with others.	1	1	1	2	3	3	1	3	2	1	2	2	2	2
CO5: Create expert work reports and presentations.	1	1	1	1	2	3	2	3	1	2	2	2	1	2

Legend:1–Low,2–Medium, 3–High

Skill Development Programs

Electric Shock Workshop

1. INTROCUTION

An electric shock occurs when an electrical current enters the body. The effects can range from an unpleasant but harmless jolt of static electricity (like when you walk over a thick carpet on a dry day) to a lethal discharge from a power line. Most fatalities occur due to alternating current at house-current frequencies (60 hertz in North America, 50 hertz in Europe) and contact with conductors at less than 500 volts. High voltages are generally present only on utility company apparatus and supply lines, accessible only to trained personnel.

The physiological effects depend on the current (amperage) rather than voltage. The path the current takes through the body matters. Current density is highest along the direct path between points of contact. Common fatalities involve currents passing between an arm and legs, affecting organs within the chest. Electric shock can directly cause death by affecting the breathing center in the brain, heart paralysis, or ventricular fibrillation.

2. COURSE OBJECTIVE

objectives for an Electric Shock Prevention Workshop:

- Basic Knowledge of Electricity
- Hazards Associated with Electric Shock
- Means of Prevention
- Range of Effects
- Physiological Effects
- First Aid

3. LEARNING OUTCOMES

An Electric Shock Prevention Workshop can include

- Participants gain a deeper understanding of electrical hazards and the importance of safety precautions
- Participants acquire practical knowledge on safe practices when working with electricity.

- Participants are trained in first aid for electric shock victims. They learn how to respond promptly and effectively during an emergency.
- The workshop aims to reduce the occurrence of electric shock incidents in workplaces and homes. Participants leave with actionable steps to minimize risks and protect themselves and others.

4. COURSE CONTENT

Topics covered in an Electric Shock Workshop:

- Basic Knowledge of Electricity-They will understand the terms "amp," "voltage," and "Ohm
- Understanding Electricity - Identifying hazards and injuries associated with electricity.
- Controlling Hazards- Safe practices when working with electrical equipment.
- First Aid for Electric Shock Victims-Steps to assist someone who has experienced electric shock.
- Risk Reduction-Actionable steps to minimize risks
- Hazards Associated with Electric Shock- explore scenarios where electric shock can occur
- Means of Prevention- safety practices to avoid electric shock while using power tools and cords.
- Range of Effects-Electric shocks can vary from a harmless jolt of static electricity (like when you walk over a thick carpet on a dry day) to a lethal discharge from a power line
- Physiological Effects-Electric shock can directly cause death by affecting the breathing center in the brain, heart paralysis, or ventricular fibrillation (rapid twitching of heart muscle).
- Industrial Visit-Industrial visits are crucial for students because they provide practical exposure to real-world manufacturing processes, machinery, and workplace environments.

5. CLASS SCHEDULE

Days Titles	Days Titles
Day 1	Basic Knowledge of Electricity
Day 2	Identifying hazards and injuries
Day3	Controlling Hazards

Day4	First Aid for Electric Shock Victims
Day 6	Risk Reduction
Day 7	Hazards Associated with Electric Shock
Day 8	Means of Prevention, Physiological Effects
Day 9	Range of Effects
Day 10	Industrial Visit

6. EVALUATION PATTERN

Duration	02.00 Hrs
Maximum Marks	100 Marks
10 Multiple choice Questions (Written Type)	20 Marks
3 Very short answer type questions (Written Type)	30 Marks
Practical and viva	50 Marks

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni,Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

LED Bulb and ceiling fan installation and Repairing

1. **INTROCUTION:** -LED bulbs are energy-efficient lighting options commonly used in homes and offices. To install an LED bulb, turn off the power, remove the old bulb, and screw in the LED bulb securely. For ceiling fan repair, address issues like wobbling, noisy operation, unresponsiveness, slow speed, or broken blades. Regular maintenance ensures optimal performance.

2. **COURSE OBJECTIVE**

The course will give a brief on:

- Disassemble the Bulb:
- Identify the Faulty Component
- Celling Fan Repairing
- Wobbling: Adjust the balance by tightening loose screws or using a balancing kit.
- Noisy Operation: Lubricate the fan motor and check for loose parts.
- Non-Responsive: Check the wall switch, capacitor, and wiring.
- Slow Speed: Adjust the fan speed settings.
- Broken Blades: Replace damaged blades.

3. LEARNING OUTCOMES

- Upon successful completion of this course, students will to be able to understand the energy-efficient lighting options and cost-effective LED bulb Installation.
- Learn about the different types of celling fan maintenance and repairing.

4. COURSE CONTENT

LED Bulb Installation: LED bulbs are energy-efficient lighting options commonly used in homes and offices. To install an LED bulb: Turn off the power to the existing bulb socket. Remove the old incandescent or CFL bulb. Screw in the LED bulb securely. Turn the power back on to test the bulb. Ceiling Fan Repair: Ceiling fans enhance air circulation and provide comfort. Common ceiling fan issues: Wobbling: Adjust the balance by tightening loose screws or using a balancing kit. Noisy Operation: Lubricate the fan motor and check for loose parts.

Non-Responsive: Check the wall switch, capacitor, and wiring. Slow Speed: Adjust the fan speed settings. Broken Blades: Replace damaged blades.

5. CLASS SCHEDULE

Days Titles	Days Titles
Day 1	Install an LED bulb
Day 2	Comparison between old incandescent and CFL bulb
Day3	Turn the power back on to test the bulb
Day4	Ceiling Fan Repair
Day 6	Lubricate the fan motor and check for loose parts.
Day 7	Check the wall switch, capacitor, and wiring
Day 8	Adjust the fan speed settings
Day 9	Replace damaged blades
Day 10	Energy conservation through fan and light

6. EVALUATION PATTERN

Duration	02.00 Hrs
Maximum Marks	100 Marks
10 Multiple choice Questions (Written Type)	20 Marks
3 Very short answer type questions (Written Type)	30 Marks
Practical and viva	50 Marks

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

SOLAR PANEL INATALLATION AND MAINTENANCE

1. INTRODUCTION

Installing solar panels involves selecting the right system, assessing your roof, and hiring professionals. Routine maintenance includes keeping panels clean and monitoring energy production Certainly! Here are some common maintenance challenges associated with solar panels Dirt and Debris Accumulation, Shading Issues, Weather and Environmental Factors, Electrical Connections and Wiring, Inverter Maintenance**.**

2. COURSE OBJECTIVE The course will give a brief on:

- Understanding Solar PV Systems
- Safety Protocols and Equipment
- Installation Techniques
- Solar Panel Maintenance and Troubleshooting

3. LEARNING OUTCOMES

Upon successful completion of this course, students will to be able to understand the Understanding Solar PV Systems, System Design and Sizing, Installation Techniques and Testing and Maintenance. These skills empower professionals to contribute to renewable energy adoption and create a sustainable future.

4. COURSE CONTENT

topics typically covered in solar panel installation and maintenance courses:

- Solar Panels: Understanding different types (monocrystalline, polycrystalline, thin-film). Efficiency factors and performance characteristics.
- Solar Inverters: Role in converting DC power to AC for household use. Types (string inverters, microinverters, etc.).
- Batteries for Solar PV Systems: Energy storage solutions for off-grid or backup power. Maintenance and safety considerations**.**

- Racking of Solar Panels: Proper mounting techniques on roofs or ground. Ensuring stability and alignment.
- PV System Design Guidelines: Sizing the system based on energy needs. Shading analysis and optimal placement.
- PV System Installation Guide: Step-by-step installation process. Wiring, grounding, and safety protocols.
- Testing and Troubleshooting: Verifying system performance. Identifying and addressing issues.

5. CLASS SCHEDULE

Days Titles	**Topic Titles**
Day 1	Solar Panels
Day 2	Solar Inverters
Day3	Batteries for Solar PV Systems
Day4	Racking of Solar Panels
Day 6	PV System Design Guidelines
Day 7	PV System Installation Guide
Day 8	Testing
Day 9	Troubleshooting
Day 10	Safety Protocols and Equipment

6. EVALUATION PATTERN

Duration	02.00 Hrs
Maximum Marks	100 Marks
10 Multiple choice Questions (Written Type)	20 Marks
3 Very short answer type questions (Written Type)	30 Marks
Practical and viva	50 Marks

Value Added Programs

Advance Electrical Machine Maintenance and Testing

Course Details

Course Name: Electrical Machine Maintenance and Testing **Contact Hours:** 6 weeks 40 Hours (30 Hours Teaching + 10 Hours of Workshop) **Duration:** 30 hours

Importance of Course

Electrical maintenance is the process of inspecting, testing, monitoring and replacing all electrical parts as required, using hand tools, thermal imaging, computerized programs and special measurement devices, to keep systems and machines working efficiently and safely It is the process of ensuring that electrical equipment is kept in good working order This includes inspecting, testing, and repairing electrical equipment as necessary to prevent problems that could lead to a loss of power or an electrical fire.

Course Objective:

The Electrical Machine Maintenance and Testing course at AKS University provides students with a comprehensive understanding of the rating and Fault of electrical Machine. Students will learn about the Fault prediction and technique used to maintenance it effectively.

Course Description:

This course provides maintenance about the various type of Machine.Machine is kept in good working condition through maintenance activity. Maintenance activity is a repairing and maintaining work is used for any electrical and mechanical equipment. When a equipment is installed then after passing sometimes like as three months then list of all we will have to health check. If any fault minor or major is present then it will be rectified through maintenance activity. Through a combination of illustrated lectures, examples and exercises, students will learn how electrical systems work, how to maintain electrical safety, and how to install and troubleshoot common electrical equipment.

.

Scope of this Course:

- Regular monitoring.
- Increase Good Quality production
- Safety
- Preventive Maintenance plan
- Public Awareness and Education: Raising awareness among the students and the general public about the impacts of Maintenance and Heavy Machine Installation. Educational programs can promote best practices, technological advancements, and policy initiatives.

Course Outcomes: After the completion of this course the student will be able to understand the following points:

- This subject will give general introduction Installation of Small and large machine.
- To know about the role and importance of Equipment's, relay and circuit breaker.

- To learn the basic techniques used in repairing and maintenance.

Main Objectives for Students:

The student learns about the various type of connection like single phase and three phase connection. They get practical experience regarding electrical equipment maintenance testing and trouble shooting.

Course Contents:

- Electrical Fundamentals- Basic Tools, personal protective equipment, Series, parallel, Delta and Star connection, Capacitor and inductor Association: series and parallel, Generation of DC, Single and three phase AC and Their Circuit operating principle
- Measuring and Testing- How to measure Ω, A, V, W and rpm, Attention when measuring Ω, A, V. Multimeter, Clamp on meter, Oscilloscope, Power quality and phase sequence meter, Insulation Resistance meter, how to measure insulation resistance in motor, transformer and MV/HV Insulator, How to choose Installation resistance in motor, Transformer and MV /HV Insulator, How to choose Insulation resistance test voltage and Analyze results, Simulation of Ω, A, V, W, Hz Metering wave analyzer with Oscilloscope.
- Basic Skill and Knowledge for electrical Circuit trouble shooting
- Electrical Schematic Diagram Symbology, Voltage Levels used in LV Electrical Circuits, Local and Remote Control, Manual and Automatic Control, Sensors and Transducers, Power, Control and Signalling Circuits: Contactors, Relays, Interlocks, etc. Fuse, Circuit Breaker, Overload, Voltage and Frequency Relays Electrical Timer and Latch Relays, Electrical Switchboards Accessories: Terminal Block, Din Rail, Cable Trunking, Buttons, Switches, Selectors, Siren, Signalling LED, Design of Power, Control and Signalling Circuits ,AC and DC Motor Starting and Speed Control Methods, Example 1: Star-Delta Stater, Example 2: DC Motor with Separate Excitation Starting, Fundamental Rules for Creating and Reading Electrical Diagrams, Basics of Ladder Diagram and PLC Programming, Power, Control and Signalling Circuit Design
- Maintenance, Testing and troubleshooting of common electrical equipment's- Trouble shooting internal and external fault, Instruments and accessories for trouble shooting. Trouble shooting charts
- Safety- fire extinguisher, Electric shock, Accident in plant

Award of Certificate

The student will be evaluated through attendance, assignments, quizzes and a final test. The student must secure a minimum of 60% of the total marks to get the course completion certificate.

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

AUTOCAD ELECTRICAL

Course Name: Electrical Autocade
Contact Hours: 6 weeks/ 40 Hours (30 Hours Teaching + 10 Hours of Workshop)
Students Strength: 30

Importance of course

This course is designed for new users who require comprehensive training in AutoCAD® Electrical software. This hands-on course focuses on how to build intelligent ladder diagrams and panel layouts, and how to leverage this intelligence. The course provides an overview of many AutoCAD Electrical utilities designed to enable users to quickly build and manage electrical controls drawings.

Course Objective:

The primary objective of this course is for students to learn the basic commands necessary for creating professional electrical-controls drawings with AutoCAD Electrical software. After completing this course, students will be able to:

- Navigate the AutoCAD Electrical user interface.
- Use the fundamental features of AutoCAD Electrical.
- Build intelligent ladder diagrams and panel layouts.
- Create, view, and edit the project settings and properties.
- Extract data from drawings into reports formatted to match user's standards.
- Insert and edit parametric PLC modules, nonparametric PLC modules, and stand-alone PLC I/O points.

Course Description

- Line, Circle, Erase, Undo, Redo, Zoom Pan, Rectangle, Move, Copy, Area
- Function key, Snap & Settings
- Offset, Extend, Trim
- Line type - LT & Lt scale
- Hatching & Gradient & Editing
- Ellipse (Centre and Axis-end) & Ellipse Arc ,Arc, Spline, Solid, Donut
- Polygon, Polyline & Pedit, Fillet, Chamfer, Mirror, Rotate, Scale, Stretch, Join, Array
- Break, Grip
- Text, Table, Data Link to Excel
- Block (making & inserting), Attribute definition, Dynamic Block Editor
- Point, Mpoint, Ddptype, Divide, Measure, Layer), Layer tools, Setting of Units, Explode.
- Introduction of 3D modeling
- Viewports
- Surfacing & setting (Rulesurf, Revsurf, Tabsurf, Edgesurf)
- Extrude, Revolve, Sweep, Loft, Presspull, Polysolid, 3Dpoly

- Solids Editing (Sunstract, Union, Intersect, Shell, Operation on Edges & Faces)
- UCS Setting
- 3D Operation (3D Array, Mirror 3D, Rotate 3D, Slice, Interference)
- Layout Setting
- Plot
- Rendering, Lighting, Texturing

Scope of this Course:

Design and collaborate with flexibility

Work the way you want. Stay connected to projects with one AutoCAD experience on desktop, web and mobile to capture, share and review ideas on the go.

Manage design data across projects

Reliably streamline document review and approval workflows with Autodesk Docs, our cloud-based document management and common data environment available in the AEC Collection.

Course Outcomes: After the completion of this course the student will be able to understand the following points:

Design across Project

Data with flexibility

Layout Setting and Tags

Main Objectives for Students:

The student learn about the various type of Command and design can be prepared by the Other engineers. Able to design single sine diagram for domestic wiring and industrial warning.

Course Contents:

1. Basics of electrical design engineering
   a. Representation of electrical symbols
   b. Design of lighting fixture
      Installation on platform
      (ii) Open area flood light fixture
      (iii) Street Light Fixture
      (iv) Floodlight mast
      (v)more…
2. Design of Radial Systems
3. Design of SLD(Single line diagrams)
   (i)Basic lighting SLD
   (ii) Detailed SLD
4. Design of Control Schematics
   (i)DOL starter
   (ii)Forward Reverse Starter
   (iii)Star Delta Starter
   (iv)More
5. Electrical panels
6. Power Diagrams
7. Sub-station layout

8. Using PLC I/O Modules
9. Design of various Electrical machine, Transformers, induction machines-single phase and three phase, DC machines, etc

Award of Certificate

The student will be evaluated through attendance, assignments, quizzes and a final test. The student must secure a minimum of 60% of the total marks to get the course completion certificate.

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Solar Pannel Installation and Maintenance

Course Details

Course Name: Solar Pannel Installation and Maintenance
Contact Hours: one weeks 30 Hours (10 Hours Teaching + 20 Hours of Workshop)
Students Strength: 49

Importance of Course

This is a skill-oriented course in the study of solar photovoltaic (PV) cells, modules, and system components; electrical circuits; PV system design and sizing for use on homes, commercial building etc., understanding energy conversion from sunlight to electricity, and working with solar conversion equipment. This Course will give students the book knowledge and hands on experience needed to become entrepreneur / self-employed.

Course Objective:

- Develop highly skilled and technically qualified rooftop solar photovoltaic installer, and also give them a pathway towards becoming a successful professional and an entrepreneur.
- Establish a technical and administrative framework to train and certify 10,000 Rooftop Solar PV Installers per year throughout the country.
- Foster100 partnering training centers and empower them by building their internal human resource and infrastructural capacities.
- Translate global knowledge and national experience into local learning through standardized and regularly updated course curriculum and content.

Course Description

Rooftop Solar PV Installation is a platform to develop and promote solar capabilities in training and educational institutions by standardizing curriculum and content, assisting in setting up training infrastructure, monitoring training quality and certifying the successful technicians.

Scope of this Course:

The solar energy industry is booming. Since 2009, the amount of solar energy connected to the grid has increased more than 35-fold, reaching 62.5 GW today. This expansion has resulted in the creation of thousands of new solar industry jobs, with more than 240,000 people currently employed and projections of major growth in the future.

Course Outcomes

- Develop a knowledge bank
- Obtain technical and other capacity requirements from the solar industry
- Obtain learnings about the sector locally and globally from experts
- Obtain requirements from government, utilities and statutory bodies
- Process the information and knowledge into simple deliverable vocational material

Develop capacities

- Guide educational and training institutions to set up relevant learning infrastructure
- Train trainers and provide teaching material with continuous upgradation and support
- Through competent trainers, develop skilled technicians in a decentralized manner
- Monitor the overall development and delivery process and in the process unify technical standards and aspects for the sector
- Standardize the teaching-learning process
- Provide skilled workforce to the sector to meet its targets

Course Contents:

- Basics of Solar Energy and Electrical Concept
- Identification and use of different tools and tackles used for installation of Solar PV syste m
- Site Survey for Solar PV Installation
- Interpretation of Drawings, Material Handling and storage of components on-site
- Installation of Electrical Components of Solar Photovoltaic Systems
- Install Civil and Mechanical Parts of Solar PV System
- Test & Commission Solar PV System

Course Outcomes:

Upon completion of this course, the student will be able to:

- Demonstrate knowledge of and apply key solar electric system terms and concepts, Size and design a photovoltaic system.
- Mount, ground, position, install, wire and connect a photovoltaic system.
- Test voltage generated by photovoltaic system Operate & Maintain of Solar Power.
- Participants will learn different types of solar PV module and batteries used in solar PV plant.
- Design of solar PV Plant based on estimated loads.

Job Opportunities:

- Become entrepreneur / self-employed.
- Design Electrical Engineer – Solar.
- Area Sales Manager-Solar Thermal & PV Products.
- Service-in-charge.

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**

Industrial Automation

Course Details

Course Name: Industrial Automation
Contact Hours: 2 weeks/ 36 Hours (10 Hours Teaching + 26 Hours of Workshop)
Students Strength: 30

Importance of Course

Industrial automation is a complex, dynamically evolving and utterly fascinating technology field. This guide covers the basics of industrial automation, including its main principles and concepts, technological solutions powering modern-day automation and their applications in the industrial environments.

In the modern world, the industrial automation is omnipresent across virtually all fields and niches of the economy. Automation systems allow manufacturing, engineering, construction, power generation and other processes laying at the core of the economy to function with increasing efficiency and productivity. Industrial automation today is going through a new major developmental boom, which is fueled by innovative technologies such as artificial intelligence (AI), cloud computing, Big Data, Internet of Things (IoT) and others

Course Objective:

The Industrial Automation course at Production site provides students with a comprehensive understanding of the management, cost Reduction, Efficiency and Productivity. Students will learn about the environmental impact of Society and the various techniques and technologies used for Monitoring and Industrial Safety.

Course Description:

This industrial automation training course is designed & developed by industrial professionals having decades of industrial experience in Automation Domain. This automation training course is designed based on practical approach i.e. ‘Hands-On’ State-of-the-art(PLCs, SCADA) equipment.

Scope of this Course:

The rear-view mirror-Because of the relatively small production volumes and huge varieties of applications, industrial automation typically utilizes new technologies developed in other markets. Automation companies tend to customize products for specific applications and requirements. So the innovation comes from targeted applications, rather than any hot, new technology.

New technology directions-Industrial automation can and will generate explosive growth with technology related to new inflection points: nanotechnology and nanoscale assembly systems; MEMS and nanotech sensors (tiny, low-power, low-cost sensors) which can measure everything and anything; and the pervasive Internet, machine to machine (M2M) networking.

The fully-automated factory-Automated factories and processes are too expensive to be rebuilt for every modification and design change – so they have to be highly configurable and flexible. To successfully reconfigure an entire production line or process requires direct access to most of its control elements – switches, valves, motors and drives – down to a fine level of detail.

High-value-added products- proprietary products and knowledge offered through effective global service providers, tailored to specific customer needs.

Course Content:

This course, provides an overall exposure to the technology of Industrial Automation and Control. It covers topics such as:

- Advantage and architecture of automation systems
- Measurement systems (including sensors and signal conditioning)
- Discrete and continuous variable control systems
- Hydraulic, pneumatic, and electric actuators
- Industrial communication and embedded countinghouse Content
- Ladder Programming
- SCADA Design
- PLC and SCADA Communication
- PLC and Sensors Communication

Course Outcomes: After the completion of this course the student will be able to understand the following points:

- This subject will give general introduction of automation and practices involved in Creating programming in PLC, its Coding, use and importance.
- To know about the role and importance of SCADA
- To Learn about Communication between PLC and SCADA

Employability-

Industrial automation offers promising job prospects across various sectors. Here are some potential career paths:

- **Automation Engineer:** Automation engineers design, develop, and maintain automated systems, including PLCs (Programmable Logic Controllers), SCADA (Supervisory Control and Data Acquisition) systems, and robotics. They work in manufacturing, automotive, pharmaceuticals, and other industries.
- **Control Systems Engineer:** Control systems engineers focus on designing and implementing control algorithms for industrial processes. They optimize efficiency, safety, and reliability of systems.
- **Robotics Engineer:** Robotics engineers specialize in designing, programming, and maintaining robotic systems used in manufacturing, logistics, and healthcare. They work on tasks like robot kinematics, vision systems, and motion planning.
- **Maintenance Technician:** Maintenance technicians troubleshoot and repair automated equipment. They ensure smooth operation and minimize downtime.
- **Process Automation Specialist:** These professionals improve production processes by implementing automation solutions. They analyze data, identify bottlenecks, and

optimize workflows.

- **Industrial IT Specialist:** Industrial IT specialists manage networks, cybersecurity, and data communication in automated systems. They ensure data integrity and system reliability.
- **Field Service Engineer:** Field service engineers install, maintain, and repair automation equipment on-site. They travel to different locations to support clients.
- **Consultant/Project Manager:** Consultants and project managers oversee automation projects. They plan, budget, and coordinate implementation.
- **Research and Development (R&D):** R&D roles involve creating innovative automation solutions. These professionals work on cutting-edge technologies.
- **Energy Management Specialist:** Energy management specialists optimize energy usage in automated systems. They focus on sustainability and cost reduction.

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**

Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering

IOT application in Smart city

Course Details

Course Name: IoT application in Smart city
Contact Hours: 6 weeks/ 40 Hours (30 Hours Teaching + 10 Hours of Workshop)
Students Strength: 50

Importance of Course

Smart cities are a technical solution to help city officials meet urban planning goals. Learn how IoT provides the foundation for smart cities and how connected solutions can help officials prove their impact and improve the lives of citizens.

Course Objective:

India predicted that by 2050, about 70% of the world's population will live in urban areas. This rapid urbanization will put enormous pressure on city officials to ensure their infrastructure can handle the demands of a growing population.

Without control over air quality, energy, transportation, building systems, and other critical facets of urban life, city officials will struggle to gather the data they need to improve infrastructure, implement smarter regulations, and foster a high quality of life. The idea of a "connected" or smart city changes that.

Course Description:

The Internet of things (IOT) is a field of study that covers physical objects that have Sensors, Processing Ability, software and other technologies that connects and exchange data with other such devices over the internet or other communication networks. Arduino is an open-source electronic platform that is based upon easy-to-use hardware and software. This programming course you to the basics of Arduino and explains how to use python

Course Contents:

Module 1 Interoperability and Arduino
Interoperability and Arduino Programming-In this module, we will introduced to interoperability in the internet of things(IoT).You will also be introduced to the basics of Arduino programming and the integration of sensor and actuators with the Arduino platform
Module 2 Python Programming and Raspberry Pi
In this module, You will be introduced to the python Programming language, you will also be introduced to Raspberry Pi, its importance in the development of internet of things and the implementation of IoT with Raspberry
Module 3 Arduino communication with different sensors and application to develop a smart city

A K S University

Faculty of Engineering and Technology

Department of Electrical Engineering

Curriculum of B.Tech. (Electrical Engineering) Program

(Revised as on 01 August 2023)

Main Objectives for Students:

- **Promote Economic Development:** Smart cities aim to boost economic growth by creating an environment conducive to business, innovation, and investment. This includes attracting industries, startups, and job opportunities.
- **Improve Quality of Life:** Smart cities prioritize residents' well-being. They enhance public services, healthcare, education, and safety. Technology-driven solutions improve daily life for citizens.
- **Generate Employment:** By fostering economic growth and attracting businesses, smart cities create employment opportunities. Job creation benefits both skilled professionals and marginalized communities.
- **Increase Income Equity:** Smart cities strive to reduce income disparities. They focus on inclusive development, ensuring that benefits reach all segments of society, especially those in need.
- **Sustainable Growth:** Smart cities balance growth with environmental conservation. They adopt eco-friendly practices, efficient resource utilization, and sustainable infrastructure.

Award of Certificate

The student will be evaluated through attendance, assignments, quizzes and a final test. The student must secure a minimum of 60% of the total marks to get the course completion certificate.

****

Curriculum Development Team

1. **Dr. Rama Shukla, HOD, Department of Electrical Engineering.**
2. **Dr. Gauri Richhariya, Assistant Professor, Department of Electrical Engineering.**
3. **Mr. Umesh Kumar Soni, Assistant Professor, Department of Electrical Engineering.**
4. **Mr. Achyut Pandey, Assistant Professor, Department of Electrical Engineering.**
5. **Mr. Ashutosh Dubey, Assistant Professor, Department of Electrical Engineering.**
6. **Mr. Ajay Singh, Assistant Professor, Department of Electrical Engineering.**
7. **Mr. Krishna Kumar Tripathi, Assistant Professor, Department of Electrical Engineering.**
8. **Ms. Deepa Shukla, Assistant Professor, Department of Electrical Engineering.**
9. **Mr. Pranjal Devendra Mishra, Teaching Associate, Department of Electrical Engineering**