Curriculum Book

And

Assessment and Evaluation Scheme

Based on

Outcome Based Education (OBE)

and

Choice-Based Credit System (CBCS)

in

Bachelor of Engineering

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 Mechanical Engineering

AKS University

Faculty of Engineering and Technology

Department of Mechanical Engineering

Curriculum & Syllabus of B.Tech. (Mechanical Engineering) program

(Revised as on 01 August 2023)

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Faculty of Engg. & Tech.
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Sherganj, Satna (MP), 485001

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

AKS University

Faculty of Engineering and Technology

Department of Mechanical Engineering

Curriculum of B.Tech. (Mechanical Engineering) Program

(Revised as on 01 August 2023)

Forwarding

I am thrilled to observe the updated curriculum of the Mechanical Engineering Department for B.Tech. Mechanical Engineering Program, which seamlessly integrates the most recent technological advancements and adheres to the guidelines set forthby AICTE. The revised curriculum also thoughtfully incorporates the directives of NEP-2020 and the Sustainable Development Goals.

The alignment of course outcomes (COs), Programme Outcome (POs) and Programme specific outcomes (PSOs) has been intricately executed, aligning perfectly with the requisites of NEP-2020 and NAAC standards. I hold the belief that this revised syllabus will significantly enhance the skills and employability of our students.

With immense satisfaction, I hereby present the revised curriculum for the B. Tech. in Mechanical Engineering program for implementation in the upcoming session.

ER. Anant Soni
Pro Chancellor & Chairman
AKS University, Satna

01 August 2023

AKS University

Faculty of Engineering and Technology

Department of Mechanical Engineering

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(Revised as on 01 August 2023)

From the Desk of the Vice-Chancellor

AKS University is currently undergoing a process to revamp its curriculum into an outcome-based approach, with the aim of enhancing the teaching and learning process. The foundation of quality of quality education lies in the implementation of a curriculum that aligns with both societal and industrial needs, focusing on relevant outcomes. This entails dedicated and inspired faculty members, as well as impactful industry internships.

Hence, it is of utmost importance to begin this endeavor by crafting an outcome-based curriculum in collaboration with academia and industry experts. This curriculum design should be informed by the latest technological advancements, market demands, the guidelines outlined in the National Education Policy (NEP) of 2020, and sustainable goals.

I'm delighted to learn that the revised curriculum has been meticulously crafted by the Mechanical Enginnering Department, in consultation with an array of experts from the cement industry, research institutes, and academia. This curriculum effectively integrates the principles outlined in the NEP-2020 guidelines, as well as sustainable goals.

Our B.Tech. Mechanical Engineering curriculum is meticulously crafted to provide students with a comprehensive understanding of the core principles, latest advancements, and practical applications in the field. We recognize the pivotal role that mechanical engineers play in shaping the future of technology, innovation, and sustainable development.

At the heart of our curriculum lies a commitment to excellence, innovation, and relevance. We continually strive to integrate emerging trends, cutting-edge technologies, and industry best practices into our courses, ensuring that our graduates are well-equipped to tackle the challenges of the modern world.

Furthermore, we place a strong emphasis on fostering critical thinking, problem-solving skills, and ethical leadership among our students. Our curriculum is designed not only to impart knowledge but also to nurture creativity, resilience, and a passion for lifelong learning.

I am confident that the updated curriculum for Mechanical Engineering will not only enhance students' technical skills but also contribute significantly to their employability. During the process of revising the curriculum, I am pleased to observe that the Mechanical Engineering department has diligently adhered to the guidelines provided by the AICTE. Additionally, they have maintained a total credit requirement of 166 for the B. Tech Mechanical Engineering program.

It's worth noting that curriculum revision is an ongoing and dynamic process, designed to address the continuous evolution of technological advancements and both local and global concerns. This ensures that the curriculum remains responsive and attuned to the changing landscape of education and industry.

AKS University warmly invites input and suggestions from industry experts and technocrats and Alumni students to enhance the curriculum and make it more student-centered. Your valuable insights will greatly contribute to shaping an education that best serves the needs and aspirations of our students.

Professor B. A. Chopade
Vice- Chancellor

AKS University, Satna
01 August 2023

AKS University

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Preface

As part of our commitment to ongoing enhancement, the Department of Mechanical Engineering consistently reviews and updates its B.Tech. Mechanical Engineering program curriculum every three years. Through this process, we ensure that the curriculum remains aligned with the latest technological advancements, as well as local and global industrial and social demands.

During this procedure, the existing curriculum for the B.Tech. Mechanical Engineering Program undergoes evaluation by a panel of technocrats, industry specialists, and academics. Following meticulous scrutiny, the revised curriculum has been formulated and is set to be implemented starting from August 01, 2023. This implementation is contingent upon the endorsement of the curriculum by the University's Board of Studies and Governing Body.

This curriculum closely adheres to the AICTE model syllabus distributed in May 2023. It seamlessly integrates the guidelines set forth by the Ministry of Higher Education, Government of India, through NEP- 2020, as well as the principles of Sustainable Development Goals. In order to foster the holistic skill development of students, a range of practical activities, including Hands-On Training, Industrial Visits, Project planning and execution, Report Writing, Seminars, and Industrial On-Job Training, have been incorporated. Furthermore, in alignment with AICTE's directives, the total credit allocation for the B. Tech Mechanical Engineering program is capped at 166 credits.

This curriculum is enriched with course components in alignment with AICTE guidelines, encompassing various disciplines such as Fundamental Science Concepts: 24 credits, Engineering Science: 34 credits, Humanities and Social Sciences: 12 credits, Core Program Courses: 62 credits, Elective Program Courses: 9 credits, Open Electives: 9 credits, Project and Practical Training: 14 credits, Seminars: 2 credits, Indian Knowledge System: 2 credits, Sustainable Development Goals: 2 credits.

To ensure a comprehensive learning experience, detailed evaluation schemes and rubrics have also been meticulously provided.

For each course, a thorough mapping of Course Outcomes, Program Outcomes, and Programme Specific Outcomes has been undertaken. As the course syllabus is being meticulously developed, various elements such as session outcomes, laboratory instruction, classroom instruction, self-learning activities, assignments, and mini projects are meticulously outlined.

We hold the belief that this dynamic curriculum will undoubtedly enhance independent thinking, skills, and overall employability of the students.

Mr. Shailendra Singh Parihar
Head of the Department
Mechanical Engineering

AKS University
01 August 2023

AKS University

Faculty of Engineering and Technology

Department of Mechanical Engineering

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Introduction:

AKS University, a trailblazing institution, initiated a comprehensive 4-year B. Tech program in Mechanical Engineering in 2012. The Mechanical Department owes its distinction to the dedicated contributions of its teaching and non-teaching staff, which have played an integral role in enhancing the teaching and learning processes. Recognizing the importance of equipping students with practical knowledge in mechanical engineering to meet industrial demands and establish a strong reputation in the field, the department has diligently provided hands-on training experiences, bridging the gap between conventional and modernized technology systems.

The curriculum has been thoughtfully designed to include cutting-edge technologies such as CNC Machineries, Wire cut EDM, Advanced Thermal Measurement Techniques, 3D Printing, and Advanced Casting Technologies. These elements have been seamlessly integrated to groom students into adept engineers well-prepared for contemporary technological challenges. Additionally, the department is committed to nurturing entrepreneurship in its students by offering industry-oriented training programs that complement their academic pursuits.

Every step in this educational journey has been carefully planned to introduce novelty into the lives of our students within the engineering environment. Our innovative curriculum is meticulously tailored to align with the evolving needs of industries and the latest technological advancements. Presently, a thriving community of aspiring students is actively enrolled in the B. Tech program in Mechanical Engineering within our department.

Vision:

To conduct its key programs and activities in a unique manner that promotes excellence and leadership in education, research, innovation in Mechanical Engineering and fosters an environment that is safe, highly productive, cooperative and collegial, and dedicated to sustainable improvement.

Mission:

M 01: By employing advanced teaching-learning methods and fostering strong collaborations with industries, our aim is to provide comprehensive and high-quality education.

M 02: To nurture the potential of young and dynamic minds, empowering them to become proficient professionals, and ultimately, to attain a prominent national ranking.

M 03: To meet international standards, contributing to the realization of the Government's "Make In India" industrial policy through continuous innovation and research efforts.

M 04: To empower students to address the demands of both individuals and industries involved in academic pursuits, applied research, and developmental endeavors associated with Mechanical Engineering.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO 01: Prepare with strong foundation in mathematical, scientific and engineering fundamentals that will enable them to have successful career in Mechanical and Interdisciplinary Industries. **(KNOWLEDGE).**

PEO 02: Strengthen their knowledge and skills through self-learning abilities throughout their professional career or during higher education. **(SKILL & PROFESSIONALISM).**

PEO 03 : Impart critical thinking skills and to develop innovative ideas for Research & Delopment **(RESEARCH & INNOVATION).**

PEO 04 : Ability to understand the impact of professional engineering solutions in societal, economic and environmental contexts and demonstrate knowledge and need for sustainable development.

Program Outcomes (POs)

B Tech Mechanical Engineering Graduate will able to perform:

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

PO 2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration forthe public health and safety, and the cultural, societal, andenvironmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to theprofessional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms ofthe engineering practice.

PO 9: Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

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

PSO 1: Mechanical System Design and Analysis: Graduates will be able to apply engineering principles to design, analyze, and optimize mechanical systems and components, considering factors such as functionality, safety, manufacturability, and cost-effectiveness.

PSO 2: Manufacturing Processes and Automation: Graduates will possess the skills to select, plan, and implement appropriate manufacturing processes, including automation and robotics, to efficiently produce mechanical components and products.

PSO 3: Computational Modeling and Simulation: Graduates will have expertise in using computational tools and simulations to model and analyze complex mechanical phenomena, aiding in design and decision-making.

PSO 4: Product Innovation and Development: Graduates will possess the skills to innovate and develop new mechanical products or systems, from concept to prototype, considering market needs and user requirements.

Consistency/Mapping of PEOs with Mission of the Department

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

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

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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 Undergraduate degree program in Engineering has about 160 credits, the total number of credits proposed for the four-year B. Tech.in Mechanical Engineering is kept as 166 considering NEP-20 and NAAC guidelines.

3. Structure of UG Program in Mechanical Engineering:

The structure of UG program in Mechanical Engineering shall have essentially the following categoriesof 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)	14.04	24
2	Engineering Sciences (ESC)	19.88	34
3	Humanities and Social Sciences (HMSC)	7.02	12
4	Program Core (PCC)	36.84	58
5	Program Electives (PEC)	5.26	9
6	Open Electives (OEC)	5.26	9
7	Project work, seminar and internship in industry	9.36	16
8	Indian Knowledge System	1.17	2
9	Sustainable Development Goals	1.17	2
	Total	**100.0**	**166**

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General Course Structure and Credit Distribution

Curriculum of B.Tech. Mechanical Engineering

Semester – 1	Credits	Semester – 2	Credits
1. Physics-1 2. Mathematics-1 3. Biology for Engineers 4. Basic Electrical Engineering 5. Engineering Graphics & Design 6. Design Thinking & Idea Lab 7. Basic Civil Engineering 8. Sustainable Development Goals	3:1:2=5 3:1:0=4 3:0:0=3 2:1:2=4 1:0:4=3 0:0:2=1 3:0:0=3 2:0:0=2	1. Chemistry-1 2. Mathematics-2 3. Programming for Problem Solving 4. Manufacturing Practice Workshop 5. Communication 6. Sports and Yoga 7. Indian Knowledge System	3:0:2=4 3:1:0=4 3:0:4=5 1:0:4=3 2:1:0=3 2:0:0=0 2:0:0=2
Total Credits	**25**	**Total Credits**	**21**
Semester – 3	Credits	**Semester – 4**	Credits
1. Mechanics of Deformable Solids 2. Mathematics-3 3. Environment Science (Audit) 4. Basic Electronics Engineering 5. Engineering Mechanics 6. Applied Thermodynamics 7. Universal Human Values	3:1:2=5 3:1:0=4 2:0:0=0 3:1:2=5 3:1:2=5 3:1:2=5 3:0:0=3	1. Heat Transfer 2. Fluid Mechanics & Hydraulic Machines 3. Manufacturing Processes 4. Kinematics & Dynamics of Machines 5. Engineering Materials & Applications	3:1:0=4 3:1:2=5 3:1:0=4 3:1:2=5 3:1:0=4
Total Credits	**27**	Total Credits	**22**
Semester – 5	Credits	**Semester – 6**	Credits
1. Machine Element & System Design 2. Mechatronics 3. HSS/Management Elective-1 4. Measurements & Metrology 5. HSS/Management Elective-2	3:1:0=4 3:1:2=5 3:0:0=3 3:0:2=4 3:0:0=3	1. Computer Aided Design & Analysis 2. Manufacturing Automation 3. Production & Operation Management 4. Product Innovation & Entrepreneurship 5. Professional Elective-1 6. Engineering Project-1(Seminar)	3:1:2=5 3:1:2=5 3:1:0=4 3:1:0=4 3:0:0=3 0:0:4=2
Total Credits	**19**	Total Credits	**23**

Semester – 7	Credits	**Semester – 8**	Credits
1. Professional Elective-2 2. Professional Elective-3 3. Open Elective-1 4. Open Elective-2 5. Open Elective-3 6. Engineering Project-2 (Design & Analysis)	3:0:0=3 3:0:0=3 3:0:0=3 3:0:0=3 3:0:0=3 0:0:10=5	1. Engineering Project-3 (Prototype & Testing) 2. Seminar	0:0:16=8 0:0:2=1
Total Credits	**20**	Total Credits	**9**

i. **Humanities & Social Sciences & Mgt. Electives (HSM):** Any 2 courses from the list of those offered.

ii. **Open Electives (OEL)**: Any 3 courses (from any department), based on individual interest and project.

iii. **Industry internship**: Internship in industry, start-up or R&D lab in 2nd/3rd year summer is compulsory (audit). 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

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
IKS = Indian Knowledge System
SDGs = Sustainable Development Goals

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

Category-wise Courses

HUMANITIES & SOCIAL SCIENCES COURSES [HS] & MANAGEMENT COURSES (2 compulsory + 2 others)

(i) Number of Humanities & Social Science Courses: 4, Credits: 12

Sl.	Code No.	Subject	Semester	Credits
1	HSMC 101	Communication Skills / English (Compulsory	2	3:0:0 =3
2	HSMC- 301	Universal Human Values (Compulsory course)	2	2:1:0 =3
3	HSMC 301	Industrial Psychology	5	3:0:0 =3
4	HSMC 302	Operations Research	5	3:0:0 =3
5	HSMC 303	Project Management	5	3:0:0 =3
6	HSMC 304	Finance & Accounting	5	3:0:0 =3
		Total Credits		**12**

BASIC SCIENCE COURSE [BSC] (TOTAL 7)

Sl.	Code No.	Subject	Semester	Credits
1	BSC 101	Physics-1 (Electromagnetism)	1	3:1:2 =5
2	BSC201	Mathematics-1 (Calculus & Linear Algebra)	1	3:1:0 =4
3	BSC 104	Chemistry-1	2	3:0:2 =4
4	BSC 105	Mathematics-2 (ODE, Complex variables)	2	3:1:0 =4
5	BSC 206	Mathematics-3 (PDE, Prob/Stat)	3	3:1:0 =4
6	BSC 107	Biology for Engineers	1	3:0:0 =3
7	BSC106-AU	Environment Science (Audit)	3	2:0:0 =0
		Total Credits		**24**

ENGINEERING SCIENCE COURSE [ESC] (Total 9)

Sl.	Code No.	Subject	Semester	Credits
1	ESC 101	Basic Electrical Engineering	1	2:1:2 =4
2	ESC 102	Engineering Graphics & Design	1	1:0:4 =3
3	ESC 103	Design Thinking + Idea Lab (Audit)	1	0:0:2 =1
4	ESC 108	Basic Civil Engineering	1	3:0:0 =3
5	ESC 104	Programming for Problem Solving	2	3:0:4 =5
6	ESC 105	Manufacturing Practice Workshop	2	1:0:4 =3
7	ESC 206	Basic Electronic Engineering	3	3:1:2 =5
8	ESC202	Engineering Mechanics	3	3:1:2 =5
9	ESC203	Applied Thermodynamics	3	3:1:2 =5
			Total Credits:	**34**

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PROFESSIONAL CORE COURSES [PCC] (Total 16)

Sl.	Code No.	Subject	Semester	Credits
1	PCC-ME 201	Mechanics of Deformable Solids	3	3:1:2 =5
2	PCC- ME 202	Heat Transfer	4	3:1:0 =4
3	PCC- ME 203	Fluid Mechanics & Hydraulic Machines	4	3:1:2 =5
4	PCC- ME 204	Manufacturing Processes	4	3:1:0 =4
5	PCC- ME 205	Kinematics & Dynamics ofMachines	4	3:1:2 =5
6	PCC- ME 206	Engineering Materials &Applications	4	3:1:0 =4
7	PCC-ME 301	Machine Element & System Design	5	3:1:0 =4
8	PCC- ME 302	Mechatronics	5	3:1:2= 5
9	PCC- ME 303	Measurements & Metrology	5	3:0:2 =4
10	PCC- ME 305	Computer Aided Design &Analysis	6	3:1:2=5
11	PCC- ME 306	Manufacturing Automation	6	3:1:2 =5
12	PCC- ME 307	Production & Operation Management	6	3:1:0 =4
13	PCC- ME 308	Product Innovation &Entrepreneurship	6	3:1:0 =4
			Total Credits	**58**

PROFESSIONAL ELECTIVE [PEC]

Total 3 to be taken, at least one from each group – Technology and Industry Sector, based on Project topic and individual interest. Illustrative courses are listed here

Sl.	Code No.	Subject	Semester	Credits
		TECHNOLOGY GROUP		
1	PEC-ME 01	Refrigeration & Air Conditioning	6/7	3:0:0 =3
2	PEC-ME 02	Power Plant Engineering	6/7	3:0:0 =3
3	PEC-ME 03	Renewable Energy Engineering	6/7	3:0:0 =3
4	PEC-ME 04	Finite Element Analysis	6/7	3:0:0 =3
5	PEC-ME 05	Computational Fluid Dynamics	6/7	3:0:0 =3
6	PEC-ME 06	Additive Manufacturing	6/7	3:0:0 =3

INDUSTRY SECTOR GROUP				
1	PEC-ME 07	Automobile Engineering	6/7	3:0:0 =3
2	PEC-ME 08	Agricultural Engineering	6/7	3:0:0 =3
3	PEC-ME 09	Nuclear Engineering	6/7	3:0:0 =3
4	PEC-ME 10	Food Technology	6/7	3:0:0 =3
5	PEC-ME 11	Marine Engineering	6/7	3:0:0 =3
6	PEC-ME 12	Textile Engineering	6/7	3:0:0 =3
Total Credit				**9**

OPEN ELECTIVE

3 courses from any department in 7th semester = 9 credit

OPEN ELECTIVE				
1	OEC01	Electronic Devices	6/7	3:0:0 =3
2	OEC02	Data Structures and Algorithms	6/7	3:0:0 =3
3	OEC04	Computer Network	6/7	3:0:0 =3
4	OEC05	Embedded System	6/7	3:0:0 =3
5	OEC11	Internet of Things.	6/7	3:0:0 =3
6	OEC12	Big Data Analysis.	6/7	3:0:0 =3
Total Credit				**9**

ENGINEERING PROJECT (3 Stages)

Sl.	Code No.	Subject	Semester	Credits
1	ME 301	Engineering Project-1 (Literature Review)	6	0:0:4=2
2	ME 401	Engineering Project-2 (Design & Analysis)	7	0:0:10=5
3	ME 403	Seminar	8	0:0:2=1
4	ME 402	Engineering Project-3 (Prototype & Testing)/ On job plant Training	8	0:0:16=8
Total Credit				**16**

Other

Sl.	Code No.	Subject	Semester	Credits
1	SDGs 01	Sustainable Development Goals	2	2:0:0 =2
2	IKS 01	Indian Knowledge System	1	2:0:0= 2
Total Credit				**04**

Induction Program

Induction program for students to be offered right at the start of the first year. It is mandatory. AKS University has design 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:

i. The weightage of Internal assessment is 50% and
ii. 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:

i. The weightage of Internal assessment is 50% and
ii. 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

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	19	02	10	31	24
Semester -III	17	05	08	30	24
Semester – IV	15	06	04	25	23
Semester -V	15	03	06	25	21
Semester -VI	15	05	10	30	25
Semester – VII	15	0	10	25	20
Semester -VIII	0	0	18	18	9
Total	113	24	76	214	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 103	Mathematics-1	3	1	0	4	4
3	BSC	BSC 107	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	ESC 108	Basic Civil Engineering	3	0	0	3	3
8	SDG	SDG 101	Sustainable Development Goal	2	0	0	2	2
Total				17	3	10	30	25

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Semester-II

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	BSC	BSC 104	Chemistry-1	3	0	2	5	4
2	BSC	BSC 105	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 101	Communication Skills (English)	3	0	0	3	3
7	IKS	IKS 101	Indian Knowledge System	2	0	0	2	2
8	AU	AU 101	Sports and Yoga	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	PCC-ME201/ PCC-ME201-L	Mechanicsof DeformableSolids	3	1	2	6	5
2	BSC	BSC201	Engineering Mathematics III	3	1	0	4	4
3	BSC	BSC106-AU	Environment Science(Audit)	2	0	0	2	0
4	ESC	ESC201/ ESC201-L	Basic Electronics Engineering	3	1	2	6	5
5	ESC	ESC202/ ESC202-L	Engineering Mechanics	3	1	2	6	5
6	ESC	ESC203/ ESC203-L	Applied Thermodynamics	3	1	2	6	5
7	HSMC	HSMC-301	Universal Human Values	2	1	0	3	3
Total				19	6	8	33	27

Semester – IV

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	PCC	PCC-ME 202	Heat Transfer	3	1	0	4	4
2	PCC	PCC-ME 203	Fluid Mechanics & Hydraulic Machines	3	1	2	6	5
3	PCC	PCC-ME 204	Manufacturing Processes	3	1	0	4	4
4	**PCC**	PCC-ME 205	Kinematics & Dynamics of Machines	3	1	2	6	5
5	**PCC**	PCC-ME 206	Engineering Materials & Applications	3	1	0	4	4
Total				15	6	4	24	22

Semester – V

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	PCC	PCC- ME 301	Machine Element & System Design	3	1	0	4	4
2	PCC	PCC- ME 302	Mechatronics	3	1	2	6	5
3	HSMC	HSMC 3XX	HSS/Management Elective-2	3	0	0	4	3
4	PCC	PCC- ME 303	Measurements & Metrology	3	0	2	5	4
5	HSMC	HSMC 3XX	HSS/Management Elective-1	3	0	0	3	3
Total				15	3	6	25	19

Semester – VI

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	PCC	PCC- ME 305	Computer Aided Design & Analysis	3	1	2	6	5
2	PCC	PCC- ME 306	Manufacturing Automation	3	1	2	6	5
3	PCC	PCC- ME 307	Production & Operation Management	3	1	0	4	4
4	PCC	PCC- ME 308	Product Innovation & Entrepreneurship	3	1	0	4	4
5	PEC	PEC-ME XX	Professional Elective-1	3	0	0	3	3
6	PROJ	ME 301	Engineering Project-1(Literature Review)	0	0	4	4	2
Total				**15**	**5**	**10**	**30**	**23**

Semester VII

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	PEC	PEC-ME XX	Professional Elective-2	3	0	0	3	3
2	PEC	PEC-ME XX	Professional Elective-3	3	0	0	3	3
3	OEC	OEC-ME XX	Open Elective-1	3	0	0	3	3
4	OEC	OEC-ME XX	Open Elective-2	3	0	0	3	3
5	OEC	OEC-ME XX	Open Elective-3	3	0	0	3	3
6	PROJ	ME 401	Engineering Project-2 (Design & Analysis)	0	0	10	10	5
Total				**15**	**0**	**10**	**25**	**20**

Semester VIII

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	PROJ	ME 402	Engineering Project-3 (Prototype & Testing)	0	0	16	16	8
2.	SEM	ME 403	Seminar	0	0	2	2	1
Total				**0**	**0**	**18**	**16**	**9**

Total credit: 166

Semester-I

Course Code: CE-101

Course Title : **Introduction to 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:

CE 101.1 Impart the knowledge on importance of Civil Engineering in the infrastructural development of society

CE 101.2: Identify the types, uses and properties of various building materials.

CE 101.3: Identify the type of construction for different components of a building

CE 101.4: Establish an idea about the different types of masonry work

CE 1015: Analyze various types of roofs and floors..

Scheme of Studies:

Board of Study	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)	CE 101	**Introduction to Civil Engineering**	3	0	1	1	5	3

Legend: **CI:** Class room Instruction (Includes different instructional strategiesi.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

Board of Study	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)
PCC	CE101	Introduction to 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.

CE 101.1: Importance of Civil Engineering in the infrastructural development of society

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Approximate Hours

Item	APPROX Hrs
CI	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	1. Advantages of Infrastructur e 2. Public Private Partnership

		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	

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

1.9 Industry emerging trends in infra spending through public and public-private partnership (PPP)

i. 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.

CE 101.2: Acquire knowledge regarding Stages in the life of construction.

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Approximate Hours

Item	APPROX Hrs
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. **SO4.** To learn about overview of Indian standards **SO5.**5 Interdisciplinary nature of civil engineering projects.	.	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. unit and conversion factors for lengths 2.7 areas, volumes and weights 2.8 Opportunities and challenge of India's Infrastructure 2.9 Interdisciplinary nature of civil engineering projects.	i.Construction Life Cycle ii.Unit Conversion

SW-2 Suggested Sessional Work (SW):

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

b. **Mini Project:**

Interdisciplinary nature of civil engineering projects.

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

Challenges of Indian Infrastructure

CT 101.3: Gain an understanding of the various types of Road in India and their utilization in infrastructure development.

Approximate Hours

Item	APPROX 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.** Analyze various types of bridges and Its parts. **SO4.** 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 uses Of Dams	i. History Of Road Development in India ii. Advantages of Bridges & Dams

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   iii. Road Plans in India.
   iv. Different types of Bridges.

b. **Mini Project:**
   Make Project Report on Dams In India

c. **Other Activities (Specify):**
   Make Report on Road Plans.

CT 101.4: Analyze the strength and properties of various building materials.

Approximate Hours

Item	APPROX Hrs
CI	11
LI	0

SW	2
SL	2
Total	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room 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.	i. Preparation of process flow chart of Portland cement manufacture ii. Draw a typical lay out of a cement plant showing various sections.

		4.8 Types of Cement 1.9 Uses & Various types of Cement Test 1.10 oncrete Uses & Properties 4.11.Various Grades used in Steel	

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.

d. Mini Project:

i. Set out buildings using modern methods.

e. Other Activities(Specify):

Power Point Presentation of Portland cement manufacture.

CT 101.5: Overview of National Highway Authority of India (NHAI)

Item	Approx Hrs
CI	07
LI	0
SW	2
SL	1
Total	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (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 of Indian Road Congress **SO5.3** Role of the new technologies in the field of civil engineering		**Unit 5:** Indian Road Congress **:** 1.1 History of Indian Road Congress. 1.2 Advantages of IRC 5.3 Overview of National Highway Authority of India (NHAI) 5.4 Various Road Plan introduced in NHAI 5.5 Overview of American Society of Civil Engineers (ASCE) 5.6 Emerging areas anew technologies in the field of civil engineering 5.7 advance technology in Civil Engineering	1.1 1. History of IRC. 2. Role of ASCE for Civil Engineers.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

Identify pavement components and design bituminous mixes
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)
CT 101.1: Importance of Civil Engineering in the infrastructural development of society .	8	2	02	12
CT 101.2: Acquire knowledge regarding Stages in the life of construction.	09	2	02	13
CT 101.3: Gain an understanding of the various types of Road in India and their utilization in infrastructure development.	10	2	02	14
CT 101.4: Analyze the strength and properties of various building materials.	11	2	2	15
CT 101.5: 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

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method Group Discussion
4. Role Play
5. Visit to cement plant

6. Demonstration
7. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
8. Brainstorming

Suggested Learning Resources:

(a) **Books**:

S. No.	Title	Author	Publisher	Edition &Year
1	Basic Civil Engineering	Dr. R K Bansal	Laxmi Publication Pvt. Ltd.	Third Edition 2013
2	Legal Aspects of Building and Engineering Contract	W. H Duda	Laxmi Publication Pvt. Ltd.	Patil, B.S.(1974)

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
	Engineering knowledge	**Problem analysis**	**Design/development ofsolutions**	**Conductinvestigations ofcomplex problems**	**Modentolusage**	**Theengineerandsociety**	**Environmentandsustainability:**	**Ethics**	**Individualandteamwork:**	**Communication:**	**Projectmanagementandfinance:**	**Life-longlearning**	**Mechanical System Design and Analysis**	**Manufacturing Processes and Automation**	**Computational Modeling and Simulation**	**Product Innovation and Development**
CO1: Impart the knowledge on importance of Civil Engineering in the infrastructural development of society	**3**	**2**							**2**	**2**		**2**	**2**	**2**	**1**	**-**
CO 2 :: Identify the types, uses and properties of various building materials**...**	**1**	**3**							**2**	**3**		**2**	**2**	**2**	**2**	**1**
CO3: Identify the type of construction for different components of a building	**2**	**2**	**1**	**1**	**2**	**2**	**2**	**1**	**1**	**2**	**1**	**2**	**2**	**1**	**2**	**2**
C04: Building Materials	**3**	**2**		**1**		**2**		**2**		**4**			**3**	**3**	**3**	**2**
C05: Indian Road Congress	**1**	**3**							**2**	**3**		**2**	**3**	**3**	**1**	**3**

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 Impart the knowledge on 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.		As mentioned in page number 2 to 6
PO1,2, 9,10,12 PSO2	CO 2 : **::** Identify the types, uses and properties of various building materials**...**	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	Unit- Stages in the life of construction 2.1,2.2,2.3,2.4,2.5.		
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,3	CO3: Identify the type of construction for different components of a building.	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.		
PO1,2, 9,10,12	C04: Building Materials	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	Unit- 4 Analyze the strength and properties of various building materials 4.1, 4.2,4.3,4.4, 4.5,4.6,4.7,4.8,4.9,4.10,4.11		
PO1,2, 9,10,12	**C05:** Indian Road Congress	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	Unit-5 Overview of National Highway Authority of India (NHAI) 5.1,5.2,5.3,5.4,5.5,5.6,5.7		

Legend:1–Low,2–Medium,3

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
6. Mr. Satish Tiwari, Teaching Associate, Dept. of Civil Engineering

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Semester-I

Course Code: **ESC 104**

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 104.1: Apply network theorems to solve electrical DC circuits.

ESC 104.2: Understand the concept of sinusoidal quantities and solve single phase AC circuits.

ESC 104.3: Analyze the three phase AC circuits and solve series and parallel magnetic circuits.

ESC 104.4: Understand the basic operating principle, types, efficiency of Transformers.

ESC 104.5: Understand the basic operating principle, types of machines.

SchemeofStudies:

Board ofStudy	CourseCode	CourseTitle	Scheme of studies(Hours/Week)					TotalCredits (C)
			CI	LI	SW	SL	Total StudyHours(CI+LI+SW+SL)	
Engineering Science Courses (ESC)	ESC 104	BASIC ELECTRICAL ENGINEERING	3	2	1	1	7	3+0+1=4

Legend: **CI:**ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)andothers),
LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop, field or other locations using different instructional strategies)
SW: Sessional Work(includesassignment, seminar, miniprojectetc.),
SL: SelfLearning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback ofteacherto ensureoutcomeofLearning.

SchemeofAssessment:

Theory

Board of Study	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 104	BASIC ELECTRICAL ENGINEERING	15	20	5	5	5	50	50	100

SchemeofAssessment:
Practical

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				End Semester Assessment	Total Marks
			Class/Home Assignment 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV+AT)	(ESA)	(PRA+ ESA)
ESC	ESC 104_L	BASIC ELECTRICAL ENGINEERING LAB	35	10	5	50	50	100

Course-CurriculumDetailing:

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 104.1: Apply network theorems to solve electrical DC circuits.

Approximate Hours

Item	AppXHrs
Cl	07
LI	12
SW	2
SL	1
Total	22

SessionOutcomes (SOs)	LaboratoryInstruction (LI)	ClassroomInstruction (CI)	Self-Learning (SL)
SO1.1 Understand the Classification of electrical elements. **SO1.2**Understand the concept of voltage and current source. **SO1.3**Understand the concept of mathematical analysis based on KCL and KVL. **SO1.4**Analyze different network theorems. **SO1.5** Understand the concept of star-delta transformation. .	1. Verification of KVL. 2. Verification of KCL. 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. 6. Verification of Thevenin's Theorem.	**Unit-1:DC Network** 1.1 Classification of elements – active, passive, unilateral, bilateral, linear, nonlinear, lumped and distributed 1.2 classification of voltage & current sources 1.3 mesh and nodal analysis 1.4 Superposition theorem 1.5 Star-Delta Transformations (Numerical only). 1.6 Thevenin's theorem (Only independent sources). 1.7 Numerical	1. Learn the theoretical concept of circuit element.

SW-1 SuggestedSessionalWork(SW):

a. Assignments:

i. Numerical Problems on mesh and nodal analysis.

b. MiniProject:

i. Derive different network theorems.

ESC 104.2: Understand the concept of sinusoidal quantities and solve single phase AC circuits.

Approximate Hours

Item	AppXHrs
Cl	7
LI	2
SW	2
SL	1
Total	12

SessionOutcomes (SOs)	**LaboratoryInstruction (LI)**	**ClassroomInstruction (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 2.4Rectangular and polar form 2.5 Power Triangle 2.6 Impedance Triangle, Power factor 2.7Solution of series, parallel, series-parallel network.	1. Remember different concept related to the Sinusoidal Periodic Waveform.

SW-2 SuggestedSessionalWork(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.

b. MiniProject:

a. Draw the chart of Phasor Representation.

ESC 104.3: Analyze the three phase AC circuits and solve series and parallel magnetic circuits.

Approximate Hours

Item	AppXHrs
Cl	9
LI	4
SW	2
SL	1
Total	16

SessionOutcomes (SOs)	**LaboratoryInstruction (LI)**	**ClassroomInstruction (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 related with 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 SuggestedSessionalWork(SW):

a. Assignments:

i. Numerical Problems on three-phase load.

ii. Numerical Problems on Magnetic circuit.

ESC 104.4:Understand the basic operating principle, types, efficiency of Transformers.

Approximate Hours

Item	AppXHrs
Cl	10
LI	8
SW	2
SL	2
Total	22

SessionOutcomes (SOs)	LaboratoryInstruction (LI)	ClassroomInstruction (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 related to efficiency for single-phase transformer.	1. Study the construction details of transformer. 2. Perform open circuit and Short Circuit test on single-phase transformer. 3. Study and Verification of Transformer Ratio Polarity. 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)	i. Remember different parts of transformer. ii. Calculate Losses and Efficiency of transformer.

SW-4 **SuggestedSessionalWork(SW):**

a. Assignments:

i. Numerical Problems on transformer

b. MiniProject:

i. Draw phasor diagram of transformer at different loads.

ESC 104.5: Understand the basic operating principle, types of machines.

Approximate Hours

Item	AppXHrs
CI	12
LI	4
SW	2
SL	1
Total	19

SessionOutcomes (SOs)	**LaboratoryInstruction (LI)**	**ClassroomInstruction (CI)**	**Self-Learning (SL)**
SO5.1 Understand the constructional details of DC machines. **SO5.2**Derive EMF and Torque equations. **SO5.3** Evaluate different types 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 SuggestedSessionalWork(SW):

a. Assignments:

i. Numerical Problem based on EMF and Torque equation of DC machine.

b. MiniProject:

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 (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
ESC 104.1: Apply network theorems to solve electrical DC circuits.	7	12	2	1	22
ESC 104.2: Understand the concept of sinusoidal quantities and solve single phase AC circuits.	7	2	2	1	12
ESC 104.3: Analyze the three phase AC circuits and solve series and parallel magnetic circuits.	9	4	2	1	16
ESC 104.4: Understand the basic operating principle, types, efficiency of Transformers.	10	8	2	2	22
ESC 104.5: 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

SuggestedSpecificationTable(ForESA)

CO	UnitTitles	MarksDistribution			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**

TheendofsemesterassessmentforProcess calculation willbeheldwith written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wiseteachers for above tasks. Teachers can also design different tasks as per requirement, for endsemesterassessment.

SuggestedInstructional/ImplementationStrategies:

1. ImprovedLecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. RolePlay
6. Visit to electrical power plant
7. Demonstration
8. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
9. Brainstorming

SuggestedLearningResources:

(a) Books:

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.			

CurriculumDevelopmentTeam

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Cos, POs and PSOs Mapping

Course Title: B. Tech. Electrical Engineering

Course Code: ESC 104

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	PSO 3	PSO 4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation	Product Innovation and Development
CO1: Apply network theorems to solve electrical DC circuits.	2	2	3	2	2	1	1	1	2	1	1	2	2	1	2	1
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	1	2	1
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	2	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	1	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	2	3	1

Legend:1–Low,2–Medium, 3–High

CourseCurriculumMap

POs &PSOsNo.	COsNo.&Titles	SOsNo.	LaboratoryInstruction(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.	SO1.1S O1.2S O1.3 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	

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.	SO2.1S O2.2S O2.3 SO2.4	1	**Unit-2**: **Single-Phase AC Circuit** 2.1,2.2,2.3,2.4,2.5,2.6, 2.7, 2.8, 2.9	As mentionedin pagenumber 3to 10
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.	SO3.1S O3.2 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, 3.10, 3.11, 3.12, 3.13, 3.14	
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.	SO4.1S O4.2S O4.3S O4.4 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, 4.11, 4.12, 4.13	
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.	SO5.1S O5.2S O5.3 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	

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:

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

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

CO 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

CO 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

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

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme ofstudies(Hours/Week)					Total Credits(C)
			CI	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: LaboratoryInstruction (IncludesPracticalperformancesinlaboratoryworkshop, 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 feed back of teacher to ensure outcome of Learning.

Scheme of Assessment:

BoardofStudy	CouseCode	CourseTitle	SchemeofAssessment (Marks)							
			ProgressiveAssessment(PRA)						EndSemesterAssessment(ESA)	TotalMarks(PRA+ESA)
			Class/HomeAssignment5number 3 marks each(CA)	ClassTest2(2 bestoutOf3)10	Seminarone **(Presentation)** (SA)	ClassActivityany	ClassAttendance	TotalMarks (CA+CT+SA+CAT		
PCC	BSC105	Biology For Engineers	15	20	5	5	5	50	50	100

Course-CurriculumDetailing:

This course syllabus illustrates the expected learning achievements, both at the course and sessionlevels, which students are anticipated to accomplish through various modes of instruction includingClassroom 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.

CO1: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry

Approximate Hours

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

Suggested Sessional Work (SW): *anyone*	SW1.1 Assignments	1 Compare living and non living
	SW1.2 Mini Project	Make a model of camera and try to make a flying object
	SW1.3 Other Activities (Specify)	and try to make a flying object

CO2: To convey the classification of organism underlying criterion, such as morphological, biochemical or ecological be highlighted

Approximate Hours

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

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

Suggested Sessional Work (SW): *anyone*	SW1.1 Assignments	Differentiate between prokaryotic cell and eukaryotic cell.
	SW1.2 Mini Project	Prepare the poster explaining classification of organism
	SW1.3 Other Activities (Specify)	Grow yeast or fungus and observe the growth.

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

.

Approximate Hours

Item	Appx.Hrs.
CI	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 recessiveness 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 on the phenotype and genotype. Concepts of recessiveness and dominance 3.2 basic knowledge of cell and cell theory 3.3: concepts of physical and genetic mapping. 3.4: Boost your knowledge on some genetic disorders in human. And mutation.

Suggested Sessional Work (SW): *anyone*	Assignments:	Differentiate between mitosis and meiosis
	Mini Project:	Explain different types of crosses of Mendelian genetics
	Other Activities (Specify):	Make a model of DNA and RNA and chart of cell cycle

CO.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

Approximate Hours

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

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

Suggested Sessional Work (SW): *anyone*	Assignments:	Write a detail note on Classification of Carbohydrate.
	Mini Project:	Make a chart explaining bio molecules.
	Other Activities (Specify):	List out important enzymes of human body.

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

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

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

Suggested Sessional Work (SW): Anyone	Assignments:	1) Draw and explain simple and compound microscope and their parts. 2) Describe Bacterial growth curve.
	Mini Project:	Make a chart showing different sterilization techniques.
	Other Activities (Specify):	Try to make a simple microscope model.

Brief of Hours suggested for the Course Outcome:-

Course Outcomes(COs)	**Class lecture(CI)**	**Self-Learning (SL)**	**Sessional work (SW)**	**Total Hours (CI+SL+SW)**
CO 1: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.	9	2	1	12
CO 2: To convey the classification of organism underlying criterion, such as morphological, biochemical or ecological be highlighted.	9	2	1	12
CO 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	4	1	14
CO 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	3	1	13
CO5: To convey the concept of microbes and their role in environment	9	2	1	12
Total Hours	45	13	05	63

Suggested Specification Table (For ESA)

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 Curriculum Development Team

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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.

Programme Title: B. Tech. Mechanical Engineering
Course Code: BSC105
CourseTitle: Biology for Engineers.

CourseOutcomes	ProgramOutcomes												ProgramSpecific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PS04
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation	Product Innovation and Development
CO 1: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry	3	1	2	2	2	2	3	1	2	2	1	2	2	2	2	1
CO 2: To convey the classification of organism underlying criterion, such as morphological, biochemical or ecological be highlighted	2	2	3	2	1	2	2	1	1	1	2	3	2	2	2	1
CO 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	2	2	1	1	2	2	2	1	1	2	1	2	2	1	1	3
CO 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	3	2	2	2	3	1	3	1	2	1	2	2	3	3	3	2
CO5: To convey the concept of microbes and their role in environment.	2	2	2	2	1	1	3	1	1	1	2	2	3	3	1	2

Program Title: B. tech
Course Code: BSC105
Course Title: Biology for engineers

Course Curriculum Map:				
POs & PSOs No.	COs No	SOs No.	Classroom Instruction (CI)	Self-Learning (SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3	**CO 1:** 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	1.1, 1.2, 1.3,1.4,1.51,6,1.7,1.8,1.9	1 SL-1,2,
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3	**CO 2:** To convey the classification of organism underlying criterion, such as morphological, biochemical or ecological be highlighted	2.1, 2.2,2.3,2.4,2.5 2.6,2.7,2.8,2.9	2.1, 2.2,2.3,2.4,2.5, 2.6,2.7,2.8,2.9	2 SL-1,2
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3	**CO 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	3.1, 3.2,3.3, 3.4,3.5 ,3.6,3.7,3.8,3.9	3.1, 3.2,3.3, 3.4,3.5 ,3.6,3.7,3.8,3.9	3 SL-1,2,3,4
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3	**CO 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	4.1,4.2, 4.3, 4.4 ,4.5,4.6,4.7,4.8,4.9	4.1,4.2,4.3, 4.4, 4.5, 4.6,4.7,4.8,4.9	4 SL-1,2,3,
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3	**CO5:** To convey the concept of microbes and their role in environment.	5.1, 5.2, 5.3,5.4,5.5,5.6,5.7,5.8,5.9	5.1, 5.2, 5.3,5.4,5.5,5.6,5.7,5.8,5.9	5 SL-1,2,

Semester-I

CourseCode: **ESC 103**

CourseTitle: 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 designthinking 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.

CourseOutcomes:

CO1: Identify the problems that fall under the purview of human centered design process for creative problem solving.

CO2: Create empathy maps to visualize user attitudes and develop innovative products or services for a customer base using ideation techniques.

CO3: Build simple prototypes for problems using gathered user requirements.

SchemeofStudies:

Board ofStudy	Course Code	CourseTitle	Schemeofstudies(Hours/Week)					Total Credits(C)
			CI	LI	SW	SL	Total Study Hours(CI+LI+SW+SL)	
Program Core	ESC 103	Design Thinking & Idea Lab	0	2	1	1	4	1

Legend: **CI:**ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)andothers),
LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop,fieldorotherlocationsusingdifferentinstructional strategies)
SW: SessionalWork(includesassignment,seminar,miniprojectetc.),
SL: SelfLearning,
C:Credits.

Note:

SW&SLhastobeplannedandperformedunderthecontinuousguidanceandfeedbackofteachertoensureoutcomeof Learning.

Scheme of Assessment:

Theory

Board ofStudy	Couse Code	CourseTitle	SchemeofAssessment(Marks)							
			Progressive Assessment(PRA)						EndSemesterAssessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5number 3 marks each (CA)	Class Test2 (2bestout of3) 10 marksea ch(CT)	Seminar one (SA)	ClassActivityan yone (CAT)	ClassAttendance (AT)	TotalMarks (CA+CT+SA+CAT+AT)		
	ESC 103	Design Thinking & Idea Lab	35	NA	5	5	5	50	50	100

Course-CurriculumDetailing:

This course syllabus illustrates the expected learning achievements, both at the course and sessionlevels, which students are anticipated to accomplish through various modes of instruction includingClassroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL).
Asthecourseprogresses,studentsshouldshowcasetheirmasteryofSessionOutcomes(SOs),culminatingint heoverallachievementofCourseOutcomes(COs)uponthecourse'sconclusion.

ESC 103.1: Create empathy maps to visualize user attitudes and develop innovative products or services for a customer base usingideation techniques.

ApproximateHours

Item	AppX Hrs
Cl	00
LI	10
SW	2
SL	1
Total	13

SessionOutcomes (SOs)	**LaboratoryInstruction (LI)**	**ClassroomInstruction (CI)**	**SelfLearning (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. 1.4Brainstorming. 1.5 Innovative Triangle		**1.** Develop ability to express their views.

SW-1SuggestedSessionalWork(SW):

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

b. MiniProject:
   i. To create a prototypeof users need using Design Thinking Stages.

ESC 103.2: Identify the problems that fall under the purview of human centered design process for creative problem solving.

ApproximateHours

Item	AppX Hrs
CI	00
LI	10
SW	2
SL	1
Total	13

SessionOutcomes (SOs)	LaboratoryInstruction (LI)	ClassroomInstruction (CI)	SelfLearning (SL)
SO2.1 Differentiate between Design thinking and Creative thinking. SO2.2 Learn different types of creative thinking techniques for generating creative ideas. SO2.3 Be able to solve a problem using creativity.	**Unit-2.0: Introduction 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 Convergent and divergent thinking tools.

SW-2 SuggestedSessionalWork(SW):

a. **Assignments:**
   i. Presentation by students' team on their own creative work.

b. MiniProject:
   To create a prototype of a product using their own creativity.

ESC 103.3: Build simple prototypes for problems using gathered user requirements.

ApproximateHours

Item	AppX Hrs
Cl	00
LI	10
SW	2
SL	1
Total	13

SessionOutcomes (SOs)	LaboratoryInstruction (LI)	ClassroomInstruction (CI)	SelfLearning (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-3SuggestedSessionalWork(SW):

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

b. MiniProject:
   Make a prototype using stages of product design

BriefofHourssuggestedfortheCourseOutcome

CourseOutcomes	ClassLecture (Cl)	Lab Lecture (LI)	Sessional Work (SW)	SelfLearning (SL)	Total hour (Cl+LI+SW+SL)
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
2: Identify the problems that fall under the purview of human centered design process for creative problem solving.	00	10	2	1	13
3: Build simple prototypes for problems using gathered user requirements.	00	10	2	1	13
TotalHours	00	30	06	03	39

SuggestionforEndSemesterAssessment

SuggestedSpecificationTable(ForESA)

CO	UnitTitles	MarksDistribution			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

TheendofsemesterassessmentforDesign Thinking & Idea Labwillbeheldwithpractical examinationof50marks.

Note.DetailedAssessmentrubricneedtobepreparedbythecoursewiseteachersforabovetasks. Teacherscanalsodesigndifferenttasksasperrequirement,forendsemesterassessment.

SuggestedInstructional/ImplementationStrategies:

1. ImprovedLecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. RolePlay
6. Visittocement plant
7. Demonstration
8. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog, Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
9. Brainstorming

SuggestedLearningResources:

(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
4	Lecturenoteprovidedby Dept.ofMechanical Engineering,AKSUniversity,Satna.			

CurriculumDevelopmentTeam

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Cos, Pos and PSOs Mapping

Course Title: B.Tech Mechanical Engineering

Course Code: ESC 103

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	PSO3	PSO4
	Engineeringknowledge	Problemanalysis	Design/developmentofsolutions	Conductinvestigationsofcomplexproblems	Moderntoolusage	Theengineerandsociety	Environmentandsustainability:	Ethics	Individualandteamwork:	Communication:	Projectmanagementandfinance:	Life-longlearning	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation	Product Innovation and Development
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	2	3
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	2	3
CO3: Build simple prototypes for problems using gathered user requirements.	2	2	1	1	2	2	2	1	1	2	1	2	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)	Class room 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.		As mentioned in Page number 2to6
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.		
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,3	CO3: Build simple prototypes for problems using gathered user requirements.	SO3.1 SO3.2 SO3.3	Unit-3:Introduction to Prototype 3.1. 3.2, 3.3, 3.4, 3.5.		

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

A K S University

Faculty of Engineering and Technology

Department of Mechanical Engineering

Curriculum of B.Tech. (Mech. Engg.) Program

(Revised as on 01 August 2023)

Scheme of Studies:

Board of Study	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

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

Board of Study	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	Engineering Graphics & Design	15	20	5	5	5	50	50	100

Practical

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV + AT)		
BSC		Engineering 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)	LaboratoryInstruction (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. 1.3Construction of involute such as polygons and circle 1.4 Construction of Cycloid, Epi-cycloid, Hypo-cycloid 1.5 Construction of Simple 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. 1.2 Construction of ellipse by different methods; Normal and Tangent .Construction of parabola by different methods; Normal and Tangent. 1.3 Construction of Cycloid, Epi-cycloid, Hypo-cycloid. Construction of Simple Scale, Diagonal Scale & Scale of Chord	**1.** Construction of Involutes 2. Construction of Archimean Spiral

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Ellipes 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)	**LaboratoryInstruction (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 positions of 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.t.r. 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)	LaboratoryInstruction (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 of Plane & Solid** **Practice of Following** 3.1 Introduction ,Projection of plane 3.2 plane perpendicular to any one and parallel to other 3.3 plane perpendicular to any one and inclinedl to other 3.4 Introduction ,Projection of solid 3.5 Axis of solid perpendicular to any one and parallel to other 3.6 Axis of solid perpendicular to any one and inclinedl to other Axis of solid inclined to both the plane HP&VP	**Unit-3.0 Projection of Plane & Solid** 3.1Introduction of Projection Plane 3.2 Projection of Plane in different position 3.3Introduction of projection of Solid Projection of solid in different position	1.Preojection of Plane in different Position w.t.r. H.P. & V.P. 2. Projection of solid in different Position w.t.r. 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:
   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
CI	03
LI	12
SW	2
SL	2
Total	19

Session Outcomes (SOs)	LaboratoryInstruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Learn the techniques for sectioning right solids using both normal and inclined planes. SO4.2 solve practical problems related to the section of solids and planes. SO4.3 Learn the parallel line method and radial-line method for developing surfaces in right solids including how to create accurate representations.	**Unit-4.0 Development of Solid & Section of Solid** **Practice of Following** 4.1 Sectioning of Cone 4.2Sectioning of pyramid 4.3Sectioning of Cylinder & Prism 4.4 Development of cylinder and prism 4.5 Development and sectioning of pyramid 4.6 development and sectioning of cone	**Unit-4.0 Development of Solid & Section of Solid** 4.1Introduction of Sectioning and sectioning lines 4.2 Sectioning of Cone 4.3 Sectioning of pyram Sectioning of Cylinder & Prism Development of cylinder and prism Development and sectioning of pyramid development and sectioning 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)	LaboratoryInstruction (LI)	Class room Instruction (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. 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.	**Unit-5.0 Isometric projection and Auto CAD** **Practice of Following** 5.1 Introduction of isometric scale and vies 5.2 Isometric view of circle, cylinder and cone 5.3 Isometric view of prism 5.4 Isometric view of pyramid 5.5 Isometric view by othographic view 5.6 Drawing of different orthographic view of planes and solid by Auto CAD commands	**Unit-5.0 Isometric projection and Auto CAD** 5.1Introduction of Isometric Projection 5.2 Isometric view of circle, cylinder and cone 5.3 Isometric view of prism and pyramid Isometric view by othographic view Introduction of Auto CADDescription of Auto CAD commands Drawing of different orthographic view of planes and solid by Auto CAD commands	1. Draw Isometric view of plane and solid 2 Draw Isometric view of plane and solid by using Auto CAD command

SW-5 Suggested Sessional Work (SW):

a. Assignments:

Draw Isometric view of a cone resting centrally on a cube
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+Sl)
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 technique to represent line, surface or 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	09	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
5	Training Manual			
6	Training Manual			
7	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna .			

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Cos,POs and PSOs Mapping

Course Title: B. Tech Mechanical Engineering

Course Code : ESC 102

Course Title: Engineering Graphics and Design

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation	Product Innovation and Development
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	1	-
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	2	1
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	2	2
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	3	2
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	1	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	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	As mentionedin page number 2 to 6
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	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	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	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	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	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	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	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	

Semester-I

Course Title: Engineering Mathematics –I
Course Code: - BSC 102
Prerequisite: Students should review the fundamentals of calculus and basic knowadge of differential 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):
CO1- - 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

CO2- - 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.

CO3- - 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.

CO4- - 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

CO5- - 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.

AKS University
Faculty of Basic Science
Department of Mathematics
Curriculum & Syllabus of B.Tech program

Scheme of Studies:

Board of Study	**Course Code**	**Course Title**	**Scheme of studies (Hours/Week)**					**Total Credits (C)**
			CI	**LI**	**SW**	**SL**	**Total Study Hours (CI+LI+SW+SL)**	
Basic Science Course (BSC)	**BSC 102**	**Engineering 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

Board of Study	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	**BSC 102**	**Engineering 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 the overall achievement of Course Outcomes (COs) upon the course's conclusion.

CO1-- 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
CI	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 extrema. **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 **So1.4** Understand the hypothesis of L' Hospital's rule **So1.5** Understand the concept of curvature.	-	**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 1.11Expansion of functions by Taylor’s series for one variable 1.12 Tutorial- 2	**SL.1** Define the derivative of a function at a point using the limit definition.

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:

Oral presentation, Poster presentation, Power Point Presentation.

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

CO2- 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 understand the basic concepts of matrices, determinant, etc **SO2.2** Perform basic matrix operations, including addition, subtraction, and	-	**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	**SL.1** Explore more advanced topics, such as linear transformations, matrix norms, and applications in optimization and computer graphics

scalar multiplication **SO2.3** Understand the connection between matrix equations and systems of linear equations **SO2.4** Define and compute the determinant of a matrix **SO2.5** Understand numerical techniques		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	

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.

CO3- 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 involving multiple variables **SO3.4** Understand mixed partial derivatives and Clairaut's theorem **SO3.5** Identify critical points of multivariable 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 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	**SL.1** Apply Lagrange multipliers to solve constrained optimization problems

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.

CO4- 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

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.

CO5- 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
CI	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 antiderivatives of elementary functions **SO4.3** Understand the concept of a definite integral as a limit of Riemann sums **SO4.4** Interpret definite integrals as areas under curves **SO4.5** Understand and evaluate improper integrals.	-	**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 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	**SL.1** Apply calculus techniques to analyze curves defined in polar form

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Write the application of double and tripal integration.
ii. Write the Properties of Beta and Gamma functions.

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)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
CO1- 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
CO1- 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
CO1- 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	12	1	1	14

functions.				
CO1- BSC102.4 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**.**	12	1	1	14
CO1- BSC102.5 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.	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 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. 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

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

CourseOutcomes	ProgramOutcomes												ProgramSpecificOutcome			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PS04**
	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**	**Mechanical System Design and Analysis**	**Manufacturing Processes and Automation**	**Computational Modeling and Simulation**	**Product Innovation and Development**
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**	**2**	**1**
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**	**2**	**1**
CO 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	**2**	**2**	**1**	**1**	**2**	**2**	**2**	**1**	**1**	**2**	**1**	**2**	**2**	**1**	**1**	**3**

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	3	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.	2	2	2	2	1	1	3	1	1	1	2	2	3	3	1	2

Legend:1–Low,2–Medium,3–High

CourseCurriculumMap:

POs&PSOsNo.	COsNo.&Titles	SOsNo.	Laboratory Instruction (LI)	ClassroomInstruction(CI)	Self-Learning(SL)
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	**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

PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	**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-2Matrices 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
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	**CO 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.	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
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	**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
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	**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		Unit5:Integral Calculus. 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.95.10,5.11, 5.12	1,2,3

Semester-I

Course Title: Physics-01
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):
CO1- - 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.

CO2- - BSC 101.2
Apply concepts in interference and diffraction to solve relevant numerical problems and to relate to relevant engineering applications.

CO3- - 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.

CO4- - 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

CO5- - 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..

AKS University
Faculty of Engineering and Technology
Department of Mechanical Engineering
Curriculum & Syllabus of B.Tech program

Scheme of Studies:

Board of Study	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

Board of Study	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	**BSC 101**	**Physics -I**	15	20	5	5	5	50	50	100

Practical

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV + AT)		
BSC		**Physics –I 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.

CO1- - 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 substance in an electric field	1. Measuring the magnetic field for a straight conductor and on circular conductor loops 2. Measuring the magnetic field for a straight conductor and on circular conductor loops at small currents **3.** Measuring the magnetic field for a	**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 1.6 Dielectrics, Dielectric substance in an electric field,	**SL.1** Define Electric charge electric field intensities **SL.2** Define Quantization & conservation of charge

So1.4 Understand Biot Savart law & its application **So1.5** Understand the magnetic materials.	straight conductor and on Straight Wire -	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.

CO2- - 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 transmission diffraction	**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	**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 power of grating.	grating -	applications **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:

i. Write the application of Interference of light in daily life.
ii. Write the application of diffraction of light in daily life.
iii. Write a short note on Newton's rings with example.
iv. 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.

CO3- - 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

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	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	**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	**SL.1** Define Wave particle duality. **SL.2** Define operators in quantum mechanics.

principle with elementary proof and applications **SO3.5** To Understand Time-dependent and time independent Schrodinger equation for wave function.	diffracted by a crystal 3. Compton effect - evidence for particle nature of light -	3.8 Uncertainty principle with elementary proof and applications 3.9 operators 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.

CO4- - 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	1.To draw the characteristics curve of p-n junction. 2.To draw the characteristics curve of zener diode 3.Study the temperature	**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	**SL.1** Define Free electron theory of metals **SL.2** Define semiconductors and it’s classification.

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	dependence of resistivity of a semiconductor (Four probe method) and to determine band gap of experimental material (Ge). -	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	

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.

CO5- - 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	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	**SL.1** Define Absorption, Stimulated and Spontaneous emission, coherence, pumping, population Inversion. **SL.2** Define Principle &

matter radiation 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	radiation interaction and A and B coefficients **5.6** different types of lasers: gas laser (He-Ne), **5.7** different types of lasers: gas laser (He-Ne), **5.8** Solid-State laser (Ruby & Nd-YAG) **5.9** solid-state laser (Ruby & Nd-YAG) **5.10** applications of lasers in science, engineering and medicine. **5.11** applications of lasers in science **5.12** applications of lasers in engineering and medicine.	properties of laser beam.

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)
CO1- - 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
CO2- - 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
CO3- - 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
CO4- - BSC 101.4 Recall the basic concepts of crystal structure and apply them in solving	12	6	1	2	21

numerical problems based on them in relating to applications for determination of crystal structure					
CO5- - 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.	2^{nd} 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

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Cos, POs and PSOs Mapping

Programme Title: B. Tech. Mechanical Engineering
Course Code: BSC101
Course Title: Physics-I

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	PSO3	PSO4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation	Product Innovation and Development
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	2	1	1	2	2	1	1	2	2	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	2	2
CO3: Learn the basic concepts of dual nature of matter and wave packet and apply them to analyze various relevant	3	3	2	1	1	2	2	2	2	1	2	3	2	2	1	2

phenomenon and to 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**	**3**	**2**	**3**	**2**	**1**	**3**	**2**	**1**	**2**	**2**	**2**	**3**	**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	**2**	**3**	**3**	**1**	**2**	**3**	**2**	**3**	**1**	**2**	**2**	**2**	**3**	**2**	**2**	**2**

Legend:1–Low,2–Medium, 3–High

CourseCurriculumMap

POs &PSOsNo.	**COsNo.&Titles**	**SOsNo.**	**LaboratoryInstruction (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 & Magneto statics 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	123	**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

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:

VAC101.1: Examine critically the 17 newly minted UN Sustainable Development Goals and understand the historical evolution, key theories, and concepts of sustainable development.
VAC101.2: Identify and apply methods for assessing the achievement of sustainable development and discover the science, technology, economics, and politics underlying the concepts of sustainability.
VAC101.3: Understand the implications of overuse of resources, population growth and economic growth and sustainabilityand explore the challenges the society faces in making transition to renewable resource use.
VAC101.4: 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.
VAC101.5: 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.

Scheme of Studies:

Board ofStudy	CourseCode	CourseTitle	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core VAC	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 projectetc.),
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

Board of Study	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)		
VAC	HSMC08	Sustainable Development Goal	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.

VAC101.1: 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 and Importance of SDGs **SO1.3**Understand the historical evolution of SDGs **SO1.4**Gain knowledge of SDGs Different goals and their importance **SO1.**5 Explain the Challenges & strategies of attaining SDGs in countries.		**Unit-1.0 Introduction to Sustainable Development** 1.1 Need and Importance of Sustainable Development 1.2 Historical & Policy perspectives of Sustainable Development 1.3 Sustainable Development: World and India Perspective 1.4 Introduction to 17 SDGs 1.5 Specific learning objectives for different SDGs 1.6 Challenges & strategies of attaining SDGs in developed and developing nations	Different SDG goals details and its importance

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.

VAC101.2: : 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 ExplainSustainable Development **SO2.2** Understand the NEP-2020 and SDG **SO2.3**Discuss higher Education role 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)

VAC101.3: 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 economic issues in the context of the global sustainable development debate. **SO3.2**Outline of health, hygiene and water sanitation issues. **SO3.3** Discuss the renewable energy resources and its importance in present scenario **SO3.4** Explain the importance of sustainable production and consumption **SO3.**5 Explain the problems and solution in rural and urban areas.		**Unit-3.0 Understanding the SDGs** 3.1 Circular economy (basic model of reuse, recycle, and reduce) 3.2 Rural & urban Problems & Challenges 3.3 Sustainable production and consumption 3.4 Renewable energy 3.5 Health & Hygiene,water , sanitation& water management 3.6 Waste Management	1. Water treatment and manageme nt practices.

SW-1 Suggested Sessional Work (SW):

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.

VAC101.4: 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.

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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 impacts of 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 of sustainable production and consumption **SO4.**5 Climate change is disrupting national economies and affecting lives and livelihoods, especially for the most vulnerable 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 Future Climate Regimes 4.4 The consequences: crop failure 4.5 Solutions technology and lifestyle changes 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

b. Other Activities (Specify):

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VAC101.5: 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 programme and processes.

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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 the concept of sustainability and the global initiatives in this direction **SO4.2**Understandrole of Corporations and Ecological Sustainability**.** **SO4.3**Explain role of CSR in Sustainability. **SO4.4**Understand the SD challenge for companies, their responsibility and their potentials for action **SO4.5**Discuss the role of world government for world justice and peace		**Unit-5.0 Sustainable Business Practices:** 5.1 Corporate Social Responsibility 5.2 Sustainable products and services 5.3 Business and Environment 5.4 Corporations and Ecological Sustainability 5.5 Life Cycle Assessment: • LCA Overview and Application 5.6 World peace and justice: • United nations goals for peace and justice • World Government for peace	Local to the Global: Can Sustainable Development Work

SW-1 Suggested Sessional Work (SW):

a. Assignments:

Consumption Patterns and Lifestyles, Company Perspectives for Environmental Sustainability, An Introduction to Economic Growth

b. Other Activities (Specify):

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (SI)	Total hour (Cl+SW+Sl)
VAC101.1: 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
VAC101.2: Identify and apply methods for assessing the achievement of sustainable development and discover the science, technology, economics, and politics underlying the concepts of sustainability.	6	1	1	8
VAC101.3: 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
VAC101.4: 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.	6	1	1	8
VAC101.5: 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.	6	1	1	8
Total Hours	30	5	5	40

Suggestion for End Semester Assessment

SuggestedSpecificationTable(ForESA)

CO	UnitTitles	MarksDistribution			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 for Sustainability	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 A: Analyse E:Evaluate C:Create

Theendofsemesterassessmentfor Sustainable Development Goals will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wiseteachers for above tasks. Teachers can also design different tasks as per requirement, for endsemesterassessment.

SuggestedInstructional/ImplementationStrategies:

1. ImprovedLecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. RolePlay
6. Visit to industry, water treatment plant
7. Demonstration
8. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
9. Brainstorming

SuggestedLearningResources:

(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: Linking Economy, Society, Environment	Tracey Strange and Anne Bayley		
5	Management Of Resources For Sustainable Devpt	Sushma Goyal	The Orient Blackswan	2016
6	Energy, Environment and Sustainable Development: Issues and Policies	S. Ramaswamy Sathis G. Kumar	Regal Publications	2009
7	The New Map: Energy, Climate, and the Clash of Nations	Daniel Yergin	Penguin Press	September 2015
8	Contributions of Education for Sustainable Development (ESD) to Quality 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 An Indian Perspective,	Hazra, Somnath., Bhukta, Anindya	Springer Switzerland	2020
12	Environmental Ecology,Biodiversity and 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			

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COs, POs and PSOs Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]
Course Code : VAC-101
Course Title: Sustainable Development Goals (SDGs

CourseOutcomes	ProgramOutcomes												ProgramSpecificOutcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation	Product Innovation and Development
CO1. Need and Importance of Sustainable Development	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO2. Education for Sustainable Development (ESD):Tools, Systems, and Innovation for Sustainability	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3.Discuss the sustainable production and consumption	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO4. How Climate Change may be Threat to Sustainable Development	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO5. Role of Corporations and Ecological Sustainability	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs&PSOsNo.	COsNo.&Titles	SOsNo.	LaboratoryInstruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO1,2,3,4,5,6,7,8 ,9,10,11,12 PSO1,2,3,4,5	CO1. Need and Importance of Sustainable Development	SO1.1 SO1.2 SO1.3 SO1.4		Unit 1: Introduction to Sustainable Development 1.1,1.2,1.3,1.4,1.5,1.6	Asmentionedin pagenumber _to_
PO1,2,3,4,5,6,7,8 ,9,10,11,12 PSO1,2,3,4,5	CO2. Education for Sustainable Development (ESD):Tools, Systems, and Innovation for Sustainability	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2Special focus on SDG 4-Quality Education and Lifelong Learning: 2.1,2.2,2.3,2.4,2.5,2.6	
PO1,2,3,4,5,6,7,8 ,9,10,11,12 PSO1,2,3,4,5	CO3.Discuss the sustainable production and consumption	SO3.1 SO3.2 SO3.3 SO3.4		Unit-3.0 Understanding the SDGs 3.1,3.2,3.3,3.4,3.5,3.6	
PO1,2,3,4,5,6,7,8 ,9,10,11,12 PSO1,2,3,4,5	CO4. How Climate Change may be Threat to Sustainable Development	SO4.1 SO4.2 SO4.3 SO4.4		Unit-4.0 Climate Change, Energy and Sustainable Development 4.1,4.2,4.3,4.4,4.5,4.6	
PO1,2,3,4,5,6,7,8 ,9,10,11,12 PSO1,2,3,4,5	CO5. Role of Corporations and Ecological Sustainability	SO5.1 SO5.2 SO5.3 SO5.4		Unit-5.0 Sustainable Business Practices 5.1,5.2,5.3,5.4,5.5,5.6	

Course Code: BSC-103

Course Title: Engineering Chemistry

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

Rationale: The students studying engineering chemistry should possessfoundational understanding about basic mathematics, differentconcentration terms and valence shell electron pair repulsion theory tounderstandthebasicprincipleofchromatographyandspectroscopic analysis.

CourseOutcomes:

Afterthecompletionofthiscourse,thelearnerwillableto

BSC-103.1 ApplyVSEPRtheorytopredictthethree-dimensionalshapesofmolecules.

BSC-103.2: Describetheconceptofsymmetry,chiralityandopticalactivityandsynthesizechiraldrugmolecule.

BSC103.3: ExplainandapplytheconceptofIntermolecularforces,Hydrogenbond,andtransitionmetalcomplexes.

BSC103.4 Predicttheconceptofthermodynamics,freeenergy&entropyandapplyNernstequation,waterchemistry as well asexplainconceptofacid-base,metallurgy,Emf cellandcorrosion.

BSC-103.5: Collectively aim to equip students with a comprehensive understanding of thetheoretical principles, practical methodologies, and diverse applications of various spectroscopictechniques.

SchemeofStudies:

Board ofStudy	Course Code	CourseTitle	Schemeofstudies(Hours/Week)					TotalCredits(C)
			CI	LI	SW	SL	Total StudyHours (CI+LI+SW+SL)	
Program Core(PCC)	BSC103	Engineering Chemistry	3	2	2	1	8	4

Legend:

CI: ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.,Lecture(L)andTutorial(T)andothers),

LI: LaboratoryInstruction (Includes Practicalperformances inlaboratoryworkshop,field orother locationsusing differentinstructional strategies)

SW: SessionalWork (includesassignment,seminar,miniprojected.),

SL: Self-Learning,

C:Credits.

Note: SW&SLhastobeplannedandperformedunderthecontinuousguidanceandfeedbackteachers ensureoutcomeofLearning.

SchemeofAssessment:

Theory

Board ofStudy	CouseCode	CourseTitle	SchemeofAssessment(Marks)							
			ProgressiveAssessment(PRA)						EndSemester Assessment (ESA)	Total Marks(PRA+ESA)
			Class/HomeAssignment 5number 3markseach	Class Test2 (2 bestoutof 3) 10 marks each(CT)	Seminar one(SA)	Class Activityany one(CAT)	ClassAttendance	Total Marks(CA+CT+SA+CAT		
BS	Bsc103	Engineering Chemistry	15	20	5	5	5	50	50	100

Practical

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV + AT)		
BSC	Bsc103	Engineering Chemistry lab	35	10	5	50	50	100

Course-CurriculumDetailing:

This course syllabus illustrates the expected learning achievements, both at the course and sessionlevels, which students are anticipated to accomplish through various modes of instruction includingClassroomInstruction(CI),LaboratoryInstruction(LI),SessionalWork(SW),andSelfLearning(SL).Asthecourseprogresses,studentsshouldshowcasetheirmasteryofSessionOutcomes(SOs),culminatingin theoverallachievementof CourseOutcomes(COs)uponthecourse's conclusion.

BSC-103.1ApplyVSEPRtheorytopredictthethree-dimensionalshapesofmolecules.

AKS University

Faculty of Engineering and Technology

Department of Mechanical l Engineering

Curriculum of B.Tech.(Mechanical Engineering) Program

ApproximateHours

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

Session Outcomes (SOs)	Laboratory Instruction(LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.Describetheclassification of differenttypesoforbitorbitalsSO1.2Discussthefundamentalconceptofwavefunction and probabilitydistribution curveSO1.3Explain andapply AtomicSpectroscopy: -Energiesofatomicorbital's SO1.4 Applyconcept of VSEPRin the determinationofgeometry of various molecules.SO1.5RestatemolecularenergyleveldiagramofN_2F_2andO_2molecules.	LI1.1.Determinationofspecificdensity ofgivenliquid LI.1.2. Determinationofviscosityofgivenliquid LI.1.3 Paperchromatography,Thin layer chromatography.	Unit 1: Atomic andMolecularStructure& Periodicproperties **1.1.** Introductionoforbit, orbitalsandelectronic configuration **1.2.** Schrodingerwaveequationanditsderivation. **1.3.** Hybridizationandtypes of hybridization.Intermixing oforbitals **1.4.** VSEPRtheory,bond pairand lonepairrepulsion, **1.5.** 1.5Determinationofgeometryofthemolecules **1.6.** Molecularorbitaltheory, **1.7.** Molecularenergyleveldiagramandbondorderforhomoandheteroatomicmolecules **1.8.** Periodicity ofatomicsizeandionizationenergy **1.9.** Electron gainenthalpyandtypesofelectrongain enthalpy	1. History of development of periodictable 2.Electronegativityandits application

SW-1SuggestedSessionalWork(SW):

a. **Assignments:**
   Applications of molecular orbital theory for the determination of bond order and magneticbehaviour.
b. **MiniProject:**
   Hybridizationanditsapplication.
c. **OtherActivities(Specify):**
   Writeanessayondifferenttypeofchemical bond.

BSC-103.2: Describetheconceptofsymmetry,chiralityandopticalactivityandsynthesizechiraldrugmolecule.

ApproximateHours

Item	AppXHrs.
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 understand theconcept ofrepresentations of 3dimensionalstructures SO2.2 explain structuralisomers andstereoisomers SO2.3 describesymmetry, chirality andoptical activity SO2.4 explain andidentify different typesof reactions withmechanisms SO2.5 apply theconcept of mechanismstosynthesize drug molecules	LI.2.1.To Synthesizedrug moleculesanddetermineitspercentageyield LI.2.2.To determine the acidvalueorsaponificationvalue of oil/fat LI2.3.To determinepartitioncoefficientofaorganicsubstancebetween two immiscibleliquids.	**UNIT 2:** Stereochemistry,Organic reactions and synthesisof a drugmolecule 2.1 Representations of 3dimensionalstructures 2.2 Structural isomers andstereoisomers 2.3 Symmetry and chirality,optical activity and absoluteconfigurations 2.4 enantiomers,diastereomers 2.5 Isomerism in transitional metalcompounds 2.6 Introduction to reactionsinvolvingsubstitution reaction 2.7 Addition, elimination,oxidation,reductionreaction 2.8 cyclizationandringopenings 2.9 Synthesis of a commonly useddrugmolecule	1. Planeof polarized light 2. Types ofsymmetry

SW-2SuggestedSessionalWork(SW):

Assignments: ConformationalIsomerismandconformationalanalysis

BSC-103.3:understandtheconceptofIntermolecularforces,Hydrogenbond,Transitionmetalcomplexes byapplying thisconcept

ApproximateHours

Item	AppXHrs.
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 force,vanderWaalsinteraction SO2.2explain Hydrogen bondandtypesofhydrogenbondSO2.3Coordinationcompounds SO2.4describeMetalligandbondingbyVBT SO2.5 explain MetalligandbondingbyCFT	LI3.1.Synthesisainorganicmetalcomplex LI3.2.Determinethetwoacid andtwobasics radical LI.2.3.Determinationofchloridecontentof water	**Unit-3:IntermolecularforcesandTransitionmetal complexes** **3.1.** Ionic, dipolar, Londondispersionforce **3.2.** VanderWaalsinteractions **3.3.** Hydrogen bond, types ofhydrogen bond. **3.4.** Coordinationcompounds **3.5.** MetalligandbondingbyVBT **3.6.** MetalligandbondingbyCFT **3.7.** Theenergyleveldiagramsfortransition metal ions and theirmagneticproperties. **3.8.** Theenergyleveldiagramsfortransition metal ions and theirmagneticproperties **3.9.** Theenergyleveldiagramsfortransition metal ions and theirmagneticproperties	1. Coordination compoundsIUPACname andWernertheory 2. The energyleveldiagramsfortransitionmetal ions and their magneticproperties

SW-3SuggestedSessionalWork(SW):

2.2Assignments:VBTtheory,CFTtheory,Theenergyleveldiagramsfortransitionmetalionsandtheirmagnetic properties

MiniProject:applicationsoftransitionmetalcomplexes

OtherActivities(Specify):

BSC-

103.4 Predicttheconceptofthermodynamics,freeenergy&entropyandapplyNernstequation,waterchemistry aswellasexplainconceptof acid-base, metallurgy,Emfcellandcorrosion.

ApproximateHours

Activity	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 conceptof free energy, Freeenergy, EnthalpyEntropy and types ofdifferentthermodynamicsystem **SO4.2**Discuss thefundamentalconcept of	LI.4.1. Determination of hardness ofwater LI.4.2. Determination of alkalinityof water	**Unit4:Useoffreeenergyinchemical equilibrium4.1**Introductionenergy,EnthalpyEntropy, system andsurroundings **4.2**Cellnotationofcell,Nernstequationandits application	**1**-derivation ofNernstequation.
cell representationstandard EMF of cellSO4.3 Explain andapply different types ofconcepts used insoftening of water andpurification of waterSO4.4 Understand andapply concept ofcorrosion for thedevelopment of greencorrosion inhibitorsSO4.5 Understanddifferent acid-baseconcepts, ionic andsolubilityproduct of salts	LI.4.3. Chemicalanalysis of asalt.	**4.3** Waterchemistry,Hardnessof water, Temporary and permanenthardness **4.4** Watersofteningmethods **4.5** Introduction of Corrosion,Mechanismof corrosion **4.6** Factorsaffectingrateofcorrosion **4.7** Variousacid-baseconcepts,Arrheniusconcept, **4.8** Lewisacid-baseconcept,Bronsted Lowry concept **4.9** Briefideaaboutionicandsolubilityequilibria	

SW-4SuggestedSessionalWork(SW):

A.Assignments:

Applicationsofgreencorrosioninhibitors

b.Mini Project:

Analysisofwaterqualityparameters.

c.OtherActivities(Specify):

Writeanessayonacid-baseconcepts,ionicandsolubilityproductof salts.

BSC-103.5: Collectively aim to equip students with a comprehensive understanding of thetheoretical principles, practical methodologies, and diverse applications of various spectroscopictechniques.

ApproximateHours

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

Session Outcomes(SOs)	LaboratoryInstruction (LI)	Class room Instruction(CI)	Self-Learning(SL)
SO5.1 UnderstandIdentification andclassificationofdifferent typesof EMR and vibrational modes inmolecules.	LI.5.1. Verification ofBeer-Lambertlaw LI5.2. Determination	**Unit 5: Spectroscopictechniquesandapplications** **5.1** Introduction of spectroscopy,discovery, properties and types ofelectromagneticradiation.	1. ApplicationsNuclear magneticresonance andmagnetic resonanceimaging

SO5.2 Understand thefundamental principles ofvibrational and rotationalspectroscopy, includingthe interaction of lightwith molecular vibrations,the concept of infrared(IR) **SO5.3** Explain and applyAtomic Spectroscopy: -Energies of atomicorbital's **SO5.4** Understand andapply concept of NMR,Nuclear spin, nuclearresonance**.** **SO5.5** Understandintroduction of X-rayDiffractiondeterminat ioncrystallographicstruct ure ofmaterials.	of absorptionma ximum of agiven organiccompo und. LI.5.3. Determination of cell constantandco nductance ofsolutions.	**5.2** Classification of differenttypes of vibrational modes inmolecules (stretching, bending,torsional,etc.).IRactivi ty. **5.3** Energies of atomic orbitalsand electronic transition, frankCondonprinciple. **5.4** Introductionof NMR, **5.5.** Nuclear spin, nuclearresonance **5.6** Principle and instrumentationof NMR **5.7.** Shieldingand deshieldingofmagneticnuclei. **5.8.** surfacecharacterization techniques **5.9.** Diffractionandscattering	

SW-5SuggestedSessionalWork(SW):

A.Assignments:

ApplicationsNuclearmagneticresonanceandmagneticresonanceimaging

b.Mini Project:

Fluorescenceandits applicationsinmedicine

c.OtherActivities(Specify):

Writeanessayonsurfacecharacterizationtechniques.Diffractionandscattering.

BriefofHourssuggestedfortheCourseOutcome

CourseOutcomes	Class Lecture (Cl)	Lab Instruction (LI)	Sessional Work(SW)	Self-Learning (SL)	Total hour(Cl+Li+SW+Sl)
BSC-103.1: ApplyVSEPRtheorytopredictthethree-dimensional shapesofmolecules.	09	06	02	01	18
BSC-103.2: Describe the conceptof symmetry, chirality and opticalactivityandsynthesizechiraldrugmolecule	09	06	02	01	18
BSC-103.3: Explain and apply theconceptofIntermolecularforces, Hydrogenbond,andtransitionmetalcomplexes	09	06	02	01	18
BSC-103.4: Predicttheconceptofthermodynamics,freeenergy&entropy and apply Nernst equation,waterchemistryaswellasexplain conceptofacid-base,metallurgy,Emfcelland corrosion.	09	06	02	01	18
BSC-103.5:Collectivelyaimtoequipstudentswithacomprehensiveunderstandingofthe theoretical principles, practicalmethodologies,anddiverse applications of various spectroscopictechniques.	09	06	02	01	18
TotalHours	45	30	10	05	90

SuggestionforEndSemesterAssessment

SuggestedSpecificationTable(ForESA)

CO	UnitTitles	MarksDistribution			Total Marks
		R	U	A	
CO-1	**Atomic and Molecular Structure &Periodicproperties**	03	01	01	05
CO-2	**Stereochemistry, Organic reactions andsynthesisof adrugmolecule**	02	06	02	10
CO-3	**IntermolecularforcesandTransition metalcomplexes**	03	07	05	15
CO-4	**Use of free energy in chemicalequilibrium**	-	10	05	15
CO-5	**Spectroscopic techniques andapplications**	03	02	-	05
Total		11	26	13	50

The end of semester assessment for Organic Chemistry I will be held with writtenexamination of 50marks

Note.DetailedAssessmentrubricneedtobepreparedbythecoursewiseteachersforabovetasks.Teacherscan alsodesigndifferenttasksasperrequirement,forendsemesterassessment.

SuggestedInstructional/ImplementationStrategies:

1. ImprovedLecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. RolePlay
6. VisittoNCL,CSIRlaboratories
7. Demonstration
8. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,WhatsApp,Mobile,Online sources)
9. Brainstorming

SuggestedLearningResources:

(a) Books:

S. No.	Title	Author	Publisher	Edition &Year
1	A textbook of engineeringchemistry	ShyamalaSundara	S. Chand	Edition2008
2	ATextbook ofEngineering Chemistry	Shashi Chawla|	Dhanpat RaiPrakashan	Edition2020
3	ATextbook ofEngineering Chemistry	PC Jain andMonikaJain	Dhanpat RaiPrakashan	Edition2018

SuggestedWebSources:

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

ModeofDelivery:Lecture,demonstration,E-tutoring,discussion,assignments,quizzes,casestudy,powerpoint;

LMS/ICTTools: DigitalClassrooms,DLMS,ZOOM,G-Suite,MSPower-Point,OnlineResources.

Program: B.Tech. Mechanical Engineering

Course Title: Engineering Chemistry

Course Code:BSC103

CourseOutcomes	ProgramOutcomes												ProgramSpecificOutcome			
	PO 1	PO 2	PO3	PO 1	PO 2	PO6	PO 1	PO 2	PO9	PO 1	PO 2	PO12	PSO1	PSO2	PSO3	PSO 4
	Engineeringknowledge	Problemanalysis	Design/developmentofsolutions	Conductstudiesofdifficultproblems	Utilizationofmoderntools	Engineersandsociety	Environmentandsustainability	Ethics	Individualandteam work	Communication	Projectmanagementandfinance	Life-longlearning	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation	Product Innovation and Development
CO1: Apply VSEPR theory to predictthethree-dimensionalshapesofmolecules.	3	1	2	2	3	2	3	2	2	1	3	2	2	3	1	2
CO2Describetheconceptofsymmetry,chiralityandopticalactivityandsynthesizechiraldrugmolecule.	2	1	2	2	1	2	3	2	1	1	2	2	2	3	1	2
CO3 Explain and apply the concept ofIntermolecularforces,Hydrogenbond,andtransitionmetalcomplexes.	2	2	1	1	1	2	2	2	1	2	1	2	1	3	1	2
CO4:Predicttheconceptofthermodynamics,freeenergy&entropyandapplyNernstequation,waterchemistryaswellasexplainconceptofacid-base,metallurgy,Emf cellandcorrosion.	2	2	2	2	3	2	3	2	2	1	2	3	3	3	2	2
CO5Collectivelyaimtoequipstudentswithacomprehensiveunderstandingofthetheoreticalprinciples,practicalmethodologies,anddiverseapplicationsofvariousspectroscopictechniques	2	-	-	1	1	3	3	3	1	1	2	2	3	3	2	2

Legend:1–Low,2–Medium,3–High

CourseCurriculumMap:

POs &PSOsNo.	**Cos.No.&Titles**	**SOsNo.**	**Laboratoryinstruction (LI)**	**ClassroomInstruction(CI)**	**Self-Learning(SL)**
PO1, 2,3,4, 5,6, 7,8,9, 10,11 ,12 PSO 1,2,3 , 4	**CO1:**Apply VSEPR theory to predictthe three-dimensional shapes ofmolecules.	SO1.1SO 1.2SO1.3, SO1.4 SO1.5	LI.1.1, LI.1 .2,L I.1. 3	**Unit-1.0 Atomic and MolecularStructure & Periodic properties**1.1,1. 2,1.3,1.4,1.5,1.6, 1.7,1.8,1.9	History of development ofperiodictable 2-Eleconegativity and itsapplication
PO1, 2,3,4 ,5,6 7,8,9, 10,11 ,12 PSO 1,2,3 , 4	**CO2:** Describe the concept ofsymmetry, chirality and optical activityandsynthesizechiral drugmolecule.	SO2.1SO 2.2SO2.3 SO2.4SO 2.5	LI.2.1, LI.2 .2,L I.2. 3	Unit-2 **Stereochemistry , Organicreactions and synthesis of a drugmolecule** 2.1,2.2,2.3,2.4,2. 5,2.6, 2.7,2.8,2.9	Resonance RamanSpectroscopy,coherentanti-stokesRamanSpectroscopy(CARS).
PO1, 2,3,4 ,5,6 7,8,9, 10,11 ,12 PSO	**CO3** Explain and apply the concept ofIntermolecular forces, Hydrogen bond,andtransitionmetal complexes.	SO3.1SO 3.2SO3.3 SO3.4SO 3.5	LI.3 .1,L I.3. 2 LI.3.3	Unit- 3**Intermolecular forcesandTransition metal complexes**3.1,3. 2,3.3,3.4,3.5,3.6, 3.7,3.8,3.9	NatureofM-Lbond,coordinationnumber,structureanddetectionofoxidationstate.

1,2,3 , 4					
PO1, 2,3,4 ,5,6 7,8,9, 10,11 ,12 PSO 1,2,3 , 4	**CO 4** Predict the concept ofthermodynamics, free energy & entropyand apply Nernst equation, waterchemistry as well as explain concept ofacid-base,metallurgy, Emfcelland corrosion	SO4.1SO 4.2SO4.3 SO4.4 SO4.5	LI.4.1, LI.4 .2,L I.4. 3	Unit-4: **Useoffreeenergyin** chemical**equilibrium** 4.1,4.2,4.3,4.4,4.5,4.6,4.7, 4.8,4.9	Quadrupolenuclei,quadrupolem oments, electric field gradient,couplingconstantsplitti ng.Applications
PO1, 2,3,4 ,5,6 7,8,9, 10,11 ,12 PSO 1,2,3 , 4	**CO5**Collectivelyaimt oequipstudentswith a comprehensive understanding ofthe theoretical principles, practicalmethodologi es, and diverse applicationsofvarious spectroscopictechniq ues.	SO5.1SO 5.2SO5.3 SO5.4SO 5.5	LI.1.1, LI.1 .2,L I.1. 3	**Unit5:Spectroscopic**tech niques **andapplications** 5.1,5.2,5.3,5.4,5.5,5.6,5.7	Lowenergyelectrondiffractionan dstructure of surfaces.

Semester-II

CourseCode: HSMC01

CourseTitle: 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 shapingindividual'spersonalityandcareer.Italsobooststhe confidenceandpreparesthemtofacetheaudience fearlessly.

CourseOutcomes:

Aftercompletionofthecourse:

1) Studentswillbeabletospeakconfidentlyinpublicasallthetopicschosenemphasisonimproving speaking skills and developing self confidence amongst them.
2) StudentswillbeabletointeractproperlywithimprovedLeadershipSkills,ProblemSolvingSkills, SocialskillsandCommunicationSkills.Studentswillalsobeable tounderstandthe Importance of Team Work.
3) Studentswillbe abletocommunicateeffectivelyinHindiandEnglishlanguageswithouthindrances.
4) Studentswillbeabletoconveytheirmessagesaccuratelybyunderstandingthesignificanceof grammar as it plays a vital role in improving speaking and writing skills.
5) TheUnderstandingofIndianCultureandEnglishLanguagewillbedevelopedthroughthestudyof Dramas and Poems written by Indian Writers.

Schemeof Studies:

Boardof Study	Course Code	CourseTitle	Schemeofstudies(Hours/Week)					Total Credits(C)
			Cl	LI	SW	SL	Total Study Hours(CI+LI+SW+SL)	
Program Core (PCC)	HSMC01	Communication Skills	3	0	1	1	5	3

Legend: **CI**:ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial

(T) andothers),

LI:LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop,fieldorotherlocations using different instructional strategies)

SW:SessionalWork(includesassignment,seminar,miniprojectetc.),

SL:SelfLearning,

C: Credits.

Note: SW &SL hasto be planned and performed underthe continuous guidance and feedback ofteacher to ensure outcome of Learning.

SchemeofAssessment:

Theory

Boardof Study	Couse Code	CourseTitle	**SchemeofAssessment(Marks)**							
			ProgressiveAssessment(PRA)						**EndSemesterAssessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5number 3 markseach(CA)	ClassTest 2 (2bestout Of3) 10markseach(CT)	Seminarone**(Presentation)** (SA)	ClassActivityanyone (CAT)	ClassAttendance (AT)	TotalMarks (CA+CT+SA+CAT+AT)		
PCC	HSMC01	CommunicationSkills	15	20	5	5	5	50	50	100

Course-CurriculumDetailing:

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 thecourseprogresses,studentsshouldshowcasetheirmasteryofSessionOutcomes(SOs),culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

CO101.1: 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. .

ApproximateHours

Item	AppXHrs
CI	9
LI	0
SW	1
SL	1
Total	11

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**ClassroomInstruction (CI)**	**Self Learning (SL)**
SO1.1Studentswillbeableto introduce themselves SO1.2Understandtheconceptof Oral Presentation SO1.3Studentswillbeabletodress and present effectively SO1.4Understandtheimportanceof Body Language SO1.5 Students will be able to influence mass through skit and dramas.		**Unit 1.Self-grooming, Basic Etiquettes and Presentation Skill** 1.1Self-introduction Practice Sessions OralPresentation Characteristicsofpresentation. Presentation topics (The importanceofEducation,The importanceofEnglishinToday's WorldandNecessityofuniforms in a college) Professionaldressingand grooming etiquettes.	1) Preparea presentation onthegiven topics. 2) Prepare a playonthe given topics.

		BodyLanguagetipsand techniques. Role play sessions on followingtopics:Classroom interaction, Hospital Scene and Scene at Railway station PerformancebyStudents	

CO101.2: Students willbe ableto interact properlywith improved Leadership Skills, ProblemSolving Skills,SocialskillsandCommunicationSkills.Studentswillalsobeabletounderstandthelmportance of Team Work.

ApproximateHours

Item	AppXHrs
Cl	9
LI	0
SW	1
SL	1
Total	11

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**ClassroomInstruction (CI)**	**Self Learning (SL)**
SO2.1 Understandthetechniquesof Group Discussion **SO2.2**Understandtheconceptof Debate **O2.3**Studentswillbeabletodesign a professional resume and crack interview **SO2.4**Explaintheconceptofhowto ace in an interview.	.	UNIT2–Confidencebuilding skills, Interview Skills and Resume Writing 2.1-GroupDiscussion Do'sandDontsofGD Group Discussion sessionson impact ofCovid 19 on mental health,impactofsocialmediaon lives, pros and cons oftechnology DifferencebetweenGDand Debate. Debate Do'sandDon'tsofDebate Debate topics on Should the Use of Plastic Be Banned?, Should Parents Decide Which Career Their Children Will Pursue?,IsArtificialIntelligence Useful or Dangerous? Interviewsandtheir Kinds MockInterviewSession Resume Writing.	Preparedebateon given topics PrepareaResume

CO101.3: Studentswillbeabletocommunicateeffectivelyin HindiandEnglishlanguageswithout hindrances.

ApproximateHours

Item	AppXHrs
Cl	10
LI	0
SW	1
SL	1
Total	12

SessionOutcomes (SOs)	Laboratory Instruction (LI)	ClassroomInstruction (CI)	Self Learning (SL)
SO3.1 Studentswillbeableto organise and prepare speeches. **SO3.2**Studentswillbeableto think and speak instantaneously. **SO3.3**Tomakethemunderstand the inquiry procedure at public places. **SO3.4** To enable them to communicateeffectively through phones.	.	**Unit-3 :Public Speaking Skills&Conversational Skills** Speech TypesofSpeech Speech /Anchoring on (National Science Day, ValedictorySpeech,Patriotic speech). Performanceintheclass. Extempore Extempore Topics on (Pros andConsofOnlineteaching, Environment Conservation and Education of a Girl Child) PracticeSession Conversational Topics (Inquiryatbank,Airport, Station and Hospitals). Telephonic Conversation (Describing about Your College Day to Your Parents from Hostel, Talking with Customer Care Executive of AnyE-Commercecompany). 3.10 Revision	1. Prepare a speechon the following topics. 2. Prepare on the following conversational topics.

CO101.4: Studentswillbeabletoconveytheirmessagesaccuratelybyunderstandingthesignificanceof grammar as it plays a vital role in improving speaking and writing skills.

ApproximateHours

Item	AppXHrs
Cl	9
LI	0
SW	1
SL	1
Total	11

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**ClassroomInstruction (CI)**	**Self Learning (SL)**
SO4.1 Understandingaboutthe use of Prepositions. **SO4.2**Studentswillbeableto understand the usage of Tenses **SO4.3**Undesrtandtheconceptof Active and Passive Voice **SO4.4**Tounderstandtheusage of Modals		Unit-4:FunctionalGrammar and Vocabulary Building Prepositions(Place,Time and Direction) MCQbasedQuestionson Prepositions. Gap filling using prepositions. Tenses PresentTense PastTense FutureTense Voice(Activeand Passive) Modals.	Prepare the structure of Tenses and Active Passive. Prepare 250 vocabularies.

CO101.5:TheUnderstandingofIndianCultureandEnglishLanguagewillbedevelopedthrough the study of Dramas and Poems written by Indian Writers.

ApproximateHours

Item	AppXHrs
Cl	8
LI	0
SW	1
SL	1
Total	10

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**Class roomInstruction (CI)**	**Self Learning (SL)**
SO5.1 Students will be abletounderstandthe value of Indian Literature (R.K. Narayan) **SO5.2** Students will be abletounderstandthe 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 abletounderstandthe value of Indian Literature (Mulk Raj Anand) **SO5.5** Students will be abletounderstandthe value of Indian Literature(Premchand)		**Unit5-IndianWritinginEnglish&Hindi** The Axe-R.K.Narayan AbouttheAuthor-R.K. Narayan TheNightoftheScorpion-Nissim Ezekiel Aboutthe Poet-NissimEzekiel ThePortraitofaLady–Khushwant Singh Abouttheauthor-Khushwant Singh TheLostChild-MulkRaj Anand TheShroud- Premchand	Prepare the summaryofallthe topics(The Axe, The Night of the Scorpion, The Portraitof a Lady, The Lost Child he Shroud).

BriefofHourssuggestedfortheCourseOutcome

CourseOutcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour(Cl+SW+Sl)
CO101.1:Studentswillbeabletospeakconfidently in public as all the topics chosen emphasis on improvingspeakingskillsanddevelopingself confidenceamongstthem.	9	1	1	**11**
CO101.2: Studentswillbeabletointeractproperly 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**
CO101.3: Students will be able to communicate effectivelyinHindiandEnglishlanguageswithout hindrances.	10	1	1	**12**
CO101.4Students will be able to convey their messagesaccuratelybyunderstandingthesignificance of grammar as it plays a vital role in improving speaking and writing skills.	9	1	1	**11**
CO101.5: The Understanding of Indian Culture and English Language will be developedthroughthestudyofDramasand Poems written by Indian Writers.	**8**	**1**	**1**	**10**
TotalHours	**45**	5	**5**	**55**

Suggestion forEndSemesterAssessment

SuggestedSpecification Table(ForESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	SelfGrooming,BasicEtiquettesand Presentation.	03	01	01	05
CO-2	ConfidenceBuildingandInterviewSkills.	02	06	02	10
CO-3	PublicSpeakingSkillsandConversational Skills	03	07	05	15
CO-4	FunctionalGrammarandVocabulary Building	-	10	05	15
CO-5	IndianWritingsinEnglishandHindi	03	02	-	05
Total		11	26	13	50

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

Theendofsemesterassessmentfor Communication Skills willbeheldwithwrittenexaminationof50 marks

Note.DetailedAssessmentrubricneedtobepreparedbythecoursewiseteachersforabovetasks.
Teacherscanalsodesigndifferenttasksasperrequirement,forendsemesterassessment.

SuggestedInstructional/ImplementationStrategies:

1. ImprovedLecture
2. Tutorial
3. GroupDiscussion
4. RolePlay
5. Presentations
6. Extempore
7. Speeches
8. Brainstorming

SuggestedLearningResources:

(a)Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Communication Skills	Dr.Meenu Pandey	NiraliPraksahan.	
2	APracticalGuideto English Grammar	K.P.Thakur	BhartiBhawan Publishers& Distributors.	
3	LivingEnglish Structure	W. Stannar d Allen	Dorling KindersleyIndia Pvt. Ltd.	FifthEdition,
4	Communication Skills for Engineers	Muralikrishna C., Sunita Mishra	Pearson,New Delhi.	Second edition(2010)
5.	Advanced Language Practice,	MichaelVince	Macmillan Education,Oxford	2003.
6.	English Conversation Practise	GrantTaylor	TataMcGrawHill Education Private Limited.	
7.	Six Weeks to WordsofPower	Wilfred Funk	W.R. Goyal Publishersand Distributors.	

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<u>Cos, Pos and PSOs Mapping</u>

Programme Title: B.Tech. Mechanical Engineering

Course Code: HSMC01

Course Title: Communication English

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation	Product Innovation and Development
CO1: Studentswillbeabletospeakconfidentlyinpublicasallthetopicschosenemphasisonimprovingspeakingskillsanddevelopingself confidenceamongstthem.	-	-	-	-	3	3	2	2	1	1	-	-	-	-	-	-
CO2: Students will be able to interact properlywith improved Leadership Skills, Problem SolvingSkills,SocialskillsandCommunicationSkills.Studentswillalsobeabletounderstandthe ImportanceofTeamWork.	-	**1**	-	-	3	3	2	2	2	2	-	-	-	**1**	-	**1**
CO3: Students will be able to communicateeffectivelyinHindiandEnglishlanguageswithouthindrances.	-	-	-	-	2	3	-	2	-	1	-	-	-	-	**1**	**2**
CO4Studentswillbeableto conveytheirmessagesaccuratelybyundersta	-	-	-	-	1	3	1	2	-	-	-	-	-	-	**1**	**2**

ndingthesignificanceof grammar as it plays a vital role in improvingspeakingandwritingskills.																
CO5: The Understanding of IndianCulture and English Language will bedevelopedthroughthestudyofDramasandPoemswrittenbyIndianWriters.	-	-	-	-	1	3	-	2	1	-	-	-	-	**1**	**1**	**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:**Studentswillbeabletospeak confidentlyinpublicasallthetopic schosenemphasisonimprovingspeakingskillsanddevelopingself confidenceamongstthem.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0Self-Grooming, Basic Etiquettes andPresentation. 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	1,2
1PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	**CO2:** Students will be able to interact properlywith improved Leadership Skills, Problem SolvingSkills,SocialskillsandCommunicationSkills.Studentswill alsobeabletounderstandtheImportanceofTeamWork.	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2ConfidenceBuildingandInterview Skills. 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	**CO**3: Students will be able to communicateeffectivelyinHind iandEnglishlanguageswithouthi ndrances.	SO3.1 SO3.2 SO3.3 SO3.4		Unit-3:PublicSpeakingSkillsandConversational Skills 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	1,2
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	**CO**4: Studentswillbeabletoconveytheirmes sagesaccuratelybyunderstandingthes ignificanceof grammar as it plays a vital role in improvingspeakingandwritingskills.	SO4.1 SO4.2 SO4.3 SO4.4		Unit-4:FunctionalGrammarandVoc abularyBuilding 4.1,4.2,4.3,4.5,4.6,4.7,4.8,4.9	1,2
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	**CO5:** The Understanding of IndianCulture and English Language will bedevelopedthroughthestud yofDramasandPoemswritte nbyIndianWriters.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit5:IndianWritingsinEnglishan dHindi 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	1

Semester-II

Course Code: HSMC07

Course Title: **Indian Knowledge System**

Pre- requisite: Fundamentals of Indian Knowledge System

Rationale: Creating awareness among the youths about the true history and past rich culture of India 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 occurrence in 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 have appeared epistemological very rigidly connected in the Indian Knowledge System. This land of Bharat Bhumi has provided invaluable knowledge stuff to the society and the world in all sphere of life.

Course Outcomes:

CO- IKS. 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.

CO- IKS.II: Students will have the ability to learnabout ancient books, Religious places,basic concept of Indian dance, music and arts, and fundamental aspects of Sangeeta and Natyashashtra etc.

CO- IKS.III: 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.

CO- IKS. IV: Understanding onancient Engineering, Science and Technology, Town Planning, Temple architecture, Chemistry and Metallurgy, Metal manufacturing etc.

CO- IKS. V: Student will able to understand about the Life, Nature and Health through basic concept of Ayurveda andYoga, Traditional Medicinal Systems, Ethnomedicine, Nature conservation, World Heritage Sites etc.

Scheme of Studies:

Category of Course	Cours e Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours CI+LI+SW+SL	
VAC	HSM C07	Indian Knowledge System	2	-	1	1	4	2

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.

Proposed examination scheme (Marking) as per the recommendation of University Grant Commission (UGC) for Under Graduate Coursesin Fundamentals of Indian Knowledge Systems 2022-23 onwards **Theory**

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)		
HSM C07	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.

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

Approximate Hours

Item	Approximate 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) SO1.2. 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		**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,	Golden era of ancient India

ancient India (The Ganga, Yamuna, Godawari, Saraswati, Narmada, Sindhu and Kaveri) SO 1.6. Understand Ancient Agriculture and ancient Universities: Takshashila and Nalanda, Gurukul system		Godawari, Saraswati, Narmada, Sindhu and Kaveri) 1.6 Agriculture system in ancient India,Ancient Universities: Takshashila 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):**

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

Approximate Hours

Item	Approximate 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 SO2.2. Understand the Religious places: Puries, Dhams, Jyotiralinga, Shaktipeeths, Kumbha Mela 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		**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, 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	**1.** Indian Art, Music and Dance

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Visit of Chitrakoot, Maihar and Bharhuta

b. Mini Project:

ii. Kumbhmela, Story of Ramayana and Mahabharata

c. Other Activities (Specify):

IKS. 3: Student will be able to understandAncient Science, Astronomy and Vedic Mathematics

Approximate Hours

Item	Approximate 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 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		**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	1. Ancient Science, Astronomy and Vedic Mathematics

the basis of their origin, Basic purpose of science of Vyakarana		science of Vyakarana.	

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):

IKS. 4: Understand the Engineering, Technology and Architecture

Approximate Hours

Item	Approximate 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		**Unit-4. Engineering, Technology and Architecture** 4.1.Engineering Science and Technology in Vedic and Post Vedic Era 4.2.Town and Home planning, Sthapatyaveda 4.3.Chemistry and Metallurgy as gleaned from archeological	2. Ancient Science, Astronomy and Vedic Mathematics

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		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	

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):**

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

Approximate Hours

Item	Approximate 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) SO5.3. Understand Fundamentals of 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		**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) 5.3.Fundamentals of Ethnobotany and Ethnomedicines of India 5.4.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	1. Concept of Ayurveda and Yoga 2. Traditional system of Indian medicines 3. Ethnobotany and Ethnomedicines of India 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)
IKS. 1: To understand Indian Civilization and Indian Knowledge Systems	**6**	**2**	**1**	**9**
IKS. 2: Students will have the ability to apply the knowledge gained about Indian Art, Literature and Religious Places	**6**	**2**	**1**	**9**
IKS.3: Student will be able to understandthe Ancient Science, Astronomy and Vedic Mathematics	**6**	**2**	**1**	**9**
IKS.4: Understand the Engineering, Technology and Architecture	**6**	**2**	**1**	**9**
IKS. 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: A Historical 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 A Handbook*	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*	Mishra, Shiv Shankar	Krishnadas Academy, Varanasi	1982

	Someswvara's Manasollasa			
21	*Fundamental Principles of Ayurveda,* 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 Private Limited, New Delhi	1981
28	Manual of Ethnobotany	Jain, S.K.	Scientific Publishers, Jodhpur	2010

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CO, PO and PSO Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]

Course Code : ES-102

Course Title: Mathematics-II

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem Analysis	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-long learning	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation	Product Innovation and Development
IKS. 1: To understand Indian Civilization and Indian Knowledge Systems	2	2	3	1	1	1	1	1	1	1	1	2	2	2	2	2

IKS. 2: Students will have the ability to apply the knowledge gained about Indian Art, Literature and Religious Places	2	3	2	1	2	2	1	1	1	1	1	1	3	2	3	2
IKS.3: Student will be able to understandthe Ancient Science, Astronomy and Vedic Mathematics	2	2	2	2	2	2	1	1	1	1	1	2	1	2	1	2

IKS.4: Understand the Engineering, Technology and Architecture	3	2	3	3	2	3	1	2	2	1	2	3	3	3	2	1
IKS. 5: Understand about the Life, Nature and Health	3	2	3	2	3	2	1	2	1	1	2	3	2	3	2	1

Course Curriculum Map

POs&PSOsNo.	COsNo.&Titles	SOsNo.	LaboratoryInstruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO1,2,3,4,5,6,7,8,9,10,11,12 PSO1,2,3,4,5	**IKS. 1:**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	Asmentionedin pagenumber _to_
PO1,2,3,4,5,6,7,8,9,10,11,12 PSO1,2,3,4,5	**IKS. 2:** 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	
PO1,2,3,4,5,6,7,8,9,10,11,12 PSO1,2,3,4,5	**IKS.3:** Student will be able to understandthe Ancient Science, Astronomy and Vedic Mathematics	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5 SO3.6		**Unit-3. Ancient Science, Astronomy, Mathematics** 3.1,3.2,3.3,3.4,3.5,3.6	
PO1,2,3,4,5,6,7,8,9,10,11,12 PSO1,2,3,4,5	**IKS.4:** Understand the Engineering, Technology and Architecture	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5 SO4.6		**Unit-4. Engineering, Technology and Architecture** 4.1,4.2,4.3,4.4,4.5,4.6	

PO1,2,3,4,5,6,7,8,9,10,11,12 PSO1,2,3,4,5	**IKS. 5:** 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	

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:

Board of Study	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 outcome of Learning.

Scheme of Assessment:

Theory

Board of Study	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	ESC105	Manufacturing Practice Workshop	15	20	5	5	5	50	50	100

Practical

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV + AT)		
BSC		Manufacturing Practice Workshop 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 105.1: Understand various production processes, selecting appropriate methods for different material, optimizing manufacturing efficiency and ensuring product quality.

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)**
SO1.1 Understand various manufacturing processes, materials and technologies. **SO1.2** Acquire knowledge in cost estimation resource	1.1 Safety aspects pertaining to common manufacturing practices. 1.2 Introduction of tools and machines used in	**Unit-1.0 Manufacturing Methods-casting, forming,machining, joining,advanced manufacturing methods, CNC machining, Additive**	1. Introduction to additive manufacturing .

management and sustainable manufacturing practices. . .	each processes. 1.3 Basic instructions and procedures for using lathe and drilling machine. 1.4 Drawing of a simple workpiece 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.	**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. .	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

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

Item	AppX Hrs
Cl	03
LI	12
S W	1
SL	1
Total	17

ession Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understand different cutting tools like hacksaw, chisels etc. SO2.2 acquire 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 workpiece 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	i. 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
CI	03
LI	12
SW	1
SL	1
Total	17

Session Outcomes (SOs)	LaboratoryInstruction (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 workpiece 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	i. Defects in timber

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)	LaboratoryInstruction (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.	i. 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.

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

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO5.1 Peforming 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, classification of welding process 5.2 gas welding and its equipments and techniques 5.3 electric arc welding and brazing process	1. study of TIG and MIG welding process

SW-5 Suggested Sessional Work (SW):

c. Assignments:

i. What are different types of joints in welding shop?
ii. What is the function of flux in gas welding?.

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d. Mini Project:

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 in using 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 wood. Gain expertise in handling various carpentry tools and machinery.	3	1	12	1	17
ESC 105.4: Appreciate and access the use of casting processes in manufacturing and understand the working of various casting processes.	3	1	12	1	17
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.	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 manufacturing methods, 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 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	Elements of Workshop Technology	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K.	Media promoters and publishers private limited, Mumbai	Vol. 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	Prentice Hall India,	4^{th} edition, 1998
5	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna .			

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Cos,POs and PSOs Mapping

Course Title: B. Tech. Mechanical Engineering

Course Code : ESC105

Course Title: Manufacturing Practice Workshop

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
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	1	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	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	1	1
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	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	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, 3, 4	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,advanced manufacturing methods, CNC machining, Additive manufacturing 1.1,1.2,1.3	As mentioned in page number 2 to 6
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 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	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO3 : 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	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	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	
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	5.1 5.2 5.3 5.4 5.5 5.6	Unit 5: Welding Shop 5.1,5.2,5.3	

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

CO1-BSC104.1
Understand the importance of Laplace transform and elementary properties of Laplace transform

CO2- BSC104.2
To introduce effective mathematical tools for the solutions of ordinary differential equations and solutions with Bessel functions and Legendre functions

CO3- BSC104.3 Demonstrate an understanding of the Vector Calculus

CO4- BSC104.4 Define and recognize the method to solve Sequences and series

CO5- BSC104.5 Students will create the concept of a Partial Differential Equations

Scheme of Studies:

Board of Study	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)	BSC104	Engineering 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

<table>
<tr><td rowspan="3">Board of Study</td><td rowspan="3">Couse Code</td><td rowspan="3">Course Title</td><td colspan="8">Scheme of Assessment (Marks)</td></tr>
<tr><td colspan="6">Progressive Assessment (PRA)</td><td>End Semester Assessment (ESA)</td><td>Total Marks (PRA+ ESA)</td></tr>
<tr><td>Class/Home Assignment 5 number 3 marks each (CA)</td><td>Class Test 2 (2 best out of 3) 10 marks each (CT)</td><td>Seminar one (SA)</td><td>Class Activity any one (CAT)</td><td>Class Attendance (AT)</td><td>Total Marks (CA+CT+SA +CAT+AT)</td><td></td><td></td></tr>
<tr><td>PCC</td><td>BSC104</td><td>Engineering Mathematics-II</td><td>15</td><td>20</td><td>5</td><td>5</td><td>5</td><td>50</td><td>50</td><td>100</td></tr>
</table>

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.

CO1-BSC104.1 Understand the importance of Laplace transform 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		**Unit-1.0** 1.1 Introduction of Laplace transform 1.2 Laplace transform of elementary functions	**SL1.1** Change of scale property

SO1.2 Understand the Laplace transform of derivatives **SO1.3** Understand the Inverse Laplace transform **SO1.4** Understand the Application of Laplace transform		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 Laplacetransform	

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

1. Example onProperties 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:

Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

CO2- 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	AppXHrs
Cl	11
LI	0
SW	1
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning
SO2.1Understand the concept Solving Second order linear differential, SO2.2 Understand the Solution by variation of parameters SO2.3 Understand the Power series solutions: SO2.4 Understand the Legendre's equations andLegendre polynomials		**2.1** Linear differential Equation with constant coefficients **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	**SL2.1**Examples of Frobenius method

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 onFrobenius method

b. Mini Project:

Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

CO3- BSC104.3 Demonstrate an understanding of the Vector Calculus

Approximate Hours

Item	AppXHrs
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 integralsVolume 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:
Oral presentation, Poster presentation, Power Point Presentation.

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

CO4- BSC104.4 Define and recognize the method to solve Sequences and series

Approximate Hours

Item	AppXHrs
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 andcosine 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 Testsfor convergence
3.Example on Comparison test
4.Example on Fourier series

5.Example on Even and odd function

b. Mini Project:
Oral presentation, Poster presentation, Power Point Presentation.

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

CO5- 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 tohomogenous 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 and5.Example on Charpit's method

b. Mini Project:

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)
CO1-BSC104.1 Understand the importance of Laplace transform and elementary properties of Laplace transform	13	1	1	15
CO2- 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
CO3- BSC104.3 Demonstrate an understanding of the Vector Calculus	12	1	1	14
CO4- BSC104.4 Define and recognize the method to solve Sequences and series	13	1	1	15
CO5- BSC104.5 Students will create the concept of a Partial Differential Equations	11	1	1	13
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 Engineering Mathematics	B.V. Ramana	Tata McGraw Hill	11th Reprint, 2010.

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COs,POs and PSOs Mapping

Programme Title: B. Tech. Mechanical 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	PSO 3	PSO 4
	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	**Mechanical System Design and Analysis**	**Manufacturing Processes and Automation**	**Computational Modeling and Simulation**	**Product Innovation and Development**
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	2	1
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	2	2
CO3-Demonstrate an understanding of the Vector Calculus	3	2	3	2	2	1	2	2	2	2	2	3	3	2	2	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	2	2
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	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 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 S02.4		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

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_SEMESTER - II

Course Code: ESC-104-L

Course Title: Programming for Problem Solving

Pre-requisite: Student should have basic knowledge programming.

Rationale: Problem solving skills can help people develop more skills and build a promising career.

Course Outcomes:

ES 104.1: Understand the basic concept of Programming languages, software, algorithm and flowchart.

ES 104.2: Acquire knowledge regarding the building blocks of programming language.

ES 104.3: Apply python for solving basic programming solutions.

ES 104.4: Create algorithms using learnt programming skills.

ES 1045: Understand real world problems and developing computer solutions for those.

Scheme of Studies:

Board of Study	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)	ES 104	Programmingfor Problem Solving	3	4	2	1	10	5

Legend: **CI:**ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.,Lecture(L)andTutorial (T)and others),

LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop, 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.

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Scheme of Assessment:

Theory

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks (PRA+ ESA)
			number 3 marks each	(2 best out of 3) 10 marks each (CT)	Seminar one (SA)	any one (CAT)	Attendance (AT)	(CA+CT+SA+CAT +AT)		
ES	ES104	Programmingfor Problem Solving	15	20	5	5	5	50	50	100

Scheme of Assessment:

Practical

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)		
			Progressive Assessment (PRA)	End Semester Assessment	Total Marks (PRA+ ESA)

			Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	(CA+CT+SA+CAT +AT)		
ES	ES104	Programmin gfor Problem Solving	35	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.

ESC-104.**1: Understand the basic concept of Programming languages, software, algorithm and flowchart.**

Approximate Hours

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

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Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1. Understand types of programming languages. **SO1.2.** Utilize Operating System **SO1.3.** Compare compiler, linker, loader **SO1.4.** Create algorithm and flow charts for problem	**LI.1.1.** Running instructions in Interactive interpreter and a Python Script. **LI.1.2.** Write a program to purposefully raise Indentation Error and Correct it. **LI.1.3.** Create Flow chart for an organisation **LI.1.4.** Create Flow chart for an education system **LI.1.5.** Compare various operating systems **LI.1.6.** Write five features of Notepad	**Unit-1 Introduction to Programming** **1.1** Evolution of languages: Machine languages, Assembly languages, High-level languages construction eras. **1.2** Software requirements for programming **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	1. Different types of programming languages examples. 2. Learn about various operating systems.

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

ESC-104**.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. ToUnderstand the datatypes **SO2.2.**Identify Expressions **SO2.3.**Apply operators **SO2.4.**Use list, string tuples	**LI.2.1.** Write a program to demonstrate basic data type in python. **LI.2.2.** Write a program to compute distance between two points taking input from the user **LI.2.3.** Write a program add.py that takes 2 numbers as command line arguments and prints its sum.	**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

	LI.2.4. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . 1/10. **LI.2.5.** Write a program using a for loop that loops over a sequence. What is sequence? **LI.2.6.** Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.		

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

ESC-104**.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)
SO2.1. To Understand the loop types **SO2.2.**Identify the looping Expressions **SO2.3.**Apply arrays **SO2.4.** 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	**Unit-3 :** **ConditionalStatements,Loops, ArraysandStrings,UserDefinedDataTypes** 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	i. Loops to access array elements ii. Member access in user defined data type .

	numbers. **LI.3.5.** Write a program to implement Merge sort. **LI.3.6.** Write a program to implement Selection sort, Insertion sort	3.9 Structure 3.10Union	

SW-3 Suggested Sessional Work(SW):

a. Assignments:

1. Compare the looping statements

2. Use of user defined data type with example.

b. Mini Project:

Create a stopwatch.

c. Other Activities(Specify):

NA

ESC-104**.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)**

SO2.1. Understand the concepts of Dictionaries and Dictionary Accumulation **SO2.2.**Identify theFunctions/Methods **SO2.3.**Apply functions **SO2.4.**Use of Functions/Methods	**LI.4.1.** Write a program to count the numbersof characters in the string and **LI.4.2.**store them in a dictionary data structure. **LI.4.3.**Write a program to use split and join methods in the string and **LI.4.4.** trace a birthday of a person with a dictionary data structure. **LI.4.5** Write a program for user define function. **LI.4.6.** 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 modularizingprogram into functions. 4.5 Functiondefinition. 4.6 Function invocation. 4.7 Positional Parameter Passing 4.8 Passing arrays to functions 4.9 Recursion 4.10 Library Functions	i. Preparation of process Dictionary ii. 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.

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ESC-104**.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)
SO2.1 Understanding the file handling task **SO2.2** know thefunctions of file handling **SO2.3** Importance of .csv file **SO2.4** Use of Memory Management	**LI.5.1.** Write a programto countfrequency of characters in a given file. **LI.5.2.**Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file? **LI.5.3**Write a program to read data from a file. **LI.5.4.** Write a program to write data into a file. **LI.5.5.**Write a program to copy data from one	**Unit 5: File Handling and Memory Management** 5.1 File Handling 5.2 Memory Management 5.3 Concepts of files and basic file operations. 5.4 Writing Data to a .csv File. 5.5 Reading Data to from a .csv File. 5.6Memory Management Operations.	1. Role of file handling. 2.Working of .csv file

	file to another. **LI.5.6.**Write a program for memory management		

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.

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)
ES 104.1**:** At the end of this chapter the student will know the basic concept of programming.	7	12	2	1	22
ES 104.2**:**At the end of this chapter the student will useOperatorsin programs.	12	12	2	1	27
ES 104.3: At the end of this	10	12	2	1	25

chapter the student will describe the control flow statements.					
ES 104.4:At the end of this chapter the student will make function and dictionary	10	12	2	1	25
ES104.5: Comprehend the functions of .csv and filehandling 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	
ESC-104.1	Understand the basic concept of Programming languages, software, algorithm and flowchart.	02	08	01	11
ESC-104.2	Acquire knowledge regarding the building blocks of programming language.	02	06	01	09

ESC-104.3	Apply python for solving basic programming solutions.	02	03	04	09
ESC-104.4	Create algorithm using learnt programming skills.	2	04	04	10
ESC-104.5	Understand real world problems and developing computer solutions for those.	3	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

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COs, POs and PSOs Mapping

Program: B. Tech. Computer Science & Engineering (CSE)
Course Code : ESC-104
Course Title: Programming for Problem Solving

CourseOutcomes	ProgramOutcomes												ProgramSpecificOutcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
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
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
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
CO 4: Create algorithms using learnt programming skills	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO5:Understand real world problems and developing computer solutions for those.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs&PSOsNo.	COsNo.&Titles	SOsNo.	LaboratoryInstruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO1,2,3,4,5,6,7,8,9,10,11,12 PSO1,2,3,4,5	CO 1: Understand the basic concept of Programming languages, software, algorithm and flowchart.	SO1.1 SO1.2 SO1.3 SO1.4	LI.1.1, LI1.2,LI1.3,LI1.4,LI1.5,LI1.6	Unit-1Introduction to Programming 1.1,1.2,1.3,1.4,1.5,1.6,1.7	Asmentionedin pagenumber above
PO1,2,3,4,5,6,7,8,9,10,11,12 PSO1,2,3,4,5	CO 2 : Acquire knowledge regarding the building blocks of programming language.	SO2.1 SO2.2 SO2.3 SO2.4	LI.2.1,LI2.2,LI2.3,LI.2.4,LI.2.5,LI2.6	Unit-2Datatypes 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	
PO1,2,3,4,5,6,7,8,9,10,11,12 PSO1,2,3,4,5	CO 3: Apply python for solving basic programming solutions. .	SO3.1 SO3.2 SO3.3 SO3.4	LI3.1,LI3.2,LI3.3,LI.3.4,LI3.5,LI3.6	Unit-3Conditional 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,	
PO1,2,3,4,5,6,7,8,9,10,11,12 PSO1,2,3,4,5	CO 4: Create algorithms using learnt programming skills.	SO4.1 SO4.2	LI4.1,LI.4.2,LI4.3,LI4.4,LI4.5,LI4.6	Unit-4Dictionaries and Dictionary Accumulation, Functions/Methods:	

		SO4.3 SO4.4		4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10,	
PO1,2,3,4,5,6,7,8,9,10,11,12 PSO1,2,3,4,5	CO 5: Understand real world problems and developing computer solutions for those.	SO5.1 SO5.2 SO5.3 SO5.4	LI.5.1,LI5.2,LI5.3,LI5.4,LI5.5,LI5.6	Unit-5 File Handling and Memory Management: 5.1,5.2,5.3,5.4,5.5,5.6	

Semester-II

Course Code:	HSMC09
Course Title:	Sports and Yoga
Pre-requisite:	Student should have basic knowledge of Sports And Yoga concepts
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:

CO 201.1: To make the students understand the importance of Introduction of Yoga.

CO201.2: To make the students understand the importance of Fundamentals of Yog.

CO201.3: 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.

CO201.4: To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize risk of injury and Yoga & Lifestyle.

CO201.5 To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health

Board of Study	Course Code	Course Title	Scheme ofstudies(Hours/Week)					Total Credits(C)
			Cl	LI	SW	SL	Total Study Hours(CI+LI+SW+SL)	
Program Core	HSMC09	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, miniproject etc.),
SL: Self Learning,
C:Credits. 2

Theory

Board of Study	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 Test2 (2 best out Of 3) 10 marks each(CT)	Seminar one (SA)	Class Activity anyone (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	**(ESA)**	(PRA+ESA)
PCC	HSMC09	Sports And Yoga	20	20	5	5	0	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 the of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

CO. 1: To make the students understand the importance of **Introduction of Yoga.**

Approximate Hours

Item	AppXHrs
Cl	06
LI	0
SW	0
SL	3
Total	09

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

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

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Approximate Hours

Item	AppX Hrs
Cl	06
LI	0
SW	0
SL	2
Total	08

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom 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 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 2.4Circulatory System, 2.5Respiratory System, 2.6 Neuro- System , Muscular System etc.	1. Effect of yoga on the functioning of Various Body Systems 2. **Fundamentals of Yoga**

CO. 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	08

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom 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 o 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**

CO. 4: To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize risk of injury and **Yoga & Lifestyle**

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom 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, PavanMuktasana, ArdhaChakrasana, Bhujangasana, Sharasana. 4.3 Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, ArdhMatsyendrasana. 4.4 Back Pain: Tadasana, ArdhMatsyendrasana, Vakrasana, Shalabhasana, Bhujangasana. 4.5 Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana,PavanMuktasana, ArdhMatsyendrasana. 4.6 Asthema: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.	1. Asanas as preventive measures

CO. 5: To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health **& Postures.**

Approximate Hours

Item	App. Hrs
CI	6
LI	0
SW	0
SL	1
Total	7

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom 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-4SuggestedSessionalWork(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)
C0101.1:To make the students understand the importance of **Introduction of Yoga**	6	0	3	**9**
C0 101.2: To make the students understand the importance of **Fundamentals of Yoga** .	6	0	2	**8**
C0101.3: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.	6	0	2	8
C0101.4: To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize risk of injury and Yoga & Lifestyle	6	0	1	7
CO 201.5 To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health **& Postures**	6	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 Introduction to yoga 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. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog, Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
8. Brainstorming

Suggested Learning Resources:

(a) Books:

TEXT BOOKS

Text Books/References:

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Light On Yoga by B.K.S. Iyengar.
3. Health and Physical Education – NCERT (11th and 12th Classes)

COs,POs and PSOs Mapping

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

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	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	**Mechanical System Design and Analysis**	**Manufacturing Processes and Automation**	**Computational Modeling and Simulation.**	**Product Innovation and Development**
CO1:To make the students understand the importance of of Yoga	-	2	-	-	1	-	1	-	2	1	-	-	-	-	-	-
CO2: To make the students understand the Fundamentals of Yoga	-	2	-	-	1	-	1	-	2	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.	-	2	-	-	2	-	2	-	2	2	-	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	-	2	-	-	1	-	1	-	2	1	-	1	-	-	-	-
CO5: To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health&Postures.	-	2	-	-	2	-	3	-	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-Learnin g (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 ,3.6,3.7,3.8,3.9,3.10,3.11,3.12	1,2
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2	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

Third Semester

Course Code: **HSMC-301**

Course Title: Universal Human Values

Pre- requisite: Creating awareness among the studentsona 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:

CO- UHV ModuleI: To understanding Value Education

CO- UHVModule II: Students will have the ability to learnabout Harmony in the Human Being**.**

CO- UHV Module III: Student will be able to gain knowledge on Harmony in the Family and Society.

CO- UHV Module IV: Understanding Harmony in the Nature/Existence.

CO- UHV Module V: Student will able to understand about Implications of Holistic Understanding- A Look at Professional Ethics.

Scheme of Studies:

Category of Course	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours CI+LI+SW+SL	
VAC	UHV	Universal Human Values	3		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: Session Work (includes assignment, seminar, mini project etc.),

SL: Self Learning,

C: Credits.

Proposed examination scheme (Marking) as per the recommendation of University Grant Commission (UGC) for Under Graduate Coursesin Fundamentals of Univarsal Human Values 2022-23 onwards

S. No.	Category of Course/Subject	Components of Marks				Total
		Semester End Examination (External	Mid Term exam (Internal)	Assignment (Internal)	Practical Exam (Internal)	
1	Only Theory Subject Course					
2	Subject/ Course with theory and Practical					
3	Subject/ Course only Practical					

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.

UHV Module I.Student will be able toUnderstand the Value Education

Approximate Hours

Item	Approximate Hours
CI	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 1.1. Understand Self-exploration as the Process for Value Education SO1.2. 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 Prosperity – Current Scenario SO 1.6. Understand Method to Fulfill the Basic Human Aspirations		**Module-I Understanding Value Education** 1.1 Self-exploration as the Process for Value Education 1.2 Continuous Happiness and Prosperity – the Basic Human Aspirations 1.3 Right Understanding 1.4 Relationship and Physical Facility 1.5 Happiness and Prosperity – Current Scenario 1.6 Method to Fulfill the Basic Human Aspirations 1.7 Tutorial 1 1.8 Tutorial 2 1.9 Tutorial 3	Human values to become a good man

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Continuous Happiness and Prosperity – the Basic Human Aspirations
b. **Mini Project:**
   ii. Relationship and Physical Facility
c. **Other Activities (Specify):**

UHV Module II: Students will have the ability to apply the gained knowledge onHarmony in the Human Being

Approximate Hours

Item	Approximate Hours
CI	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 2.1. Understanding Human being as the Co-existence of the Self and the Body SO2.2. Understand the Distinguishing between the Needs of the Selfand 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 SO2.6. Understand Programme to ensure self-regulation and Health		**Module-II Harmony in the Human Being** 2.1. Human being as the Co-existence of the Self and the Body 2.2. Distinguishing between the Needs of the Selfand Body 2.3. Body as an Instrument of the Self 2.4 Harmony in the Self 2.5 Harmony of the Self with the Body 2.6 Programme to ensure self-regulation and Health. 2.7 Tutorial 1 2.8 Tutorial 2 2.9 Tutorial 3	**1.** Harmony in and among human being

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Harmony in the self

b. **Mini Project:**
   ii. Body an an instrument

c. **Other Activities (Specify):**
   N/A

UHV Module III: Student will be able to understandHarmony in the Family and Society

Approximate Hours

Item	Approximate Hours
CI	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 3.1. Understand Harmony in the Family – the Basic Unit of Human Interaction SO 3.2. Understand the Values in Human-to-Human Relationship SO 3.3. Understand the 'Trust' – the Foundational Value in Relationship SO 3.4. Understand the 'Respect' – as the Right Evaluation SO 3.5. Understanding Harmony in the Society SO 3.6. Understand the Vision for the Universal Human Order		**Module III. 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 Foundational Value in Relationship 3.4 'Respect' – as the Right Evaluation 3.5 Understanding Harmony in the Society 3.6 Vision for the Universal Human Order. 3.7 Tutorial 1 3.8 Tutorial 2 3.9 Tutorial 3	1. Harmony in the society

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Respect the right evaluation

b. Mini Project:

1. Trust is the fundamental value of relationships

c. Other Activities (Specify):

N/A

UHV Module IV: Student will be able to understandHarmony in the Nature/Existence

Approximate Hours

Item	Approximate Hours
CI	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 4.1. Understanding Harmony in the Nature, Interconnectedness SO 4.2. 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 SO 4.6. Understand the Exploring Co-Existence in Existence		**Module-IV 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 4.4Realizing Existence as Co-existence at All Levels 4.5 The holistic Perceptions of Harmony in Existence 4.6The Exploring Co-Existence in Existence 4.7 Tutorial 1 4.8 Tutorial 2 4.9 Tutorial 3	i. Harmony in the nature

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Harmony in nature
b. **Mini Project:**
   i. Exploring 4 orders of nature
c. **Other Activities (Specify)**
   N/A

UHV Module V: Students will have the ability to apply the gained knowledge in Implications of Holistic Understanding- A Look at Professional Ethics

Approximate Hours

Item	Approximate Hours
CI	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 5.1. Understand Natural acceptance of Human Values SO 5.2 Understand Definitiveness of (Ethical) Human Conduct SO5.3. Understand A Basis for Humanistic Education SO 5.4. Understand the Humanistic Constitution and Universal Human Order SO 5.5. Understand Competence in Professional Ethics		**Module V. Implications of Holistic Understanding- A Look at Professional Ethics** 5.1 Natural acceptance of Human Values 5.2.Definitiveness of (Ethical) Human Conduct 5.3 A Basis for Humanistic Education 5.4 Humanistic Constitution and Universal Human Order 5.5Competence in	Holistic understanding of human values

SO 5.6. Understand Strategies for Transition towards value based Life and Profession		Professional Ethics 5.6 Strategies for Transition towards value based Life and Profession. 5.7 Tutorial 1 5.8 Tutorial 2 5.9 Tutorial 3	

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Human conduct
b. **Mini Project:**
   i. Humanistic constitution
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)
UHV Module. I: Student will be able to understand The Value Education	**9**	**2**	**1**	**12**
UHV Module. II: Students will have the ability to apply the knowledge gained about Harmony in the Human Being	**9**	**2**	**1**	**12**
UHV Module. III: Student will be able to understandthe Harmony in the Family and Society	**9**	**2**	**1**	**12**
UHV Module. IV: Understand the Harmony in the Nature/Existence	**9**	**2**	**1**	**12**
UHV Module. V: Understand about the Implications of Holistic Understanding- A Look at Professional Ethics	**9**	**2**	**1**	**12**
Total	**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	The Value Education	**2**	**5**	**1**	**8**
CO 2	Harmony in the Human Being	**2**	**6**	**2**	**8**
CO 3	Harmony in the Family and Society	**2**	**6**	**5**	**13**
CO 4	Harmony in the Nature/Existence	**2**	**4**	**4**	**10**
CO 5	Implications of Holistic Understanding- A Look at Professional Ethics	**2**	**5**	**2**	**9**
Total		**10**	**26**	**14**	**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 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	*JeevanVidya: EkParichaya*	A Nagaraj	JeevanVidyaPrakashan, Amarkantak	1998
2	*Human Values*	A.N. Tripath	New Age Intl. Publishers, New Delhi,	2004
3	*Universal Human Values*		AICTE	2021
	Human Values and Professional Ethics	R.R. Gaur, R Sangal and G P Bagaria	Excel Book Publisher	2009
	Vyavaharvadï. Samajshastra	A Nagaraj	JeevanVidyaPrakashan, Amarkantak	1999
	Manava Vyavahara Darsana	A Nagaraj	JeevanVidyaPrakashan, Amarkantak	2003
	Foundations of Ethics and Management,	B P Banerjee	Excel Book	2005
	Fundamentals of Ethics for Scientists & Engineers	E G Seebauer& Robert L. Berry	Oxford University Press.	2000
	Engineering Ethichs (including Human Values)	M Govindrajran, S Natrajan and V.S. Senthil Kumar	Eastern Economy Edition, Prentice Hall of India Ltd.	-

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4. Prof. G.C. Mishra, Director, IQAC,AKS University, Satna (M.P.).
5. Prof. R.L.S. Sikarwar, Director, Centre for Traditional Knowledge Research & Application,AKS University, Satna (M.P.).

COs, POs and PSOs Mapping

Program: B. Tech. Mechanical Engineering
Course Code : HSMC-301
Course Title: Universal Human Values

CourseOutcomes	ProgramOutcomes												ProgramSpecificOutcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and development
UHV Module. I: Student will be able to understand The Value Education	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
UHV Module. II: Students will have the ability to apply the knowledge gained about Harmony in the Human Being	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
UHV Module. III: Student will be able to understand the Harmony in the Family and Society	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
UHV Module. IV: Understand the Harmony in the Nature/Existence	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
UHV Module. V: Understand about the Implications of Holistic Understanding- A Look at Professional Ethics	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3

ii. **Legend: 1 – Low, 2 – Medium, 3 – High**

Course Curriculum Map

POs&PSOsNo.	COsNo.&Titles	SOsNo.	LaboratoryInstruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO1,2,3,4,5,6,7,8,9,10,11,12 PSO1,2,3,4,5	**UHV Module. I:**Student will be able to understand The Value Education	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5 SO1.6		Unit-1 **Understanding Value Education** 1.1,1.2,1.3,1.4,1.5,1.6	Asmentionedin pagenumber _to_
PO1,2,3,4,5,6,7,8,9,10,11,12 PSO1,2,3,4,5	**UHV Module. II:** Students will have the ability to apply the knowledge gained about Harmony in the Human Being	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5 SO2.6		Unit-2**Harmony in the Human Being** 2.1,2.2,2.3,2.4,2.5,2.6	
PO1,2,3,4,5,6,7,8,9,10,11,12 PSO1,2,3,4,5	**UHV Module. III:** Student will be able to understandthe Harmony in the Family and Society	SO3.1SO3.2 SO3.3 SO3.4 SO3.5 SO3.6		Unit-3**Harmony in the Family and Society** 3.1,3.2,3.3,3.4,3.5,3.6	
PO1,2,3,4,5,6,7,8,9,10,11,12 PSO1,2,3,4,5	**UHV Module. IV:** Understand the Harmony in the Nature/Existence	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5 SO4.6		Unit-4**Harmony in the Nature/Existence** 4.1,4.2,4.3,4.4,4.5,4.6	
PO1,2,3,4,5,6,7,8,9,10,11,12 PSO1,2,3,4,5	**UHV Module. V:** Understand about the Implications of Holistic Understanding- A Look at Professional Ethics	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5 SO5.6		Unit-5 **Implications of Holistic Understanding- A Look at Professional Ethics** 5.1,5.2,5.3,5.4,5.5,5.6	

Semester-III

Course Code: ESC-ME203

Course Title : Engineering Thermodynamics

Pre-requisite: Student should have basic knowledge of physics and basic laws. Understanding concepts such as energy, heat and basic principles of chemical reactions is crucial.

Rationale: The rationale of Engineering Thermodynamics primarily revolves around enhancing efficiency in engineering systems. By understanding energy transfer, conversion, and limitations through thermodynamic principles, engineers can optimize designs, reduce energy losses, and create more efficient systems. This focus on efficiency drives innovation and ensures sustainable practices in various industries, ultimately aiming for better resource utilization and cost-effectiveness in engineering applications.

Course Outcomes:

ME203**.1:** Grasp fundamental thermodynamic concepts, systems, energy forms, and basic processes.

ME203**.2:** Apply energy conservation principles to closed and open systems, understanding their significance in various devices.

ME203**.3:** Comprehend entropy and the limitations it imposes on energy conversion processes.

ME203**.4:** Understand gas equations, pure substance properties, and phase change diagrams.

ME203**.5:** Analyze different power cycles, evaluating efficiency and practical limitations.

A K S University

Faculty of Engineering and Technology

Department of Mechanical Engineering

Curriculum of B.Tech. (Mech. Engg.) Program

(Revised as on 01 August 2023)

Scheme of Studies:

Board of Study	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 (ESC)	ME203	Engineering Thermodynamics	4	2	1	1	8	5

Legend: **CI:** Class room Instruction (Includes differentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)andothers),
LI: Laboratory Instruction(Includes Practical performancesinlaboratoryworkshop, field or other locations using different instructional strategies)
SW: Sessional Work (includesassignment, 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

Board of Study	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	ME 203	Engineering Thermodynamics	15	20	5	5	5	50	50	100

Practical

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV + AT)		
ESC	ME203-L	Applied thermodynamics-L	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-ME203**.1: To understand the thermodynamic fundamentals before studying their application in applied thermodynamics.**

Approximate Hours

Item	AppX Hrs
Cl	11
LI	4
SW	2
SL	1
Total	18

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**

SO1. 1 Grasp macroscopic and microscopic viewpoints, the continuum concept, and distinctions among system, surrounding, and boundary. **SO1.2** Identify thermal, chemical, mechanical, and thermodynamic equilibrium, differentiating control volume and systems approaches.. **SO1.3** Differentiate intensive and extensive properties, understand state-path-process-cycle concepts, and distinguish point and path functions.. **SO1.4** Explore energy fundamentals, sources, forms, and mechanisms like work and heat transfer **SO1.**5 Understand the Zeroth Law, temperature scales, and equations of state, focusing on the ideal gas equation and gas constants. .	1.1 To verify the Boyle's law. 1.2 To determine Joule Thomson coefficient of Carbon dioxide	**Unit-1: Basic Concepts & definitions** 1.1 Introduction of Thermodynamics and its importance 1.2 Macroscopic and Microscopic view point, Concept of Continuum 1.3 Thermodynamic System, Surrounding and Boundary, Control Volume approach and Systems approach 1.4 Equilibrium – Thermal ,Chemical, Mechanical and thermodynamic 1.5 Pure Substance, Property – Intensive and Extensive, State, Path, Process and Cycle Point Function and Path Function 1.6 Quasi Static Process and processes like Isobaric, Isochoric, Isothermal 1.7 Polytropic Process, Temperature and different scales 1.8 Zeroth Law of Thermodynamics, Energy, sources of energy forms of energy, Energy transfer by work and forms of work 1.9 Free Expansion, Energy transfer by heat	i. Different conditions of equilibrium ii. Thermodynamic System, Surrounding and Boundary, Control Volume approach and Systems approach

		Adiabatic Process, Equations of state 1.10 Ideal gas Equation 1.11 Specific gas constant and Universal Gas Constant	

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i) Equilibrium – Thermal, Chemical, Mechanical and thermodynamic
   ii) Zeroth Law of Thermodynamics, Energy, sources of energy forms of energy, Energy transfer by work and forms of work

b. **Mini Project:**

c. **Other Activities (Specify):**
   Difference between state function and path function.

ESC-ME203**.2: To determine the thermodynamic efficiency of different energy related processes.**

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO2.1 Explore heat-work relation, cyclic processes, conservation principle, and	1. To study Mountings &	**Unit-2: First Law of Thermodynamics**	i) First Law of Thermodynamics applied to open

applications in closed and open systems. **SO2.2** Analyze perpetual motion, apply the first law to diverse systems, and study open system processes like throttling. **SO2.3** Understand ideal gas equation, real gas deviations, Vander Waals equation, and limitations with corresponding states **SO2.** 4 Apply the first law to real systems, considering the significance of Joule-Thomson coefficients in processes like throttling **SO2.5** Apply thermodynamics to real systems, addressing ideal gas limitations and evaluating constants for non-ideal gases.	Accessories of a Boiler. 2. To study the Cochran Boiler and it's Accessories and Mountings 3. To study the Lancashire and it's Accessories and Mountings. .	2.1 Relation between Heat and Work- Joules Constant 2.2 First law of thermodynamics for a cyclic process 2.3 First law of thermodynamics for a closed system undergoing a process Conservation principle 2.4 First Law of Thermodynamics 2.5 applied to open system Steady Flow Energy Equation 2.6 Perpetual motion Machine of First kind, Application of first law of thermodynamics to closed system 2.7 Application of first law of thermodynamics to Non flow Process 2.8 Application of first law of thermodynamics to Open Systems like Steam Nozzle, Boiler, Steam Turbine, 2.9 Application of first law of thermodynamics to Open Systems like Pump, Heat Exchanger, Throttling Process 2.10 **Equation of state:** Idealgas equation of	system ii) Application of first law of thermodynamics to Open Systems like Steam Nozzle, Boiler, Steam Turbine,

		state, Real gas deviation with ideal gas 2.11 Vanderwaals equation, Evaluation of its constants, 2.12 Virial expansions, Limitations of the equation. The law of corresponding states	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i) First law of thermodynamics for a cyclic process.

ii) First law of thermodynamics for a closed system undergoing a process Conservation principle

b. **Mini Project:**

Discuss the application of First law of thermodynamics for different processes used in power plant.

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

Application of first law of thermodynamics to Open Systems like Pump, Heat Exchanger.

ESC-ME203**.3: To learn the device a technically feasible refrigerator for wide applications.**

Approximate Hours

Item	AppXHrs
Cl	12
LI	6
SW	3
SL	2
Total	23

SessionOutcomes (SOs)	LaboratoryInstruction (LI)	ClassroomInstruction (CI)	SelfLearning (SL)
SO3.1 Grasp limitations of the first law, thermal reservoirs, and the	1. study the Babcock Wilcox and it's Accessories and	**Unit-3 : Second Law of Thermodynamics**	i)Limitation of first law of

concepts of heat engine, heat pump, and refrigerator. **SO3.2** Understand Kelvin-Planck and Clausius statements, equivalence, reversible and irreversible processes, causes of irreversibility, and the need for Carnot theorem **SO3.3** Explore Carnot cycle, thermodynamic temperature scale, and its equivalence with the Ideal Gas Scale **SO3.4** Understand Clausius inequality, theorem, and the concept that entropy is a property of a system. **SO3.5** Analyze isentropic processes, temperature-entropy plots, entropy change during a process, and the interpretation of the concept of entropy	Mountings.. 2. To study a Simple Steam Engine. 3.To study a Compound Steam Engine	3.1 Limitation of first law of thermodynamics, Thermal Reservoir – Source and Sink 3.2 Concept of Heat Engine, Heat Pump and Refrigerator 3.3 Second law of thermodynamics – Kelvin Planck and Clausius Statements Equivalence of Clausius and Kelvin Planck Statement 3.4 Reversible and Irreversible Process 3.5 Causes of Irreversibility, Perpetual Motion Machine of Second Kind 3.6 Need of Carnot theorem and its corollaries 3.7 Car not cycle, 3.8 Thermodynamic Temperature Scale and its equivalence with Ideal Gas Scale **Entropy:** 3.9 Clausius Inequality, Clausius Theorem 3.10 Entropy is Property of a system, Isentropic Process 3.11 Temperature Entropy Plot and its	thermodynamics, Thermal Reservoir – Source and Sink ii)Second law of thermodynamics – Kelvin Planck and Clausius Statements ii)Entropy is Property of a system

		relationship with heat interactions 3.12 Entropy Principle, Entropy change During a Process. Interpretation of concept of entropy.	

SW-3 Suggested Sessional Work(SW):

a. Assignments:

i) Concept of Heat Engine, Heat Pump and Refrigerator

.

ii) Second law of thermodynamics – Kelvin Planck and Clausius Statements Equivalence of Clausius and Kelvin Planck Statement

iii) Reversible and Irreversible Process

b. **Mini Project:**

Describe the Kelvin Planck and Clausius Statements Equivalence of Clausius and Kelvin Planck Statement

c. Other Activities (Specify):

Entropy is Property of a system, Isentropic Process Temperature Entropy Plot and its relationship with heat interactions

ESC-ME203**.4: To understand fundamental concepts related to vapor-liquid equilibrium including vapor pressure, boiling points and phase diagrams.**

Approximate Hours

Item	AppXHrs
Cl	12
LI	6
SW	2
SL	1
Total	21

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)

SO4.1 Explore reciprocal, cyclic, and Maxwell relations, TdS equations, and relationships in heat capacities, volume expansivity, and isothermal compressibility **SO4.2** Differentiate high and low-grade energy, understand dead states, available and unavailable energy, and analyze second law efficiency with the Clausius-Clapeyron equation. **SO4.3** Study phase changes, property diagrams (T-v, T-s, and p-h), and gain proficiency with Steam Tables and Mollier charts **SO4.4** Understand dryness fraction, steam calorimeters (barrel, separating, throttling, combined), and their applications **SO4.5** Analyze available energy in processes and cycles, and comprehend the decrease of available energy during heat transfer with a finite temperature difference..	1. To study a Simple Steam Engine With D-Slide Valve. 2 To study Meyer's Expansion Valve of Steam Engine. 3. To study Drop Valve of Steam Engine	**Unit-4 Thermodynamic Relations** 4.1 Reciprocal Relation, Cyclic Property relations Maxwell Relations 4.2 TdS equations, Heat capacity relations, Volume Expansivity 4.3 Isothermal Compressibility, Clausius-Clapeyron Equation 4.4 **Availability:** High grade and Low Grade Energy Available and Unavailable Energy 4.5 Dead State, Available energy with respect to a process and a cycle, Decrease of Available Energy 4.6 When heat is transferred through a finite temperature Difference 4.7 Second Law efficiency 4.8 **Properties of Pure Substance:** Pure substance and Phase changes Phase change processes of pure substance, 4.9 Property diagrams for phase change process (T-v, T-s and p-h diagrams) 4.10 Understanding of Steam Table and Mollier chart with suitable examples 4.11 Dryness fraction and its determination 4.12 Study of steam calorimeters (Barrel, Separating, Throttling and	i) **Properties of Pure Substance:** Pure substance and Phase changes ii)TdS equations, Heat capacity relations, Volume Expansively

		combined	

SW-4 Suggested Sessional Work(SW):

a. Assignments:

i. Find out the expression Reciprocal Relation, Cyclic Property relations Maxwell Relations

.

ii. Write down the Property and diagrams for phase change process (T-v, T-s and p-h diagrams)

. b. **Mini Project:**

Dryness fraction and its determination Study of steam calorimeters (Barrel, Separating),

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

Power Point Presentation to describe **Availability:** High grade and Low Grade Energy Available and Unavailable Energy

ESC-ME203**.5: To apply concepts related to thermodynamic cycle, properties of solutions such as volume, pressure, entropy, nthalpy of energy.**

.

Item	AppXHrs
Cl	13
LI	8
SW	2
SL	2
Total	25

SessionOutcomes (SOs)	LaboratoryInstruction (LI)	ClassroomInstruction (Cl)	SelfLearning (SL)
SO5.1 Grasp Carnot cycle limitations, analyze Rankine	**1.** To study Two Stroke Petrol Engine.	**Unit 5: Vapour Power cycles**	i) Carnot cycle and its

cycle variations, and explore mean temperature of heat addition. **SO5.2** Learn methods to improve Rankine cycle efficiency, emphasizing reheat and regeneration cycles **SO5.3** Understand Air Standard Cycle assumptions and operational principles for Otto, Diesel, Dual, and Brayton cycles. **SO5.4** Apply theoretical concepts practically, emphasizing real-world implications of power cycles **SO5.**5 Develop skills to solve problems related to power cycles, optimizing thermodynamic systems	2. To study Four Stroke Petrol Engine 3.To study Four Stroke Petrol Engine 4.To study Four Stroke Petrol Engine	5.1 Carnot cycle and its limitations as a vapour cycle 5.2 , Rankine cycle 5.3 Rankine cycle with different turbine inlet conditions 5.4 Mean temperature of heat addition 5.5 Methods to improve thermal efficiency of Rankine cycle 5.6 Rankine cycle – Reheat cycle and Regeneration Cycle. **5.7 Gas Power cycles:** Assumptions of Air Standard Cycle 5.8 Otto cycle 5.9 Diesel Cycle 5.9 Dual cycle 5.10 Brayton Cycle 5.11Numerical problem on otto cycle 5.12Numerical problem on Diesel cycle 5.13Numerical problem on Brayton cycle	limitations as a vapour cycle ii)Rankine cycle and Standard Cycle

SW-5 SuggestedSessionalWork(SW):

a. **Assignments:**

i. Describe the equation for Assumptions of Air Standard Cycle and otto cycle.

.ii. Describe the equation for Assumptions of Air Standard Cycle and otto cycle

iii. Describeand draw the Rankine cycle with different turbine inlet conditions

b. **MiniProject:**

Visit the thermal power plant and Manufacturing factory

c. **OtherActivities(Specify):**

Power Point Presentation to describe the Carnot cycle and its limitations as a vapour cycle and Rankine cycle
.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Lecture (Ll)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
ME203**.1:** Grasp fundamental thermodynamic concepts, systems, energy forms, and basic processes.	11	4	2	1	18
ME203**.2:** Apply energy conservation principles to closed and open systems, understanding their significance in various devices.	12	6	2	1	21
ME203**.3:** Comprehend entropy and the limitations it imposes on energy conversion processes	12	6	2	2	22
ME203**.4:** Understand gas equations, pure substance properties, and phase change diagrams.	12	6	2	1	21
ME203**.5:** Analyze different power cycles, evaluating efficiency and practical limitations.	13	8	2	2	25
Total Hours	60	30	10	7	107

Suggestion for End Semester Assessment

SuggestedSpecificationTable(ForESA)

CO	UnitTitles	MarksDistribution			Total Marks
		R	U	A	
CO-1	Grasp fundamental thermodynamic concepts, systems, energy forms, and basic processes.	03	05	02	10
CO-2	Apply energy conservation principles to closed and open systems, understanding their significance in various devices.	02	06	02	10
CO-3	Comprehend entropy and the limitations it imposes on energy conversion processes	02	07	01	10
CO-4	Understand gas equations, pure substance properties, and phase change diagrams..	02	04	04	10
CO-5	Analyze different power cycles, evaluating efficiency and practical limitations.	02	05	03	10
Total		11	27	12	50

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

The end of semester assessment for Introduction to Thermodynamics applications 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. ImprovedLecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. RolePlay
6. Visit to power plant
7. Demonstration
8. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whats app,Mobile,Onlinesources)

9. Brainstorming

Suggested Learning Resources:

(a) **Books**:

S. No.	Title	Author	Publisher	Edition&Year
1	Thermodynamics,	Yunus A. Cengel and Michael ABoles	TMH	7th Edition, 2018
2	Basic Engineering Thermodynamics	Rayner Joel,	Longman Publishers Engineering	5th Edition, 2016
3	Thermodynamics	P K Nag	TMH	5st Edition, 2015
4	Thermodynamics	Onkar Singh,	New Age International	6st Edition, 2017
5	Thermodynamics	C P Arora	TMH	2009

Curriculum Development Team

Curriculum Development Team

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A K S University

Faculty of Engineering and Technology

Department of Mechanical Engineering

Curriculum of B.Tech. (Mech. Engg.) Program

(Revised as on 01 August 2023)

Cos,POs and PSOs Mapping

Course Title: B. Tech Mechanical Engineering

Course Code: ESC ME 203

Course Title: Applied thermodynamics

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	Engin e ering knowl edge	Pro b lem anal ysis	Design/d evelop ment of solutions	Cond uct invest igations of compl ex probl ems	Mod en tool usag e	The engi neer and soci ety	Environ ment and sustain ability:	Eth ics	Indivi dual and team work:	Com mun ic atio n:	Project manage ment and finance:	Life-long learning	Mechani cal System Design and Analysis	Manufactur ing Processes and Automation	Computation al Modeling and Simulation.	Product Innovatio n and Develop ment
CO1 : Grasp fundamental thermodynamic concepts, systems, energy forms, and basic processes .	1	1	2	2	2	2	3	1	2	2	1	2	2	2	1	-
CO 2 : Apply energy conservation principles to closed and open systems, understanding their significance in various devices	1	2	2	2	1	2	2	1	1	1	2	3	2	2	2	1

CO3 : Comprehend entropy and the limitations it imposes on energy conversion processes. .	2	2	1	1	2	2	2	1	1	2	1	2	2	1	2	2
CO 4: Understand gas equations, pure substance properties, and phase change diagrams	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2
CO 5: Analyze different power cycles, evaluating efficiency and practical limitations	1	2	2	-	1	1	3	1	1	1	2	2	3	3	1	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	CO1 : Grasp fundamental thermodynamic concepts, systems, energy forms, and basic processes	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1 ,2	**Unit-1: Basic Concepts & definitions** 1.1,1.2,1.3,1.4,1.5,1.6,1.7	As mentioned in page number 2 to 6
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2 : Apply energy conservation principles to closed and open systems, understanding their significance in various devices.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	1,2,3	**Unit-2: First Law of Thermodynamics** 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, 3, 4, 5	CO3 : Comprehend entropy and the limitations it imposes on energy conversion processes .	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	1,2,3	**Unit-3 : Second Law of Thermodynamics** 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, 5	CO 4: Understand gas equations, pure substance properties, and phase change diagrams.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	1,2,3	**Unit-4 Thermodynamic Relations** 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10	

PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 5: Analyze different power cycles, evaluating efficiency and practical limitations.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	1,2,3,4	**Unit 5: Vapour Power cycles** 5.1,5.2,5.3,5.4,5.5	

Semester-III

Course Code: **ESC201**

Course Title : **Basic Electronics Engineering**

Pre-requisite: Student should have basic knowledge of physics, Semiconductor Electronics andElectronic 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:

ESC201.1: Understanding of the concept of semiconductor materials, pnjunction,pn junction diodes and BJT and its types

ESC201.2: Understanding of Operational amplifier its construction working and its different types .

ESC201.3: : Explain the principle, construction and working of different timing circuits and oscillator with its types.

ESC201.4: Explain the basic concepts of digital electronics,Boolean algebra, logic gates and different logic circuits

ESC201.5: Explain the principle of Electronics communication System its types and different modulation techniques

SchemeofStudies:

Board ofStudy	Course Code	CourseTitle	Scheme of studies(Hours/Week)					TotalCredits (C)
			Cl	LI	SW	SL	Total StudyHours(CI+LI+SW+SL)	
Engg. Science course ESC	ESC201	Basic Electronics Engineering	4	2	1	1	8	5

Legend:

CI: ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)andothers),
LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop, field or other locations using different instructional strategies)
SW: Sessional Work(includesassignment, seminar, miniprojectetc.),
SL: SelfLearning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback ofteacherto ensureoutcomeofLearning.

SchemeofAssessment:
Theory/ Practical

Board of Study	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	ESC201	Basic Electronics Engineering	15	20	5	5	5	50	50	100

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV + AT)		
ESC	ESC201-L	Basic Electronics Engineering	35	10	5	50	50	100

Course-CurriculumDetailing:

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.

ESC201.1: Understanding of the concept of semiconductor materials, pnjunction,pn junction diodes, BJT and its types

Approximate Hours

Item	ApproxHrs
Cl	10
LI	3
SW	1
SL	1
Total	15

SessionOutcomes (SOs)	**LabInstruction (LI)**	**ClassroomInstruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the concept of semiconductor material **SO1.2**Understand the concept of PN junction diode and its characteristics **SO1.3**Understand the concept of BJT and its working **SO1.4** understand the different type of BJT and characteristics	1. Study of PN junction diode . 2. Study of half wave and full wave rectifier. 3. study of CB CE CC of BJT.	**Unit-1:Semiconductor Devices and Applications** 1.1 Introduction to semiconductor 1.2 Introduction to P-N Junction Diode and V-I characteristics, 1.3 Half wave and Full-wave rectifiers,capacitor filter. 1.4 Zener diode and its characteristics, 1.5 Zener diode as voltage regulator. 1.6 Regulated power supply IC based on 78XX and 79XX series, 1.7 Introduction to BJT, 1.8 its input-output and	1. Semiconductor and its types 2. Concept of PN junction

		transfer characteristics, 1.9 BJT as a single stage CE amplifier, 1.10 frequency response and bandwidth.	

SW-1 SuggestedSessionalWork(SW):

a. Assignments:

- Explain forward biasing and reverse biasing of PN junction.
- Describe the application of rectifier.

ESC201.2: Understanding of Operational amplifier its construction working and its different types .

Approximate Hours

Item	ApproxHrs
Cl	10
LI	3
SW	1
SL	1
Total	15

SessionOutcomes (SOs)	LaboratoryInstruction (LI)	ClassroomInstruction (CI)	SelfLearning (SL)
SO2.1 Understanding of operational amplifier **SO2.2**Learn the working of OP-AMP as open loop and feedback circuit **SO2.3**Understandthe construction and working of OP-AMP as inverting non inverting amplifier **SO2.4** Understand the	1. study of operational amplifier as summing and differencial 2. study of OP-AMP as integrator and differentiator 3. Study of OP-AMP as inverting and non invertingamplifier	**Unit-2:Operational amplifier and its applications** 2.1 Introduction to operational amplifiers, 2.2 Op-amp input modes and parameters, 2.3 Op-amp in open loop configuration, 2.4 op-amp with negative feedback, 2.5study of practical op-amp IC 741, 2.6 inverting and noninverting amplifier 2.7 applications:	1. Concept of BJT as an amplifier 2. Concept of feedback circuit 3. Operation Of integrators and differentiators

different application of OP-AMP		summing and difference amplifier, 2.8 unity gain buffer, 2.9 comparator, 2.10 integrator and differentiator.	

SW-2 SuggestedSessionalWork(SW):

a. Assignments:

i. Theoretical Assignment related to different types of OP-AMP

ii. Explain the working principle of OP-AMP as inverting and Non inverting OP-AMP

a. MiniProject:

i. Draw a Poster of different operations of OP-AMP

ESC201.3: Explain the principle, construction and working of different timing circuits and oscillator with its types.

Approximate Hours

Item	ApproxHrs
Cl	11
LI	3
SW	1
SL	1
Total	16

SessionOutcomes (SOs)	**LaboratoryInstruction (LI)**	**ClassroomInstruction (CI)**	**SelfLearning (SL)**
SO3.1 Tostudy of timing circuits and their types **SO3.2** To understand the Design and Characteristic of Timing circuit **SO3.3** To learn about the Oscillator **SO3.3** To understand the Design and Characteristic of oscillator and its types.	1. study of Astable multi vibrator 2.study of R-C phase shift oscillator 3. study of Wein bridge oscillator	**Unit-3Timing Circuits and Oscillators** 3.1 RC-timing circuits, 3.2 Introduction to IC 555 3.3 IC 555 and its applications 3.4 IC 555astable 3.5 IC 555 mono-stable 3.6 multi-vibrators, 3.7 Introduction of oscillators 3.8 positive Feedback oscillators 3.9 Barkhausen's criteria for oscillation, 3.10 R-C phase shift 3.11 Wein bridge oscillator.	1. Significance of timing circuits 2. Uses of oscillator

SW-3 SuggestedSessionalWork(SW):

b. Assignments:

- **i.** Make a poster of IC 555 timer
- **ii.** explain different types of oscillators

ESC201.4: Explain the basic concepts of digital electronics,Boolean algebra, logic gates and different logic circuits

Approximate Hours

Item	Approx Hrs
Cl	15
LI	3
SW	1
SL	1
Total	20

SessionOutcomes (SOs)	LaboratoryInstruction (LI)	ClassroomInstruction (CI)	Self-Learning (SL)
SO4.1 Understand the building Blocksof digital electronics **SO4.2** Understand the building Blocks of Boolean algebra **SO4.3**Understand the concepts of logic gates and circuits **SO4.4**Understand the applications of logic gates and circuits	1.study of Microprocessor . 2. Study of Microcontroller 3.Identification of different logic gates.	**Unit-4 :Digital Electronics Fundamentals** 4.1 Difference between analog and digital signals, 4.2 Boolean algebra, 4.3 examples of Boolean algebra 4.4 examples of Boolean algebra 4.5 Basic and Universal Gates,Symbols, Truth tables, logic expressions, 4.6 Logic simplification using K- map, 4.7 Logic ICs, 4.8 half and fulladder 4.9 half and full subtractor, 4.10 multiplexers, de-multiplexers, 4.11 flip-flops and its types 4.12 shift registers,	1. Difference between analog electronics and digital electronics 2. Difference between logic gates and logic circuits

		4.13 counters, 4.14 Block diagram of microprocessorand their applications. 4.15 microcontroller and their applications.	

SW-4 **SuggestedSessionalWork(SW):**

a. Assignments:

i. Theoretical Assignments Based on Different types logic gates and circuits

ii. Numerical Problems Based on Boolean algebra

ESC201.5: Explain the principle of Electronics communication System its types and different modulation techniques

Approximate Hours

Item	ApproxHrs
Cl	13
LI	3
SW	1
SL	1
Total	18

SessionOutcomes (SOs)	**LaboratoryInstruction (LI)**	**ClassroomInstruction (CI)**	**Self-Learning (SL)**
SO5.1 Discussion about the communication system and its types **SO5.2**Understand the concept of modulation techniques **SO5.3**Understand the Building blocks of communication system	1.Study of Amplitude Modulation. 2. study of Frequency modulation 2.Study of AM and FM modulators	**Unit 5: Electronic Communication Systems** **5**.1intoduction of communication system 5.2 block diagram of communication system 5.3 The elements of communication system	1. Structure and operation of communication system 2. Types of communication system

SO5.4 Study of different types of modulation techniques,		5.4 IEEE frequency spectrum, 5.5 Transmission media: wired andwireless, 5.6 Introduction of Modulation 5.7 need of modulation, 5.8 types of modulation 5.9 Introduction to AM 5.10 Introduction FM modulation schemes, 5.11 Mobile communication systems: 5.12 cellular concepts 5.13 block diagram of GSM system.	

SW-5 SuggestedSessionalWork(SW):

a. Assignments:

i. Theoretical Assignment based on Different types of communication system

ii. explain different types of modulation techniques.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	LaboratoryInstruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
ESC201.1: Understanding of the concept of semiconductor materials, pnjunction,pn junction diodes and special purpose diodes.	10	3	1	1	15
ESC201.2: Understanding of Operational amplifier its construction working and its different types .	10	3	1	1	15
ESC201.3: : Explain the principle, construction and working of different timing circuits and oscillator with its types.	11	3	1	1	16
ESC201.4: Explain the basic concepts of digital electronics,Boolean algebra, logic gates and different logic circuits	15	3	1	1	20
ESC201.5: Explain the principle of Electronics communication System its types and different modulation techniques	13	3	1	1	18
Total Hours	59	15	5	5	84

Suggestion for End Semester Assessment

SuggestedSpecificationTable(ForESA)

CO	**UnitTitles**	**MarksDistribution**			**Total Marks**
		R	**U**	**A**	
CO-1	Semiconductor Devices and Applications	02	05	03	10
CO-2	Operational amplifier and its applications	04	06	00	10
CO-3	Timing Circuits and Oscillators	02	06	02	10
CO-4	Digital Electronics Fundamentals	03	07	00	10
CO-5	Electronic Communication Systems	03	05	02	10
Total		14	29	07	50

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

TheendofsemesterassessmentforProcess calculation willbeheldwith written examination of 50 marks

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

SuggestedInstructional/ImplementationStrategies:

1. ImprovedLecture
2. Tutorial
3. GroupDiscussion
4. Practical Demonstration of Instruments.
5. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,WhatApp,Mobile,Onlinesources)
6. Brainstorming

SuggestedLearningResources:

(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	Electronic Devices‖	Floyd,	Pearson Education	9th edition, 2012.
4	―Communication Electronics: Principles and Applications	Frenzel,	Tata Mc Graw Hill,	, 3rd Edition, 2001
5	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

Cos,PosandPSOsMapping

Course Title: B.Tech. Mechanical

Course Code : ESC201

CourseTitle: Basic Electronic Engineering

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	Conductinvestigationsofcomplexproblems	Modern Tool usage	The engineer and society	Environment and sustainability:	Ethics	Individual andteam work:	Communication:	Project management and finance:	Life-longlearning	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
CO.1: Understanding of the concept of semiconductor materials, pnjunction,pn junction diodes and special purpose diodes.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO.2: Understanding of Operational amplifier its construction working and its different types .	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
C0.3: : Explain the principle, construction and working of different timing circuits and oscillator with its types.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO.4: Explain the basic concepts of digital electronics,Boolean algebra, logic gates and different logic circuits	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO.5: Explain the principle of Electronics communication System its types and different modulation techniques	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3

Legend:1–Low,2–Medium,3– High

CourseCurriculumMap:

Pos&PSOs No.	CosNo.&Titles	SOsNo.	Laboratory Instruction(LI)	ClassroomInstruction(CI)	Self Learning(SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	**CO.1:** Understanding of the concept of semiconductor materials, pnjunction,pn junction diodes and special purpose diodes. .	SO1.1 SO1.2 SO1.3 SO1.4	1,2,3	Unit-1.0**Semiconductor Devices and Applications** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	As mentioned in Page number 2 to 6
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	**CO.2:** Understanding of Operational amplifier its construction working and its different types .	SO2.1 SO2.2 SO2.3 SO2.4	1,2,3	Unit-2.0 **Operational amplifier and its applications** 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 PSO1,2,3,4,	**C0.3: :** Explain the principle, construction and working of different timing circuits and oscillator with its types	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	1,2,3	Unit-3.0 : **Timing Circuits and Oscillators** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,3.11,	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	**CO.4:**Explain the basic concepts of digital electronics,Boolean algebra, logic gates and different logic circuits	SO4.1 SO4.2 SO4.3 SO4.4	1,2,3	Unit-4.0 : **Digital Electronics Fundamentals** 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	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	**CO.5:** Explain the principle of Electronics communication System its types and different modulation techniques	SO5.1 SO5.2 SO5.3 SO5.4	1,2,3	**Unit 5.0 :Electronic Communication Systems** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11,5.12 ,5.13	

Semester-III

Course Code:	BSC201
Course Title :	Engineering 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 :

CO1-BSC201.1 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.

CO2-BSC201.2 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.

CO3-BSC201.3 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.

CO4-BSC201.4 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**.**

CO5-BSC201.5- 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:

Board of Study	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			CI	**LI**	**SW**	**SL**	**Total Study Hours (CI+LI+SW+SL)**	
BSC	201	Engineering Mathematics III	4[3+1]	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

Board of Study	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	201	Engineering 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.

CO1- BSC201.1

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
CI	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	-	**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	SL.1 Apply the Cauchy-Riemann equations to verify the analyticity of a given function. SL.2 Explore the properties of trigonometric functions in the context of complex analysis SL.3 Define logarithmic functions and explore their behavior in the complex plane

integrals using the residue theorem.			

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. write the application of complex function.

ii. Properties of Complex Variables.

iii. Write all formula of complete unit.

b. Other Activities (Specify):

Quiz, Class Test.

CO2-BSC201.2

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
CI	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. **SO2.3** Apply contour integrals		**Unit-2.0** **Complex Variable (Integration)**. 2.1 Cauchy's integral formula for analytic function 2.2Questions of Cauchy's integral formula for simple poles. 2.3 2Questions of Cauchy's integral formula for order poles.	**SL.1** Apply contour integrals to evaluate complex integrals. **SL.2** Compute Taylor series expansions for given functions **SL.3** Define residues of complex functions and

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		2.4 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	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.

CO3-BSC201.3

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.** 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	**SL.1** Analyze compound probability involving multiple events **SL.2** Define and understand conditional probability **SL.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.

CO4-BSC201.4

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 4.10 Range 4.11 quartile deviation 4.12 standard deviation and its properties	**SL.1** Define mode and recognize its applications **SL.2** Understand the concept of unimodal, bimodal, and multimodal distributions **SL.3** Explore the relationships and patterns among the mean, median, and mode

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.

CO5-BSC201.5

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** Calculate and interpret Pearson's correlation coefficient. **SO5.4** Define and calculate		**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 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	**SL.1** Define regression analysis and understand its purpose in modeling relationships between variables **SL.2** Apply the method of least squares to fit straight lines, second-degree parabolas, and more general curves to datasets **SL.3** Test the difference between two proportions

rank correlation coefficients **SO5.5** Understand the use of rank correlation in cases where variables may not have a linear relationship		significance for small sample 5.12 Tutorial-2	

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-BSC201.1 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
CO2-BSC201.2 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
CO3-BSC201.3 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
CO4-BSC201.4 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

CO5-BSC201.5 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.	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	Complex Variable – Differentiation	03	03	04			10
CO-2	Complex Variable – Integration	05	04	01			10
CO-3	Probability and Random Variable	03	04	03			10
CO-4	Measures of Central Tendency and Measures of Dispersion	05	03	02			10
CO-5	Statistics	04	04	02			10
Total		20	18	12			50

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

The end of semester assessment for Engineering Mathematics III 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	Engineering Mathematics-III	D. K. Jain. Engineering	Shree Ram Prakashan.	1st edition, 2018
2	Engineering Mathematics-III	D.C.Agrawal	Shree Sai Prakashan	2022
3	Introduction to Engineering	H.K.Dass	S Chand Prakashan.	2nd edition, 2014
4	Engineering Mathematics-III	Sonendra Gupta	Dhanpat Rai Publishing	

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Cos,POs and PSOs Mapping

Course Title: ENGG.MATHEMATICS-III
Course Code: BSC201

Course Outcome	PO1 Advanced Mathematical Knowledge	PO2 Problem-solving Skills	PO3 Research Abilities	PO4 Quantitative Analysis	PO5 Teaching and Academia	PO6 Theoretical Understanding	PO7 Communication Skills	PO8 Operations Research	PO9 Application in Industry	PO10 Engineering and Technology	PO11 Government and Public Sector	PO12 Consulting	PSO 1 Mechanical System Design and Analysis	PSO 2 Manufacturing Processes and Automation	PSO 3 Computational Modeling and Simulation.	PSO 4 Product Innovation and development
CO1-BSC**201.1** Understand the importance of algebraic properties with regard to working within various number systems.	2	3	1	2	1	2	2	2	1	1	1	1	2	1	1	2
CO2-BSC201.2. Students will determine whether a given binary operation on the given set gives a group structure by applying the axioms.	1	3	2	1	1	1	1	1	1	2	3	1	3	1	1	1
CO3-BSC201.3. Students will be able to describe all elements in a cyclic subgroup by using generators.	1	3	2	2	1	1	3	2	1	1	3	1	2	1	2	
CO4-BSC201.4 Students will compute the expression of permutation groups by using permutation multiplication.	2	3	2	2	1	1	3	2	1	1	3	1	2	1	2	2
CO5-BSC201.5 Students will create the concept of a group action to real life problems such as Counting.	2	3	2	2	1	1	3	2	1	1	3	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)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO1-BSC**201.1** 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	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	SL1.1 SL1.2 SL1.3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO2-BSC201.2. 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	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	SL2.1 SL2.2 SL2.3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO3-BSC201.3. 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.	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	SL3.1 SL3.2 SL3.3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO4-BSC201.4 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 .	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	SL4.1 SL4.2 SL4.3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO5-BSC201.5. 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	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	SL5.1 SL5.2 SL5.3

Semester-III

Course Code: **ESC 202**

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.
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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 a 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:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week) CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	Total Credits (C)
Program Core (ESC)	ESC 202	Engineering Mechanics	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

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks) Progressive Assessment (PRA) 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)	End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
ESC	ESC 207	Engineering Mechanics	15	20	5	5	5	50	50	100

Practical

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV + AT)		
ESC	ESC202-L	Engineering mechanics-L	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 202.1: Understanding of term Mechanics and its classification.

Approximate Hours

Item	AppX Hrs
CI	9
LI	4
SW	2
SL	2
Total	17

Session Outcomes (SOs)	**LaboratoryInstruction (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	**1.** Numerical problem related to classification of mechanics **2.** Numerical problem related to basic laws

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Explain Newton 2nd law of motion and its application
2. Write the definition of basic term related to static and dynamic

ESC 202.2: Resolution and composition of force acting on the rigid body.. Approximate Hours

Item	AppX Hrs
Cl	13
LI	12
SW	0
SL	1
Total	26

Session Outcomes (SOs)	LaboratoryInstruction (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 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 SO4. 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.	**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 2.2 Pressure and Stress 2.3 Concept of free body diagram 2.4 Characteristics and Effects of a Force 2.5 System of Forces 2.6 Resolution of a Force 2.7 Composition of Forces, Resultant / Equilibrant Force, 2.8 Law of Parallelogram of Forces, 2.9. Law of Triangle of Forces, Polygon Law of Forces. 2.10 Lami's Theorem 2.11 Equilibrium of a Body Under Two / Three/More Than Three Forces 2.12. Law of Superposition of Forces. 2.13 Practice class	1. Numericals of resolution of forces 2. Numerical problem of Law of Parallelogram of Forces

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Derivation of lamis theorem and its numerical problem
2. Derivation of Parallelogram and its numerical

ESC 202.3: Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.

Approximate Hours

Item	AppX Hrs
Cl	11
LI	4
SW	2
SL	2
Total	19

Session Outcomes (SOs)	**LaboratoryInstruction (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. So.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** 3.1Introduction of system of forces 3.2 Moment of a force 3.3 Varignon'sTheorem 3.4 Resultant of Parallel Forces 3.5 Moment of a Couple 3.6 Resolution of Force into a Couple 3.7 Resultant of Coplanar,Non Con-Current Forces 3.8 Numericals on Moment 3.9 Numericals on Couple 3.10 Numericals on system of forces 3.11 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
   2. Explain the concept of couple

ESC 202.4: Compute the different types of load acting on a different types of beam.

Approximate Hours

Item	AppX Hrs
Cl	13
LI	4
SW	2
SL	2
Total	21

Session Outcomes (SOs)	LaboratoryInstruction (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. 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	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 4.5 Load on theBeam or Frame 4.6 Load on theBeam or Frame 4.7 Calculation of support reaction and its type 4.8 Support reaction calculation in cantilever beam 4.9 Support reaction calculation in simple supported beam 4.10 Concept of truss 4.11 Analysis of truss by	1. Numerical problem of support reaction calculation in cantilever beam and simply supported beam. 2. Numerical problem of truss analysis by joint method.

bridges and roofs. They rely on the framework of triangles to distribute loads efficiently.		analytical method (Joint method) 4.12 Analysis of truss by analytical method (Section method) 4.13 Practice class	

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   1. Classify Beams and Load acting on it.
   2. Explain types of truss.

ESC 202.5: Compute the centroid, second moment of area, center of gravity, moment of inertia and mass moment of inertia.

Approximate Hours

Item	AppX Hrs
Cl	14
LI	6
SW	1
SL	2
Total	23

Session Outcomes (SOs)	LaboratoryInstruction (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 5.4 Centroid of I section 5.5 Centroid of angle section 5.6 Centroid of channel	1. Numerical problem related to center of gravity 2. Numerical of MI of T section 3. Numerical of I section.

		section 5.7 Theorems ofMoment of Inertia 5.8 Radius of Gyration 5.9 Polar Moment of Inertia of Standard Sections 5.10 Moment of Inertia of Composite Section 5.11 Principal Moment of Inertia 5.12 Concept of mass moment of inertia 5.13 Mass moment of inertia of basic solid figures. 5.14 Practice class	

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**

1. 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 (SI)	Total hour (Cl+LI+SW+SI)
ESC 202.1: Understanding of term Mechanics and its classification	9	4	2	**2**	17
ESC 202.2: Understanding Resolution and composition of force acting on the rigid body.	13	12	0	**1**	26
ESC 202.3: Compute the resultant of force or different system of force and study of different laws related to different force System.	11	4	2	2	19
ESC 202.4: compute the different types of load acting on a different types of beam.	13	4	2	2	21
ESC 202.5: Compute the centroid, second moment of area, center of gravity, moment of inertia and mass moment of inertia	14	6	1	**2**	23
Total Hours	60	30	7	9	106

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	ESC 202.1: Understanding of term Mechanics and its classification	03	01	01	05
CO-2	ESC 202.2: Understanding Resolution and composition of force acting on the rigid body.	02	06	02	10
CO-3	ESC 202.3: 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	ESC 202.4: compute the different types of load acting on a different types of beam.	-	10	05	15
CO-5	ESC 202.5: Compute the centroid, second moment of area, center of gravity, moment of inertia and mass moment of inertia	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	Engineering Mechanics	Dr.R.K bansal	Laxmi Publicatio n(p) ltd.	4rth and 2016
2	Engineering mechanics	R.K Rajpoot	Laxmi Publication(p) ltd.	3rd and 2016
3	Engineering Mechanics: Statics & Dynamics	Russell C. Hibbeler	Pearson	14th Edition, 2015
4	*Engineering Mechanics*	*Timoshenko, and Young*	TMH	5th 2017
5	Training Manual			
6	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna .			

Curriculum Development Team

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Cos,POs and PSOs Mapping

Course Title: B. Tech Mechanical Engineering

Course Code : ESC 202

Course Title: Engineering Mechanics

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
CO1 : Understanding of term Mechanics and its classification	1	1	2	2	2	2	3	1	2	2	1	2	2	2	1	-
CO 2 : Understanding Resolution and composition of force acting on the rigid body.	1	2	2	2	1	2	2	1	1	1	2	3	2	2	2	1
CO3 : Compute the resultant of force for different system of force and study of different laws related to different force system.	2	2	1	1	2	2	2	1	1	2	1	2	2	1	2	2
CO 4: compute the different types of load acting on a different types of beam.	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2
CO 5: Compute the centroid, second moment of area, center of gravity, moment of inertia and mass moment of inertia	1	2	2	-	1	1	3	1	1	1	2	2	3	3	1	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	CO1 : Understanding of term Mechanics and its classification	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 Introduction to Mechanics 1.1,1.2,1.3,1.4,1.5,1.6,1.7	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2 : Understanding Resolution and composition of force acting on the rigid body.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2 Resolution and Composition of Forces 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, 3, 4, 5	CO3 : Compute the resultant of force for different system of force and study of different laws related to different force system.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 : System of forces 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, 5	CO 4: compute the different types of load acting on a different types of beam.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 : Beams and Trusses 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 5: Compute the centroid, second moment of area, center of gravity, moment of inertia and mass moment of inertia	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit 5: Center of gravity and moment of inertia 5.1,5.2,5.3,5.4,5.5	

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Semester-III

Course Code: PCC-ME-201

Course Title: MECHANICS OF DEFORMABLE SOLIDS

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:

ME 201.1 Apply elasticity principles to analyze and design structures, understanding stress-strain relationships, deformations, and temperature effects for practical engineering solutions."

ME 201.2 Analyze plane stresses using principal stresses, Mohr's circle, and transformations. Understand plain strain, principal strains, and combined loading in structures and pressure vessels.

ME 201.3 Develop shear force and bending moment diagrams for beams, understanding loading rate relationships and identifying maximum moments and contra flexure points.

ME 201.4 Derive flexural and shear formulas, analyze stress distribution, calculate slope and deflection using double integration method for standard cases.

ME 201.5 Analyze strain energy in axial loads, bending, torsion, determine torsion stresses, and study buckling of columns using Euler's and Rankine's formulas.

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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 course category) PCC	ME 201	MECHANICS OF DEFORMABLE BODIES	4	2	1	1	8	5

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	Coues Code	Course Title	Scheme of Assessment(Marks)							
			Progressive Assessment(PRA)						End Semester Assessment	Total Marks
			Class/HomeAssignment5number 3marks each (CA)	ClassTest 2 (2bestout of3) 10marks each(CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
(Professional course category)PCC	ME 201	MECHANICS OF DEFORMABLE BODIES	15	20	5	5	5	50	50	100

Practical

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV + AT)		
PCC	ME201-L	Mechanics of deformable solids-L	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.

ME 201.1: 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	10
LI	6
SW	2
SL	1
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room 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 To study the Universal Testing Machine 1.2 To perform the Tensile Test of Mild Steel on U.T.M and To Draw Stress–Strain Curve. 1.3 To determine strength of wood on U.T.M (i) Along the Grain (ii) Across the Grain.	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. 1.10 Temperature stresses in simple members.	1. Stresses and strains determinate and indeterminate unde concentrated loads.

SW-1Suggested Sessional Work (SW):

a. Assignments:

1. **Stresses and strains in determinate and indeterminate bars under self weight**

ME 201.2: 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
CI	12
LI	6
SW	1
SL	2
Total	21

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 To determine shear strength of Mild Steel on U.T.M. 2.2 To observe Flexural Behavior of Timber specimen and to determine it's strength under transverse loading on U.T.M. 2.3 To study the Impact Testing Machine and test specimen of Izod and Charpy	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 Numerical solving 2.7 Plain strain and its Mohr's circle representation 2.8 Principal strains, 2.9 Maximum shear strain. 2.10 Combined Loading: Components subjected to bending, torsion & axial loads. 2.11 Analysis of thin pressure vessels. 2.12 Numerical solving	1. Maximum shear strain

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SW-2 Suggested Sessional Work (SW):

a. **Assignments:** Plain strain and its Mohr's circle representation

ME 201.3: Develop shear force and bending moment diagrams for beams, understanding loading rate relationships and identifying maximum moments and contra flexure points.

Approximate Hours

Item	Appx Hrs
Cl	8
LI	6
SW	1
SL	1
Total	16

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 To determine Izod and Charpy Value of the given mild steel specimen. 3.2 To study the Fatigue Testing Machine and to discuss the procedure to find out endurance limit of given material. 3.3 To study the Spring Testing Machine.	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 3.7 Relationship between rate of loading, shear force and bending moment. 3.8 Maximum bending moment and position of points of contra flexure	1. Shear force and bending moment diagrams for statically determinate beam due to uniformly varying load

SW-3Suggested Sessional Work(SW):

a. **Assignments:**

i.

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ME 201.4: 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	9
LI	6
SW	1
SL	1
Total	17

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. SO4.4 Calculate second moment for various cross sections, stress diagrams. SO4.5 Explore shear stresses, connections between flange and web.	4.1To study the Rockwell Hardness Testing Machine and to determine the Rockwell Hardness of the given material. 4.2 To study the Brinell Hardness Machine and to determine the Brinell hardness of the given material. 4.3 To study the Vickers Hardness Machine and to conduct a test on the machine.	**UNIT-4.0** **4.1** Theory of simple bending, assumptions 4.2 Derivation of flexural formula, Second moment of area of common cross sections (rectangular, I,T,C) with respect to centroidal and parallel axes ,4.3 bending stress distribution diagrams, moment of resistance and section modulus. **4.4 Shear stresses:** Concept, derivation of shear stress distribution formula, shear 4.5 stress distribution diagrams for common symmetrical sections, 4.6 maximum and average shears stresses, shear connection between flange and web. **4.7Slope and deflection of beams:** Relation between bending moment and slope, slope and deflection of 4.8determinate beams, double integration method (Macaulay's method), derivation of formula for slope and deflection for standard cases.	1. SFD BMD diagram

SW-4Suggested Sessional Work (SW):

a. **Assignments: numerical problem**

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ME 201.5 Analyze strain energy in axial loads, bending, torsion, determine torsion stresses, and study buckling of columns using Euler's and Rankine's formulas.

Item	AppX Hrs
Cl	9
LI	6
SW	1
SL	1
Total	17

17

Session Outcomes **(SOs)**	**Laboratory Instruction** **(LI)**	**Classroom Instruction** **(CI)**		
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 To study the Torsion Testing Machine 5.2 To determine ultimate shear stress and modulus of rigidity under Torsion. 5.3 To determine modulus of rigidity for the material of open and closed Coiled Helical Spring Subjected to Axial Load by spring testing machine.	**5.1Strain energy:** Strain energy due to gradual load **5.**2 Strain energy due to sudden load **5.**3 Strain energy due to impact load, **5.**4 Strain energy due to bending and torsion. **5.5 Torsion:** Stresses, strain and deformations in determinate shafts of solid and hollow, 5.6 homogeneous and composite circular cross section subjected to twisting moment, derivation of torsion equation, stresses due to combined torsion, bending and axial force on shafts. **5.7 Buckling of columns:** Concept of buckling of columns, derivation of Euler's formula for buckling 5.8 loads for column with hinged ends, concept of equivalent length for various end conditions, limitations of 5.9 Euler's formula, Rankine's formula, safe load on columns.	1.	

SW-5Suggested Sessional Work (SW):

a. Assignments:

1. Numerical problem

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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)
Apply elasticity principles to analyze and design structures, understanding stress-strain relationships, deformations, and temperature effects for practical engineering solutions."	9	6	**2**	1	18
Analyze plane stresses using principal stresses, Mohr's circle, and transformations. Understand plain strain, principal strains, and combined loading in structures and pressure vessels.	14	6	**1**	2	23
Develop shear force and bending moment diagrams for beams, understanding loading rate relationships and identifying maximum moments and contra flexure points.	12	6	1	1	20
Derive flexural and shear formulas, analyze stress distribution, calculate slope and deflection using double integration method for standard cases.	10	6	1	1	18
Analyze strain energy in axial loads, bending, and torsion, determine torsion stresses, and study buckling of columns using Euler's and Rankine's formulas.	15	6	**1**	1	23
Total Hours	60	30	**6**	6	102

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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 Mechatronics 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:

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

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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

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Cos,POsandPSOsMapping

Course Title: B.Tech. Mechanical

Course Code : ME 201

Course Title: Mechanics of Deformable bodies

Course Outcomes	ProgramOutcomes												ProgramSpecificOutcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problemanalysis	Design/developmentofsolutions	Conductinvestigationsofcomplexproblems	Moderntoolusage	Theengineerandsociety	Environment and sustainability:	Ethics	Individualandteamwork:	Communication:	Project management and finance:	Life-longlearning	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
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	3	1
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	2	1
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	2	2

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	3	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.**	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	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 PSO1,2,3,4,5	**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	As mentioned in Page number 2 to 6
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	**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, 2.8,2.9,2.10,2.11,2.12,2.13,2.14	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	**CO 3: Develop shear force and bending moment diagrams for beams, understanding loading rate relationships and identifying maximum moments and contra flexure points.**	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3.0 : **Shear Force and Bending Moment Diagrams** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,3.11, 3.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	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	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	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:** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11,5.12 ,5.13,5.14,5.15	

Semester-III

Course Code: **BSC106-AU**

CourseTitle: **EnvironmentalScience(Audit)**

Pre-requisite: Tostudythiscourse,thestudentmusthaveaknowledgeabouttheenvironmental components,pollution,biodiversityandecosystematseniorsecondary,Class12thlevel .

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, knowledgeofthelegalconcepts,proceduresandtechniqueswhichhaveevolved. 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.

CourseOutcomes:

BSC106-AU.1: Gain an understanding of the fundamental principles and components of environmentalauditing.

BSC106-AU.2: Traininconductinganenvironmentalauditinanyorganization/institution

BSC106-AU.3: Implement criticalthinkingtoward environmentalproblems andformulatelocalsolutions for their Mitigation.

BSC106-AU.4: Develop,Implement,maintainandAuditEnvironmentalManagementsystemsforOrganizations.

BSC106-AU.5: Forenvironmentalprotection,socialequityandsustainabledevelopment

SchemeofStudies:

Course Category	CourseCode	CourseTitle	Schemeofstudies(Hours/Week)					TotalCredits (C)
			CI	LI	SW	SL	TotalHours(CI+LI+SW+SL)	
BSC	BSC106-AU	Environmental Science(Audit)	2	0	1	1	4	2

Legend:CI: ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)andothers),**LI:**LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop, field or other locations using different instructional strategies),SW**:** Sessional Work(includesassignment, seminar, miniprojectetc.),**SL:**SelfLearning,**C:**Credits.

Note: SW&SLhastobeplannedandperformedunderthecontinuousguidanceand feedback ofteacherto ensureoutcomeofLearning.

SchemeofAssessment:

Theory

CourseCategory	CourseCode	CourseTitle	SchemeofAssessment(Marks)							
			ProgressiveAssessment(PRA)						EndSemesterAssessment (ESA)	TotalMarks(PRA+ESA)
			Class/HomeAssignment5 number 3 marks each (HA)	ClassTest2(2bestoutof 3)10 marks each (CT)	Seminarone(TSN)	ClassActivityanyone (TCA)	ClassAttendance(TA)	Total Mark (HA+CT+TSN+TCA+TA)		
BSC	BSC106-AU	Environmental Science(Audit)	15	20	5	5	5	50	50	100

Course-CurriculumDetailing:

Thiscoursesyllabusillustratestheexpectedlearningachievements,bothatthecourseandsessionlevels, 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.

BSC106-AU.1:Gainanunderstandingofthefundamentalprinciplesandcomponentsof environmental auditing.

ApproximateHours

Item	Appx.Hrs
CI	07
LI	0
SW	1
SL	2
Total	10

SessionOutcomes (SOs)	LaboratoryInstruction(LI)	ClassroomInstruction (CI)	SelfLearning (SL)

SO1.1 Understandairpollutionand its sources. **SO1.2** Knowabout gaseousand particulate pollutants. **SO1.3** Observethesourcesofwater pollution. **SO1.4** Learnaboutwater quality parameter. **SO1.5** Evaluatetheeffectsofnoise pollution.		**Unit-1 Industrial pollution and its mitigation** Air Pollution: Sources, classification of air pollutants Mitigation and controlmeasures of Particulate matters and gaseous pollutants Water Pollution: sources, classification Waterqualityparameters, Control measures of water pollution Soil pollution and impacts, soil conservation, Noisepollution:sources,effects and control measures.	1. Difference betweenpollution and pollutants. 2. Water quality standards.

SW-1SuggestedSessionalWork(SW):

a. Assignments:

i. Classifytheairpollutantsondifferentbasis.

ii. Describecontrolmeasuresof noisepollution.

b. MiniProject:

i. EnlistthePPEswhichusedtominimizetheeffectsofnoisepollution.

c. OtherActivities(Specify):

ii. Measuretheair qualityofdifferentplacesbyusingSammerApp.

BSC106-AU.2:Traininconductinganenvironmentalauditinanyorganization/institution

ApproximateHours

Item	Appx.Hrs
CI	6
LI	0
SW	1
SL	1
Total	08

SessionOutcomes (SOs)	LaboratoryInstruction (LI)	ClassroomInstruction (CI)	SelfLearning (SL)

SO2.1 Know about the environmental acts. **SO2.2** TolearnaboutWater Pollutionact. **SO2.3** Tounderstandtheair Pollution Act. **SO2.4** To discuss about Environmental protection act **SO2.5** To learn about the waste managementact.		**Unit-2EnvironmentalLawandPolicy** Highlights of the Environmental Acts, Institutional arrangements for The water (Prevention & Control of pollution) Act 1974, The Air (Prevention & Control of pollution) Act 1981 The Environmental ProtectionAct 1986, ThewastemanagementAct1996 The National Green Tribunal Act 2010.	i.Whatisthedifference betweenlaw andpolicies?

SW-2SuggestedSessionalWork(SW):

a. **Assignments:**
   i. Mentionthemeasureprovisionsofairpollutioncontrolact.
   ii. Describewastemanagement act.

BSC106-AU.3:Implement critical thinking toward environmental problems and formulate local solutions for their Mitigation

ApproximateHours

Item	Appx,Hrs
CI	06
LI	0
SW	1
SL	1
Total	8

SessionOutcomes (SOs)	LaboratoryInstruction (LI)	ClassroomInstruction (CI)	SelfLearning (SL)
SO3.1 KnowaboutISO14000& 14001 **SO3.2** LearnapplicationsofEMS **SO3.3** Knowthemethodsof EIA **SO3.4**		**Unit-3:Environmental ManagementSystem** **3.1** ISO14000-EMSasper ISO 14001– benefits and barriers of EMS **3.2** Concept of continual improvement and pollution prevention, **3.3** Applications ofEMS, Environmental	ISOCertification

Applythemethodsof EIA **SO3.5** Discussaboutsustainable development.		Managementplan. Introduction and Principle – purpose of EIA Sustainable development and EIA The EIA Process – methodologies and practice.	

SW-3SuggestedSessionalWork(SW):

a. **Assignments:**
   i. MethodsofEIA
   ii. ApplicationsofEMS
   iii. EnvironmentalManagementPlan
b. **MiniProject:**StudytheEIAreportsofdifferentdevelopmentalProjectsandcreateaEIAreport for cement plant.

BSC106-AU.4: Develop,Implement,maintainandAuditEnvironmentalManagementsystemsfor Organizations.

ApproximateHours

Item	Appx,Hrs
CI	5
LI	0
SW	1
SL	1
Total	7

SessionOutcomes (SOs)	**LaboratoryInstruction (LI)**	**ClassroomInstruction (CI)**	**Self Learning (SL)**
SO4.1 Defineenvironmental auditing. **SO4.2** KnowtheScopesof Environmentalauditing. **SO4.3** Learntheobjectivesof environmental auditing. **SO4.4**		**Unit-4:EnvironmentalAudit-Scope and Requisites** Introduction to Environmental Auditing, Objectives and scope, Types, Basic structure of Environmental Auditing, General Audit Methodology Elements of Audit Process:coverage- GOI notification on environmental audit- benefits to industry. Reporting environmental audit findings- Importanceofenvironmentalaudit	i.Basic introduction of environmental auditing.

Applythemethodsof Auditing. **SO4.**5 Create the auditing reports.		reporttoindustry,publicandthe government.	

SW-4 **SuggestedSessionalWork(SW):**

a. **Assignments:**
   i. Objectives,scope&Typesofenvironmentalauditing.
b. **OtherActivities(Specify):**Createanenvironmentalauditreportforcementplant.

BSC106-AU.5:**Forenvironmentalprotection,socialequityandsustainabledevelopment**

ApproximateHours

Item	Appx,Hrs
CI	6
LI	0
SW	1
SL	1
Total	8

SessionOutcomes (SOs)	**LaboratoryInstruction (LI)**	**ClassroomInstruction (CI)**	**Self Learning (SL)**
SO5.1 Knowabout 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.**5Createreport ofEnergyaudit.		**Unit5:ToolsandTechniquesfor EnvironmentalAuditing** **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 CycleAssessment (LCA) **5.5**BriefaboutWateraudit **5.6**BriefaboutEnergyaudit	1. How to prepare audit report of Energy, waterand Waste

SW-5SuggestedSessionalWork(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).

BriefofHourssuggestedfortheCourseOutcome

CourseOutcomes	Class Lecture(CI)	Laboratory Instruction(LI)	Sessional Work(SW)	Self Learning(Sl)	Total hour(CI+SW+Sl)
BSC106-AU.1:Gainanunderstanding of the fundamental principles and componentsofenvironmental auditing	7	-	1	2	10
BSC106-AU.2: Train in conductingan environmental audit in any organization/ institution	6	-	1	1	8
BSC106-AU.3:Implement critical thinking toward environmental problemsandformulatelocal solutionsfortheirMitigation	6	-	1	1	8
BSC106-AU.4:Develop, Implement, maintain and Audit Environmental Management systems for Organizations	5	-	1	1	7
BSC106-AU.5:Forenvironmental protection, social equity and sustainable development	6	-	1	1	8
TotalHours	30	0	5	6	41

SuggestionforEndSemesterAssessment

SuggestedSpecificationTable(ForESA)

CO	UnitTitles	MarksDistribution			Total Marks
		R	U	A	
CO-1	Gainanunderstandingofthefundamentalprinciplesand componentsofenvironmentalauditing.	03	01	01	05
CO-2	Traininconductinganenvironmentalauditinany organization/ institution	02	06	02	10
CO-3	Implement critical thinking toward environmental problemsandformulatelocalsolutionsfortheirMitigation	03	07	05	15
CO-4	Develop,Implement,maintainandAuditEnvironmental Management systems for Organizations.	-	10	05	15
CO-5	Forenvironmentalprotection,socialequityandsustainable development	03	02	-	05
Total		11	26	13	50

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

TheendofsemesterassessmentforIntroductiontoPortlandcementwillbeheldwithwrittenexaminationof50 marks

Note.DetailedAssessmentrubricneedtobepreparedbythecoursewiseteachersforabovetasks.
Teacherscanalsodesigndifferenttasksasperrequirement,forendsemesterassessment.

SuggestedInstructional/ImplementationStrategies:

- **(a)** ImprovedLecture
- **(b)** Tutorial
- **(c)** CaseMethod
- **(d)** GroupDiscussion
- **(e)** RolePlay
- **(f)** Visittocementplant
- **(g)** Demonstration
- **(h)** ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
- **(i)** Brainstorming

SuggestedLearningResources:

Books

S.No.	Title	Author	Publisher	Edition&Year
1	EnvironmentalHealthandSafety Audits:ACompendiumofThoughts and Trends	Cahill,L.B	BernanPress.	2017
2	HandbookofEnergyAudits	Thuman,A., Niehus, T., Younger,W.J.	RiverPublishers	2012
3	Environmental Audits. Mercury Learning & Information.	Taylor and Francis Van Guilder,C.V.,	MercuryLearning and Information	2014
4	AGuidetoLocalEnvironmental Auditing	Barton,H.,and Bruder N.,	Routledge	1993
5	LecturenoteprovidedbyDept.ofEnvironmentalScience,AKSUniversity,Satna.			

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AK S University

FacultyofEngineeringandTechnology

DepartmentofCementTechnology

CurriculumofB.Tech.(CementTechnology)Program

(Revisedas on01August2023)

Cos.PosandPSOs Mapping

ProgramTitle:B.TechCementTech **CourseCode:BSC106-AU** **CourseTitle:EnvironmentalScience(Audit)**

CourseOutcomes	ProgramOutcomes												ProgramSpecificOutcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineeringknowledge	Problemanalysis	Design/developmentof solutions	Conductinvestigationsofcomplex problems	Moderntoolusage	Theengineerand society	Environmentand sustainability	Ethics	Individualandteamwork	Communication	Projectmanagementandfinance	Life-longlearning	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
CO-1: Gain an understanding of the fundamental principles and components of environmental auditing	1	3	2	2	2	3	3	2	2	2	2	3	2	3	2	3
CO-2:Traininconductinganenvironmental audit in any organization/ institution	3	3	3	3	1	2	3	3	2	2	2	3	3	2	3	3
CO-3: Implement critical thinking toward environmentalproblemsandformulatelocal solutions for their Mitigation	3	2	3	2	2	1	3	2	2	2	2	3	3	2	3	3
CO-4: Develop, Implement, maintain and Audit Environmental Management systems for Organizations	3	3	2	2	2	2	3	3	2	2	2	2	2	3	3	3
CO-5: For environmental protection, social equity and sustainable development	3	3	3	3	2	3	3	3	2	2	2	2	3	3	3	3

Legend:1–Low,2–Medium,3–High

CourseCurriculumMap:EnvironmentalScience(Audit)

POs&PSOsNo.	COsNo.&Titles	SOsNo.	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self Learning(SL)
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	**CO-1**:Gainanunderstandingofthe fundamentalprinciplesandcomponents ofenvironmentalauditing	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0Gainanunderstandingofthe fundamentalprinciplesand components of environmental auditing. 1.1,1.2,1.3,1.4,1.5,1.6,1.7	Asmentioned, inabovepages
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	**CO-2**: Train in conducting an environmental audit in any organization/ institution	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2Traininconductingan environmental audit in any organization/ institution 2.1,2.2,2.3,2.4,2.5,2.6,	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	**CO-3**:Implement critical thinking toward environmental problems and formulate local solutions for their Mitigation	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3:Implement critical thinking towardenvironmentalproblemsand formulate local solutions for their Mitigation 3.1,3.2,3.3,3.4,3.5,3.6	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	**CO-4**:Develop,Implement,maintainand Audit Environmental Management systemsforOrganizations	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4:Develop,Implement, maintainandAuditEnvironmental Managementsystemsfor Organizations. 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	**CO-5**:Forenvironmentalprotection, socialequityandsustainabledevelopment	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit5:Forenvironmentalprotection, social equityandsustainable development 5.1,5.2,5.3,5.4,5.5,5.6	

Semester-IV

Course Code: **PCC-ME 206**

Course Title: **Engineering Materials and Applications**

Pre-requisite: Prior knowledge in chemistry, physics, math, and introductory engineering principles is required for Engineering Materials and Applications.

Rationale: Understanding foundational concepts in chemistry, physics, math, and engineering is crucial for comprehending the complexities of material behavior and selection in Engineering Materials and Applications. This prerequisite ensures students possess necessary background knowledge to engage effectively with course content and applications.

Course Outcomes:

PCC- ME 206.1: Students will apply diverse material properties to engineering applications, considering cost and standards adherence.

PCC- ME 206.2: Students will conduct and interpret mechanical tests, including tension, compression, fatigue, and hardness, while understanding key concepts like Young's modulus and yield strength, including an introduction to non-destructive testing techniques.

PCC- ME 206.3: Students will learn about diverse materials, including steel, copper, aluminum, nickel-based alloys, and titanium, and their heat treatment techniques for enhancing properties in engineering applications..

PCC- ME 206.4: Students will comprehend classification, applications, polymerization, properties, and applications of polymers, ceramics, composites, and advanced materials.

PCC- ME 206.5: Students will analyze properties, applications, and types of conducting, semiconducting, magnetic, superconducting, dielectric, and smart materials..

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Scheme of Studies:

Board of Study	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)	PCC- ME 206	Engineering Materials and Applications	4	0	1	1	6	4

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

Board of Study	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 (2bestout of3) 10marks each(CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
Program Core (PCC)	**PCC-ME 206**	**Engineering Materials and Applications**	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.

PCC- ME 206.1 Students will apply diverse material properties to engineering applications, considering cost and standards adherence.

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)
SO1.1 Students will classify materials and analyze their physical, mechanical, thermal, electrical, and chemical properties, along with costs. **SO1.2** Students will understand the range of applications for metals, plastics, ceramics, and composites, considering material designation and Ashby Diagrams. **SO1.3** Students will evaluate selection criteria and processes for metals, enhancing understanding of material behavior and application suitability.	.	**Unit-1.0 Engineering Materials and Classification** 1.1 Metals, plastics, ceramics and composites. 1.2 Physical properties of metals, plastics, ceramics and composites 1.3 Mechanical properties of metals, plastics, ceramics and composites 1.4 Thermal properties of metals, plastics, ceramics and composites 1.5 Electrical properties of metals, plastics, ceramics and composites 1.6 Chemical properties of metals, plastics, ceramics and composites 1.7 Cost of metals, plastics, ceramics and composites 1.8 Range of applications. 1.9 Material designation and standards. 1.10 Ashby Diagrams 1.11 Selection criteria of metals 1.12 Process of metals	1.1 Nano materials Exploration 1.2 Sustainable Materials

SW-1Suggested Sessional Work (SW):

a) Assignments:

1. Ashby Diagrams Application in Material selection.
2. Chemical Properties Comparison and Impact on Applications

PCC- ME 206.2: Students will conduct and interpret mechanical tests, including tension, compression, fatigue, and hardness, while understanding key concepts like Young's modulus and yield strength, including an introduction to non-destructive testing techniques.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	2
SL	2
Total	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO2.1 Students will conduct and interpret tensile, compression, torsion, fatigue, fracture, and wear tests, understanding material behavior. **S02.2** Students will analyze Young's modulus, stress-strain relationships, Hooke's law, yield strength, ductility, resilience, and toughness. **SO2.3** Students will assess hardness, SN curves, endurance limits, and NDT principles, enhancing materials testing proficiency.	.	**Unit-2.0 Mechanical Properties and Testing** 2.1 Tensile and compression test 2.2 Torsion and Fatigue test 2.3 Fracture and Wear test. 2.4 Young’s modulus 2.5 Relations between true and engineering stress-strain curves 2.6 Generalized Hooke’s law 2.7 Yielding and yield strength 2.8 ductility, resilience, toughness and elastic recovery 2.9Hardness measurement their relation to strength 2.10 SN curve 2.11 endurance and fatigue limits 2.12 Introduction to non-destructive testing (NDT).	2.1Wear Resistance2.2 Material Hardness

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Ductility, Resilience, Toughness and Elastic Recovery Evaluation.
2. Hardness, Measurement Techniques and Strength Correlation Study.

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PCC- ME 206.3 Students will learn about diverse materials, including steel, copper, aluminum, nickel-based alloys, and titanium, and their heat treatment techniques for enhancing properties in engineering applications.

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)**
SO3.1 Students will classify metal alloys and understand their compositions, including iron, steel, stainless steel, and tool steels. **SO3.2** Students will analyze copper alloys, aluminum alloys, nickel-based superalloys, and titanium alloys, considering phase diagrams and microstructures. **SO3.3** Students will comprehend heat treatment processes like annealing, tempering, normalizing, case hardening, and various hardening techniques.	.	Unit-3.0 : Metal ,Alloys and Heat Treatment 3.1 Iron and steel; Stainless steel and tool steels 3.2 Copper & its alloys – brass, bronze & cupro-nickel 3.3 Aluminium & Al-Cu-Mg alloys 3.4 Nickel based superalloys & Titanium alloys 3.5 Phase diagrams and interpretation of microstructure 3.6 Iron-carbide phase diagram and cooling (TTT) diagrams 3.7 Heat treatment of Steel; Annealing, tempering, normalizing 3.8 Spheroidising, austempering, martempering 3.9 case hardening, carburizing 3.10 nitriding, cyaniding, carbo-nitriding 3.11 flame and induction hardening 3.12 vacuum and plasma hardening	1. Phase Diagrams 2. Carbide Phase

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SW-3Suggested Sessional Work (SW):

a. Assignments:

1. Aluminum Alloys and Their Mechanical Properties Analysis
2. Superalloys vs. Titanium Alloys: Strengths and Limitations Contrast

PCC- ME 206.4: Students will comprehend classification, applications, polymerization, properties, and applications of polymers, ceramics, composites, and advanced materials.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	2
SL	2
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO4.1 Students will classify polymers, understanding their applications and polymerization techniques. **SO4.2** Students will analyze ceramics, including oxide ceramics, ceramic insulators, bio-ceramics, and glasses. **SO4.3** Students will comprehend composites, including reinforcement, matrix, ceramic, and polymer composites, and other advanced materials like biomaterials, optical materials, and nanomaterials.	.	**Unit-4.0:Polymers, Ceramics and Composites** 4.1 Polymers – Classification and applications 4.2 Polymerization Techniques 4.3 Ceramics – Oxide ceramics 4.4 ceramic insulators. 4.5 bio-ceramics and Glasses 4.6 Composites – Reinforcement, matrix, metal matrix composites 4.7 ceramic composites 4.8 polymer composites 4.9 Other Advanced materials – biomaterials 4.10 optical materials 4.11 high temperature materials 4.12 energy materials, And nano materials.	1. Polymer Basics 2. Ceramic Insights

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SW-4Suggested Sessional Work (SW):

a. **Assignments:**
1. Ceramic Properties Analysis: Focus on Oxide Ceramics.
2. Ceramic Insulators: Characteristics and Uses Examination.

PCC- ME 206.5: Students will analyze properties, applications, and types of conducting, semiconducting, magnetic, superconducting, dielectric, and smart materials.

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO5.1 Students will classify conducting, resisting, semiconducting, and magnetic materials, understanding their properties and applications. **SO5.2** Students will analyze superconductors, dielectric materials, and smart materials, grasping their properties and applications in sensors and actuators. **SO5.3** Students will comprehend piezoelectric, magnetostrictive, and electrostrictive materials, enhancing understanding of their functionalities and applications.		**Unit 5.0 Electrical and Magnetic Materials** 5.1 Conducting and resisting materials – types 5.2 Conducting and resisting materials – properties 5.3 Conducting and resisting materials – applications 5.4 Semiconducting materials – properties 5.5 Semiconducting materials – applications 5.6 Magnetic materials – Soft and hard magnetic materials 5.7 Magnetic materials –applications 5.8 Superconductors and dielectric materials – properties 5.9 Superconductors and dielectric materials – applications 5.10 Smart materials; Sensors and actuators 5.11 Piezoelectric, magnetostrictive 5.12 electrostrictive materials	1. Smart Material Basics 2. Sensor Technology

SW-5 Suggested Sessional Work(SW):

a. **Assignments:**
1. Soft vs. Hard Magnetic Materials: Magnetic Properties and Applications Comparison
2. Applications of Conducting and Resisting Materials in Various Industries: Case Studies and Examples Examination

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Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
PCC- ME 206.1: Students will apply diverse material properties to engineering applications, considering cost and standards adherence. .	12	2	1	15
PCC- ME 206.2: Students will analyze properties, applications, and types of conducting, semiconducting, magnetic, superconducting, dielectric, and smart materials.	12	2	2	16
PCC- ME 206.3: Students will learn about diverse materials, including steel, copper, aluminum, nickel-based alloys, and titanium, and their heat treatment techniques for enhancing properties in engineering applications.	12	2	1	15
PCC- ME 206.4: Students will comprehend classification, applications, polymerization, properties, and applications of polymers, ceramics, composites, and advanced materials	12	2	2	16
PCC- ME 206.5 Students will analyze properties, applications, and types of conducting, semiconducting, magnetic, superconducting, dielectric, and smart materials.	12	1	1	14
Total Hours	60	9	7	76

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Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Engineering Materials and Classification**	05	03	02	10
CO-2	**Mechanical Properties and Testing**	04	03	03	10
CO-3	**Metal ,Alloys and Heat Treatment**	04	04	02	10
CO-4	**Polymers, Ceramics and Composites**	04	04	02	10
CO-5	**Electrical and Magnetic Materials**	05	05	-	10
Total		22	19	09	50

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

The end of semester assessment for **Engineering Materials and Applications** 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. Visit to cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog , Face book, Twitter, Whets-app, Mobile, Online sources)
9. Brainstorming

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Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher
1	Materials Science & Engineering	W. D. Callister	Wiley India, 2014
2	Engineering Materials	K. G. Budinski and M.K. Budinski	PHI India, 2002
3	Material Science and Engineering	V. Raghavan	PHI India, 2015
4	Engineering Materials and Metallurgy	U. C. Jindal	Pearson, 2011

Curriculum Development Team

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Cos, Pos and PSOs Mapping

Course Title: B.Tech. Mechanical
Course Code : PCC- ME 206
Course Title: Engineering Materials and Applications

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/developmentof solutions	Conductinvestigations of complex problems	Modern Tool usage	The engineer andsociety	Environment and sustainability:	Ethics	Individual andteamwork:	Communication:	Project management and finance:	Life-longlearning	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
C01 Students will apply diverse material properties to engineering applications, considering cost and standards adherence.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO 2 : Students will analyze properties, applications, and types of conducting, semiconducting, magnetic, superconducting, dielectric, and smart materials..	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3 : Students will learn about diverse materials, including steel, copper, aluminum, nickel-based alloys, and titanium, and their heat treatment techniques for enhancing properties in engineering applications.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO4: Students will comprehend classification, applications, polymerization, properties, and applications of polymers, ceramics, composites, and advanced materials	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO5: Students will analyze properties, applications, and types of conducting, semiconducting, magnetic, superconducting, dielectric, and smart materials.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	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 PSO1,2,3,4,	CO-1: Students will apply diverse material properties to engineering applications, considering cost and standards adherence.	SO1.1 SO1.2 SO1.3		**Unit-1.0 Engineering Materials and Classification** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11,1.12	As mentioned in Page number 2 to 6
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	CO 2 : Students will analyze properties, applications, and types of conducting, semiconducting, magnetic, superconducting, dielectric, and smart materials..	SO2.1 SO2.2 SO2.3		**Unit-2.0 Mechanical Properties and Testing** 2.1,2.2,2.3,2.4,2.5,2.6,2.7, 2.8,2.9,2.10,2.11,2.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	CO3: Students will learn about diverse materials, including steel, copper, aluminum, nickel-based alloys, and titanium, and their heat treatment techniques for enhancing properties in engineering applications.	SO3.1 SO3.2 SO3.3		**Unit-3.0 : Metal ,Alloys and Heat Treatment** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,3.11,3.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	CO4: Students will comprehend classification, applications, polymerization, properties, and applications of polymers, ceramics, composites, and advanced materials	SO4.1 SO4.2 SO4.3		**Unit-4.0: Polymers, Ceramics and Composites** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10,4.11,4.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	CO5: Students will analyze properties, applications, and types of conducting, semiconducting, magnetic, superconducting, dielectric, and smart materials.	SO5.1 SO5.2 SO5.3		**Unit 5.0 Electrical and Magnetic Materials** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11, 5.12	

Semester-IV

Course Code: **PCC- ME 203**

Course Title : **FLUID MECHANICS AND HYDRAULIC MACHINES**

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:

PCC- ME 203.1: Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).

PCC- ME 203.2: Analyze fluid motion using Lagrangian/Eulerian methods, study flow lines and particle acceleration.

PCC- ME 203.3: Apply Euler's/Bernoulli's equations, understand Venturimeter, Orifice meter, and implications of momentum equations.

PCC- ME 203.4: Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena.

PCC- ME 203.5: Master boundary layer theory, friction factors, and separation control, plus dimensional analysis methods and model laws in fluid dynamics.

Scheme of Studies:

Board ofStudy	**Course Code**	**CourseTitle**	**Scheme of studies(Hours/Week)**					**TotalCredits (C)**
			CI	**LI**	**SW**	**SL**	**Total StudyHours(CI +LI+SW+SL)**	
Program Core (PCC)	PCC-ME203	**Fluid Mechanics and Hydraulic Machines**	4	2	1	1	8	5

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.

SchemeofAssessment: Theory

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks)							
			Progressive Assessment(PRA)						End Semester Assessment	Total Marks
			Class/ Home Assignment 5number 3marks each (CA)	ClassTest2 (2bestoutof3) 10marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
Program Core (PCC)	PCC-ME203	**Fluid Mechanics and Hydraulic Machines**	15	20	5	5	5	50	50	100

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV + AT)		
Program Core (PCC)	PCC-ME203 -L	**Fluid Mechanics and Hydraulic Machines-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.

PCC - ME 203.1 Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).

Approximate Hours

Item	AppX Hrs
Cl	13
LI	04
SW	01
SL	01
Total	19

SessionOutcomes (SOs)	**LaboratoryInstruction (LI)**	**ClassroomInstruction (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 Determination of Metacentric Height of Flat bottomed pantoon. 1.2 Study of Pressure Gauge	1.1 Introduction to fluid mechanics 1.2 Properties of fluid: Mass density, Weight density. Specific volume, Specific gravity, Viscosity, Surface tension. 1.3 Numericals on properties of fluid. 1.4 Capillarity, Vapour pressure, Compressibility and bulk modulus. 1.5 Newtonian and non-Newtonian fluids. 1.6 Fluid statics: Pressure, Pascal's law 1.7 Hydrostatic law, 1.8 Pressure measurement 1.9Hydrostatic force on submerged plane 1.10 Hydrostatic force on curved surface 1.11 Buoyancy 1.12 Floatation, Liquid in relative equilibrium. 1.13 Tutorial 1	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 SuggestedSessionalWork(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. MiniProject:

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.

PCC- ME 203.2 : Analyze fluid motion using Lagrangian/Eulerian methods, study flow lines and particle acceleration.

Approximate Hours

Item	AppX Hrs
Cl	13
LI	06
SW	01
SL	01
Total	21

SessionOutcomes (SOs)	**LaboratoryInstruction (LI)**	**ClassroomInstruction (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 Determination of performance characteristics of centrifugal pump. 2.2 Determination of performance characteristics of Pelton wheel. 2.3 Study of different types of fluid flows	2.1Fluid Kinematics: Description of fluid motion, Langragian and Eulerian approach, 2.2Type of fluid flow, 2.3 Type of flow lines-path line, Streak line, Stream line, Stream tube 2.4 Continuity equation 2.5 Acceleration of a fluid particle 2.6 Motion of fluid particle along curved path 2.7 Normal and tangential acceleration 2.8 Rotational flow, Rotation 2.9 Vorticity, Circulation, 2.8 Stream and potential function, 2.10 Flow net, Its characteristics and utilities 2.11 Vortex motion. 2.12 Numerical On Vortex Motion. 2.13 Tutorial 1	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.

b. Mini Project:

a) Discuss the continuity equation and its significance in fluid dynamics.

b) Explore the acceleration of a fluid particle, considering both normal and tangential components along curved paths. Provide examples to illustrate these concepts.

PCC-ME 203.3: Apply Euler's/Bernoulli's equations, understand Venturimeter, Orifice meter, and implications of momentum equations.

Approximate Hours

Item	AppX Hrs
Cl	11
LI	08
SW	1
SL	1
Total	21

SessionOutcomes (SOs)	**LaboratoryInstruction (LI)**	**ClassroomInstruction (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 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.	3.1 Verification of Bernoulli's Theorem experimentally. 3.2 Determination of coefficient of Discharge of venturimeter. 3.3 To determine hydraulic Coefficients Cd, Cv and Cc of an Orifice. 3.4 Study of Reynolds transport theorem	3.1 Fluid dynamics: Euler's Equation 3.2 Bernoulli's equation and its practical application, 3.3 Venturimeter 3.4 Orifice meter 3.5 Nozzle 3.5 Pitot tube 3.6 Impulse momentum equation 3.7 Momentum of Momentum equation 3.8 Kinetic energy 3.9 Momentum correction factor. 3.10 Reynold's transport theorem 3.11 Tutorial 1.	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 Renyold'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.

b. 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.

PCC- ME 203.4: Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena

Approximate Hours

Item	AppX Hrs
Cl	11
LI	08
SW	2
SL	1
Total	22

SessionOutcomes (SOs)	**LaboratoryInstruction (LI)**	**ClassroomInstruction (CI)**	**SelfLearning (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 To determine the minor head loss coefficient of different pipe fittings. 4.2 Determine the Renyold's no in different flow conditions. 4.3 Determination of Coefficient of Discharge of Rectangular and Triangular Notch. 4.4 Study of fluid flow through 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 4.10 Water hammer in pipes. 4.11 Tutorial 1	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

b. **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.

PCC- ME 203.5: 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	12
LI	04
SW	01
SL	2
Total	19

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 Determination of Friction Factor 'f' for G.I pipes. 5.2 Study of Boundary Layer theory	5.1 Internal flows: Friction factor, Darcy- Weisbach friction factor 5.2 Moody's diagram 5.3 Boundary Layer theory 5.4 Boundary layer equation 5.5 Laminar and turbulent boundary layer and its growth over flat plat. 5.6 Momentum boundary layer and its solutions, separation of boundary layer and its control. 5.7 Dimensional analysis: Methods of dimensional analysis, Rayleigh's method 5.8 Buckingham's theorem, Limitations 5.9 Model analysis, Dimensionless number and their significance 5.10 Model laws, Reynolds model law, 5.11Fraude's model law, Euler's model law, Weber's model law, Mach's Model law. 5.12 Tutorial 1	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 SuggestedSessionalWork(SW):

a. Assignments:

i. Discuss real-world applications where understanding friction factors and boundary layer theory is crucial.

b. MiniProject:

i. 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)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+LI+SW+Sl)
PCC- ME 203.1: Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).	13	4	1	1	19
PCC- ME 203.2 : Analyze fluid motion using Lagrangian/Eulerian methods, study flow lines and particle acceleration.	13	6	1	1	21
PCC- ME 203.3: Apply Euler's/Bernoulli's equations, understand Venturimeter, Orifice meter, and implications of momentum equations.	11	8	1	1	21
PCC- ME 203.4: Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena.	11	8	2	1	22
PCC- ME 203.5: Master boundary layer theory, friction factors, and separation control, plus dimensional analysis methods and model laws in fluid dynamics.	12	4	1	2	19
Total Hours	60	30	6	6	102

Suggestion for End Semester Assessment

Suggested Specification Table(ForESA)

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

TheendofsemesterassessmentforProcess calculation willbeheldwith written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wiseteachers for above tasks. Teachers can also design different tasks as per requirement, for endsemesterassessment.

SuggestedInstructional/ImplementationStrategies:

1. ImprovedLecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. RolePlay
6. Visit to cement plant
7. Demonstration
8. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
9. 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

Curriculum Development Team

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Cos,POs and PSOs Mapping

Course Title: B. Tech Mechanical Engineering
Course Code : PCC- ME 203
Course Title: Fluid Mechanics and Hydraulic Machines

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO 1	PO 2	PO3	PO4	PO 5	PO6	PO 7	PO8	PO 9	PO10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
PCC- ME 203.1: 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	2	2
PCC- ME 203.2 : 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	2	1
PCC- ME 203.3: 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	2	2
PCC- ME 203.4: Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena.	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2
PCC- ME 203.5: Master boundary layer theory, friction factors, and separation control,plus dimensional analysis methods and model laws in fluid dynamics.	2	2	2	-	1	1	3	1	1	1	2	2	3	3	1	3

Legend: 1 – Low, 2 – Medium, 3 – Hi

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	PCC- ME 203.1 Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1 1.2	**Unit-1 Properties of Fluid and Fluid Statics** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11,1.12, 1.13	As mentionedin page number 4 to 11
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	PCC- ME 203.2 Analyze fluid motion using Lagrangian/Eulerian methods, study flow lines and particle acceleration.	SO2.1 SO2.2 SO2.3 SO2.4	2.1 2.2 2.3	**Unit-2 Fluid Kinematics** 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	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	PCC- ME 203.3: 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	3.1 3.2 3.3 3.4	**Unit-3 : Fluid Dynamics** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,3.11	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	PCC- ME 203.4: Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena.	SO4.1 SO4.2 SO4.3 SO4.4	4.1 4.2 4.3 4.4	**Unit-4 :laminar and turbulent flow and flow through pipes** 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10,4.11	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	PCC- ME 203.5: 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	5.1 5.2	**Unit 5: Internal flows and dimensional analysis** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11,5.12	

Semester-IV

Course Code: **PCC- ME 202**

Course Title : **HEAT TRANSFER**

Pre-requisite: Student should have basic knowledge of Physics and Mathematics.

Rationale: This course follows a unified approach to introduce the physical origins and rate equations of heat transfer. The principal topics covered include identification of the driving forces for heat transfer. The students will learn how to identify the fundamental heat transfer mechanisms.

Course Outcomes:

PCC- ME 202.1: Explain different modes of heat transfer and Calculate heat transfer for one-dimensional steady state conduction in solids.

PCC- ME 202.2: Explain the phenomenon of transient heat transfer in one dimension. Define, classify and analyze the fins.

PCC- ME 202.3: Discuss various correlations of natural and forced convection, Explain and solve heat transfer problems in forced and natural convection.

PCC- ME 202.4: Define, classify and analyze the performance of heat exchanges such as parallel flow, counter flow and cross flow heat exchangers. Discuss various boiling and condensation regimes.

PCC- ME 202.5: Discuss mechanism and various laws associated with Thermal radiation. Find out shape factors for the various geometries and evaluate the rate of heat exchange between them.

SchemeofStudies:

Board ofStudy	Course Code	CourseTitle	Scheme of studies(Hours/Week)					TotalCredits (C)
			Cl	LI	SW	SL	Total StudyHours(CI+LI+SW+SL)	
Program Core (PCC)	**PCC-ME 202**	**Heat transfer**	4	0	1	1	6	4

Legend:

CI: ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)andothers),
LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop, field or other locations using different instructional strategies)
SW: Sessional Work(includesassignment, seminar, miniprojectetc.),
SL: SelfLearning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback ofteacherto ensureoutcomeofLearning.

SchemeofAssessment:
Theory

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)		
			Progressive Assessment (PRA)	**End**	**Total**

			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)**	**Marks** (PRA + ESA)
PCC	**PCC-ME 202**	HEAT TRANSFER	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.

PCC- ME 202.1: Explain different modes of heat transfer and Calculate heat transfer for one-dimensional steady state conduction in solids.

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)
SO1.1 Ability to understand the concept of heat and mass transfer, explain the different mode of heat transfer and their applications **SO1.2**Understand and Solve heat transfer by conduction in solids for steady state conditions. **SO1.3**The students will be able to Analyze examples of heat conduction in everyday objects and systems.	.	**Unit-1: Heat Transfer By Conduction** 1.1 Introduction to heat transfer 1.2 General concepts of heat transfer by conduction, convection and radiation 1.3 Fourier's Law and Electrical analogy of thermal systems. 1.4 General heat conduction equation in three dimensions (3D) in Cartesian coordinates. 1.5 One dimensional (1D) conduction without heat generation: through plain walls. 1.6 1D conduction without heat generation: cylindrical surfaces 1.7 1D conduction without heat generation: spherical surface 1.8 1D conduction without heat generation: composite layers. 1.9 Critical thickness of insulation for cylinder and sphere. 1.10 Problems based on 1D conduction without heat generation 1.10 1D conduction with heat generation: through plain walls 1.11D conduction with heat generation: cylindrical surfaces 1.12 Problems based on 1D conduction without heat generation	1. Numerical problems based on critical radius of insulation for cylinders and spheres. 2. Numerical problem solving on composite slabs using electrical analogy and Fourier's Law.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Derivation of general conduction equation in 3D for cylindrical & spherical surfaces.

ii. Numerical on one dimensional conduction with and without heat generation

b. Mini Project:

i. List down various thermal insulating materials used in thermal power plants and refrigeration and air conditioning applications.

PCC- ME 202.2: Analysis of Transient heat transfer in one dimension and Fins.

Approximate Hours

Item	Approx. Hrs
Cl	12
LI	0
SW	2
SL	2
Total	16

Session Outcomes (SOs)	Laboratory Instruction	Classroom Instruction (CI)	Self-Learning

	(LI)		(SL)
SO2.1 The students will be able to understand the concept of lumped capacity analysis. **SO2.2** The students will be able to use Heisler chart for unsteady state heat transfer problems. **SO2.3** The students will be able to understand the concept and applications of fins.	.	**Unit-2**:**Transient Heat Conduction and Fins** 2.1 Introduction: Unsteady state Heat Transfer conduction. 2.2 Lumped capacity method and its Validity.Biot no.& Fourier No. 2.3Response time of thermocouple 2.4 I-D Transient heat conduction in large plane walls,when Bi>0.1 2.5 I-D Transient heat conduction in long cylinders, whenBi>0.1 2.6 Equation of Heat conduction and temperature distribution through fins. 2.7 Design of fins for maximum heat transfer. 2.8 Fin effectiveness and fin efficiency. 2.9 Use of fin analysis for measuring temperature error of Thermometer.	1. Numerical problems based on Heisler chart. 2. Numerical problems based on design of fins.

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

i. Prepare a chart listing down all the formulae related to heat transfer and temperature distribution for unsteady heat transfer and fins.
ii. Numerical problem on response of thermocouple.

a. Mini Project:

a. Prepare a chart classifying various types of fins with the help of neat sketch.

PCC- ME 202.3: Explanation and analysis of heat transfer by forced and natural convection.

Approximate Hours

Item	Appx. Hrs
Cl	12
LI	0
SW	2
SL	3
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 The students will be able to understand the mechanisms of forced and natural convection. **SO3.2** The students will be able to apply the empirical equation for	.	**Unit-3: Forced and Natural convection.** 3.1 Physical Mechanism of Forced and Free convection 3.2 Dimension a analysis for forced convection.	1. Understanding Dimensionless numbers. 2. Study the Boundary layer

calculation of heat transfer through natural convection. **SO3.3** The students will be able to apply the empirical equation for calculation of heat transfer through forced convection.		3.3 velocity and Thermal Boundary layer 3.4 Flow over plates 3.5 Flow across cylinders and spheres. 3.6 Reynold's analogy. 3.7 Problem based on heat transfer over flat surfaces. 3.8 Problem based on heat transfer over cylinders and spheres. 3.9 Physical Mechanism of Natural Convection. 3.10 Dimensionless analysis of natural convection 3.11 Empirical relationship for natural convection. 3.12 Problem based on heat transfer for natural convection.	theory.

SW-3 Suggested Sessional Work(SW):

a. Assignments:

i. Problem based on heat transfer for natural convection over flat plate.

b. Mini Project:

i. Write down all the heat transfer correlations for forced and natural convective heat transfer problem also list down the formulae of all the dimensionless numbers involved.

PCC- ME 202.4: Explanation and analysis of Two-Phase Heat Transfer and heat exchangers.

Approximate Hours

Item	Appx. Hrs
Cl	12
LI	0
SW	2
SL	2
Total	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO4.1 To understand the regimes of boiling. **SO4.2**To understand the regimes of condensation. **SO4.3**. Analyzing& Solving Problems on heat exchangers. **SO4.4**.Design the heat exchangers	.	**Unit-4:Two Phase Heat Transferand Heat Exchangers.** 4.1 Boiling regimes and boiling curve. 4.2 Heat transfer correlations in pool boiling. 4.3 condensation regimes and condensation curve. 4.4 Derivation for the average heat transfer coefficient 'h' for the laminar film condensation over vertical plate. 4.5Heat transfer correlation for inclined plates and Vertical tubes. 4.6Numerical problems on boiling.	1. Analyze the cross-flow heat exchanger. 2. Problems on cross flow heat exchangers.

		4.7Numerical problems on condensation. 4.8LMTD analysis of parallel and counter flow heat exchangers. 4.9NTU analysis of parallel and counter flow heat exchangers. 4.10Effectiveness and efficiency of heat exchangers. 4.11Numerical problems on LMTD approach of heat exchangers. 4.12Numerical problems on NTU approach of heat exchangers.	

SW-4 Suggested Sessional Work(SW):

a. Assignments:

i. Numerical Problems on Heat exchangers

ii. Neat sketches of various boiling & condensation regimes.

b. Mini Project:

i. Make a chart classifying various heat exchangers with the help of neat sketches.

PCC- ME 202.5: Explanation and analysis of Thermal Radiation.

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 Understanding basic definitions. **SO5.2**Evaluate the Radiative heat exchange. **SO5.3**To determine the Emissive power		**Unit 5: Thermal Radiation** 5.1 Black body radiation: Absorptivity, reflectivity & Transmissivity. 5.2 Kirchhoff'slaws 5.3 Shape factor:Algebra , salient features 5.4 Plank's experiment, Stefan Boltzman&wein'sequations. 5.5 Radiant heat exchange betweenparallelsurfaces,long concentric cylinders, small graybodies. 5.6 Radiation shields. 5.7 Numerical problems on shape factor. 5.8 Numerical problems on radiation shields. 5.9 Numerical problems on gray surfaces. 5.10 Practical Problems 5.11 Tutorial 1 5.12 Tutorial 2	1. Electrical analogy to thermal radiation.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Explain Errors in temperature measurement due to radiation.

b. Mini Project:

i. Explain Non-luminous gas radiation.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
PCC-ME 201.1: Explain different modes of heat transfer and Calculate heat transfer for one-dimensional steady state conduction in solids.	12	2	1	15
PCC- ME 202.2: Explain the phenomenon of transient heat transfer in one dimension. Define, classify and analyze the fins.	12	2	2	16
PCC- ME 202.3: Discuss various correlations of natural and forced convection, Explain and solve heat transfer problems in forced and natural convection.	12	2	3	17
PCC- ME 202.4: Define, classify and analyze the performance of heat exchanges such as parallel flow, counter flow and cross flow heat exchangers. Discuss various boiling and condensation regimes.	12	2	2	16
PCC- ME 202.5: Discuss mechanism and various laws of Thermal radiation. Find out shape factors and evaluate the rate of heat exchange.	12	2	1	15
Total Hours	60	10	9	79

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Heat transfer by conduction**	02	05	05	12
CO-2	**Transient heat transfer and fins**	02	03	03	8
CO-3	**Forced and free convection**	02	05	05	12
CO-4	**Two phase heat transfer and heat exchangers.**	02	04	04	10
CO-5	**Heat transfer by radiation**	01	04	03	08
Total		9	21	20	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. Case Method
4. Group Discussion
5. Role Play
6. Visit to cement plant
7. Demonstration
8. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
9. Brainstorming

Suggested Learning Resources:

(a) **Books**:

S. No.	Title	Author	Publisher	Edition&Year
1	Heat Transfer	Holman, J. P.	McGraw Hill	9th Edition, 2004
2	Heat Transfer - A Practical Approach	Cengel, Y.A.	McGraw-Hill	1998
3	Fundamentals of Heat and Mass Transfer	Incropera, F.P. and Dewitt, D.P.	John Wiley	5th Edition, 2002
4	Lecture note provided by Dept. of Mechanical engineering, AKS University, Satna.			

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Course Title- B.Tech Mechanical Engineering

Course Code- PCC- ME 202

Course Title- Heat Transfer

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineeringknowledge	Problemanalysis	Design/developmentofsolutions	Conductinvestigationsofcomplex problems	Moderntoolusage	Theengineerandsociety	Environmentandsustainability:	Ethics	Individualandteamwork:	Communication:	Projectmanagementandfinance:	Life-longlearning	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
CO-1: Explain different modes of heat transfer and Calculate heat transfer for 1-D steady state conduction in solids.	2	1	2	2	3	2	2	2	2	1	3	2	2	2	1	2
CO-2: Explain the phenomenon of transient heat transfer in one dimension. Define, classify and analyze the fins.	1	1	1	1	3	2	2	2	2	1	2	2	1	2	1	2
CO-3: Discuss various correlations of natural and forced convection, Explain and solve heat transfer problems in forced and natural convection.	2	2	1	1	3	1	2	2	2	1	1	2	1	2	1	1
CO-4: Define, classify and analyze the performance of heat exchanges such as parallel flow, counter flow and cross flow heat exchangers. Discuss various boiling & condensation regimes.	2	2	2	1	3	2	2	2	2	1	2	2	1	2	1	2
CO-5: Discuss mechanism and various laws associated with Thermal radiation. Find out shape factors for the various geometries and evaluate the rate of heat exchange between them	2	1	1	1	1	3	2	2	2	1	2	2	1	2	1	1

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 PSO1,2,3,4,	**CO-1:** Explain different modes of heat transfer and Calculate heat transfer for 1-D steady state conduction in solids. various boiling & condensation regimes.	SO1.1 SO1.2 SO1.3		**Unit -1.0 Heat transfer by conduction** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11,1.12	As mentioned in Page number 2 to 6
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	**CO-2:** Explain the phenomenon of transient heat transfer in one dimension. Define, classify and analyze the fins.	SO2.1 SO2.2 SO2.3		**Unit-2.0 Transient heat transfer and fins** 2.1,2.2,2.3,2.4,2.5,2.6,2.7, 2.8,2.9,2.10,2.11,2.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	**CO-3:** Discuss various correlations of natural and forced convection, Explain and solve heat transfer problems in forced and natural convection.	SO3.1 SO3.2 SO3.3		**Unit-3.0 : Forced and free convection** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,3.11,3.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	**CO-4:**Define, classify and analyze the performance of heat exchanges such as parallel flow, counter flow and cross flow heat exchangers. Discuss various boiling & condensation regimes.	SO4.1 SO4.2 SO4.3 SO4.4		**Unit-4.0: Two phase heat transfer and heat exchangers.** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10,4.11,4.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	**CO-5:** Discuss mechanism and various laws associated with Thermal radiation. Find out shape factors for the various geometries and evaluate the rate of heat exchange between them	SO5.1 SO5.2 SO5.3		**Unit 5.0 Heat transfer by radiation** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11,5.12	

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SEMESTER- IV

Course Code: **PCC-ME-205**

Course Title: **Kinematic and Dynamics of machines**

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 theory helps engineers understand how different types of machines operate, from simple mechanisms to complex systems. It provides the foundational principles for designing machines that are efficient, safe, and reliable. It provides a framework for solving engineering problems related to the design and operation of machines.

Course Outcomes:

PCC-ME-205 .1: Demonstrate a clear understanding of fundamental concepts related to kinematics and dynamics of machines and enumerate different link-based mechanisms with basic understanding of motion.

PCC-ME-205 .2: Student will be able to understand fundamentals of gear theory which will be the prerequisite for gear design. Student will be able to perform force analysis of Spur, Helical, Bevel, Worm and Worm gear.

PCC-ME-205 .3: The student will analyze the different type of Governor and applicability in practical application The student will analyze the gyroscopic couple or effect for stabilization of Ship Aero plane and Four-wheeler vehicles

PCC-ME-205 .4: Student will be able to design cam profile for given follower motions and understand cam Jump phenomenon, advance cam curves

PCC-ME-205 .5: Understand the principles of balancing rotating and reciprocating masses and the importance of stability in machine design.

Scheme of Studies:

Board of Study	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)	PCC-ME-205	Kinematic and Dynamics of machine	4	2	1	1	8	5

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Legend: **CI:**Class room Instruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)and others),
LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop,fieldorotherlocationsusingdifferentinstructional strategies)
SW: SessionalWork(includesassignment,seminar,miniprojectetc.),
SL: SelfLearning,
C: Credits.

Note:

SW&SLhastobeplannedandperformedunderthecontinuousguidanceandfeedbackofteachertoensureoutcomeof Learning.

Scheme of Assessment:
Theory

Board of Study	Course Code	Course Title	**Scheme of Assessment(Marks)**							
			Progressive Assessment(PRA)						**End Semester Assessment**	**Total Marks**
			Class/HomeAssignment5number 3 markseach (CA)	Class Test2 (2bestoutof3) 10 markseach(CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	**(ESA)**	(PRA+ ESA)
PCC	**PCC-ME-205**	**Kinematic and Dynamics of machine**	15	20	5	5	5	50	50	100

Practical:

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV + AT)		
PCC	**PCC-ME-205**	**Kinematic and Dynamics of machine**	35	10	5	50	50	100

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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). Asthecourseprogresses,studentsshouldshowcasetheirmasteryofSessionOutcomes(SOs),culminatingintheoverallachievementofCourseOutcomes(COs)uponthecourse'sconclusion.

PCC-ME 205 .1: Demonstrate a clear understanding of fundamental concepts related to kinematics and dynamics of machines. And enumerate different link-based mechanisms with basic understanding of motion

Approximate Hours

Item	Appx. Hrs
Cl	12
LI	08
SW	01
SL	01
Total	22

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Students should be able to identify and classify different types of simple mechanisms such as levers, linkages, gears, and cams. SO1.2 Students should understand the basic principles of kinematics and be able to describe the motion of simple mechanisms using terms like displacement, velocity, and acceleration. SO1.3 Ability to analyze the motion and forces in planar linkages, including determining the velocity and acceleration of various points within the mechanism.	1.1. To study various types of kinematics links, pairs, chains & Mechanisms 1.2. To Study of Inversions of Four bar linkage. 1.3.Draw the velocity and acceleration diagram for the given mechanism 1.4. study of inversions of single slider crank mechanisms, double slider crank mechanisms.	**Unit-1.0 Simple Mechanism and Kinematic analysis** 1.1 Definitions Link or Element. 1.2 Kinematic Pairs and iys classification. 1.3 Kinematic Chain, Mechanism, Structure. 1.4 Mobility of Mechanism 1.5 Inversion of Mechanism 1.6 Inversions of Four Bar Chain 1.7 Single Slider Crank Chain 1.8 Double Slider Crank Chain. 1.9 Displacement, velocity Analysis 1.10 Numerical problems 1.11 Acceleration analysis 1.12 Numerical problems 1.13 Coriolis component of acceleration	1.1 Analysis of Inversion of single slider cranks chain mechanism. 1.2 Numerical practice of DOF

SW-1Suggested Sessional Work (SW):

a. Assignments:

i. Numerical problem of Velocity Analysis by Relative velocity Approach
ii. Numerical problem of Acceleration Analysis.
iii. Classification of Kinematic Pair

PCC-ME-205 .2: Student will be able to understand fundamentals of gear theory which will be the prerequisite for gear design. Student will be able to perform force analysis of Spur, Helical, Bevel, Worm and Worm gear

Item	Appx. Hrs
Cl	12
LI	06
SW	01
SL	01
Total	20

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Students should be able to explain the basic terminology associated with gears, including pitch circle, pitch diameter, module, and pressure angle **SO2.2** Identify different types of gears (spur, helical, bevel, and worm gears) and understand their specific applications in mechanical systems. **SO2.3** Analyze and design gear trains, considering the arrangement of gears to achieve specific speed reductions or increases. **SO2.4** Relate the concepts of gears and gear trains to practical applications in various engineering fields, such as automotive systems and industrial machinery.	2.1 to study various types of gears. 2.2. to study various types of gear trains 2.3. Demonstrate the effect of gear ratios on the speed and torque of a system.	**Unit-2.0GEAR AND GEAR TRAIN** 2.1 Introduction to gear and its classification 2.2 Involute and cycloidal profiles 2.3 Gear parameters. 2.4 Fundamental law of gearing 2.5 conjugate action of gear 2.6 Analysis of spur gear 2.7 Numerical problem on spur gear 2.8 Interference 2.9 Helical, bevel, worm, rack & pinion gears. 2.10 Gear train and its classification 2.11 Epicyclic and regular gear train kinematics 2.12 Force analysis of spur	2.1 Nomenclature of gear 2.2 difference between involute and cycloidal teeth profile.

SW-2 Suggested Sessional Work (SW):

a. Assignments:
1. Classify Gear
2. Numerical problem of Involutes gear analysis
3. Numerical problem of Epicyclical gear train.

PCC-ME-205 .3: The student will analyze the different type of Governor and applicability in practical application The student will analyze the gyroscopic couple or effect for stabilization of Ship Aero plane and Four-wheeler vehicles

Approximate Hours

Item	Appx. Hrs
Cl	12
LI	06
SW	01
SL	01
Total	20

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Students will be able to define governors and understand their role in controlling the speed of rotating machinery. **SO2.2** Students will connect theoretical concepts to practical applications, understanding how governors are utilized in various engineering systems, such as steam engines and turbines **SO3.3** Students will connect theoretical concepts to practical applications, understanding how governors are utilized in various engineering systems, such as steam engines and turbines. **SO3.4** Students will be able to define gyroscopes	3.1. To perform experiment on Hartnell governor to prepare performance characteristic Curves, and to find stability & sensitivity. 3.2To perform experiment on porter governor to prepare performance characteristic Curves, and to find stability & sensitivity 3.3to study gyroscopic effects through models.	**Unit-3.0 Governors and Gyroscope** 3.1Introduction of Governor 3.2 Types of governors 3.3force analysis of Porter 3.4 force analysis of Porter 3.5 Hartnell governors 3.6 Numerical Problem 3.7 Controlling force, effort and power. 3.8 Introduction of gyroscope 3.9 Vectorial representation of angular motion 3.10 gyroscopic couple, Effect of gyroscopic couple on ship 3.11 Effect of gyroscopic couple plane disc, aero plane 3.12 Effect of gyroscopic couple stability of 4 wheelers	3.1. Numerical problem related to porter governor 3.2. Numerical problem related to gyros couple

and understand their fundamental role in maintaining stability and orientation in rotating systems **SO3.5** Students will connect theoretical concepts to practical applications, understanding how gyroscopes are utilized in various engineering systems for stabilization and orientation control			

SW-3Suggested Sessional Work (SW):

a. **Assignments:**
1. Derive the expression for height of Porter governor
2. Derive the expression for stiffness of spring in Hartnell governor
3. Derive the expression for gyroscopic couple

PCC-ME-205 .4: Student will be able to design cam profile for given follower motions and understand cam Jump phenomenon, advance cam curves.

Approximate Hours

Item	Appx Hrs
Cl	12
LI	04
SW	01
SL	01
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Students will be able to define cam and follower mechanisms and understand their fundamental role in converting rotary motion to oscillatory or reciprocating motion **SO4.2** Students will be able to design cam profiles for specific follower motions, considering factors such as displacement, velocity, and acceleration **SO4.3** Students will connect theoretical concepts to practical applications, understanding how cam and follower mechanisms are utilized in various engineering systems. **SO4.4** Students will develop problem-solving skills by applying cam and follower concepts to address engineering challenges related to motion control and mechanism design.	4.1. Study of different type of CAM and follower. 4.2. To draw displacement diagram, velocity diagram & acceleration diagram of cam follower for SHM motion of follower	**Unit-4.0 CAM AND FOLLOWER** 4.1 Classification of CAM 4.2 Classification of follower 4.3 Terminology of CAM 4.4 Displacement, velocity, acceleration and jerk diagrams Uniform velocity 4.5 Displacement, velocity, acceleration and jerk diagrams uniform acceleration 4.6Displacement, velocity, acceleration and jerk diagrams SHM 4.7Displacement, velocity, acceleration and jerk diagrams Cyclical profile 4.8 Derivatives of follower motions; Circular and tangent cams 4.9 Pressure angle and undercutting 4.10 Graphical and analytical disc cam profile 4.11 syntheses for roller and flat face followers. 4.12 Numerical	1. Draw the cam profile for SHM motion of follower 2. Draw the cam profile for uniform acceleration motion of follower

SW-4Suggested Sessional Work(SW):

a. **Assignments:**
   1. Explain the terminology of CAM
   2. Numerical problem of CAM profile

PCC-ME-205 .5: Understand the principles of balancing rotating and reciprocating masses and the importance of stability in machine design.

Approximate Hours

Item	Appx. Hrs
Cl	12
LI	06
SW	01
SL	01
Total	20

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 -Students will be able to define static balancing and understand its significance in rotating machinery. **SO5.2 -** Students will apply static balancing principles to real-world examples, such as balancing wheels, flywheels, and crankshafts. **SO5.3 -** Students will develop problem-solving skills by applying static balancing concepts to address engineering challenges related to unbalanced systems. **SO5.4** Students will understand the concept of dynamic balancing and its importance in reducing vibration in rotating	5.1. Perform static balancing of a simple system. 5.2. Demonstrate dynamic balancing of rotating masses. 5.3 Experiment on balancing of rotating masses.	**Unit-5.0 Static and dynamic balancing** 5.1 Balancing of Rotating Masses 5.2 Static and dynamic balancing 5.3 Balancing of single rotating mass by balancing masses in same plane and in different planes 5.4 Numerical Problem 5.5 Balancing of single rotating mass by balancing masses in different planes. 5.6 Numerical Problem 5.5Balancing of several rotating masses by balancing masses in same plane and in different planes. 5.5 Numerical Problem 5.6 Balancing of several rotating masses by balancing masses in different planes 5.7 Numerical Problem 5.8 Balancing of Reciprocating Masses	5.1 Numerical Problem on static balancing 5.2 Numerical Problem on balancing when masses are rotating in different plane

machinery. **SO5.5** Students will apply dynamic balancing principles to real-world examples, such as balancing crankshafts, fans, and turbines. **SO5.6** Students will develop problem-solving skills by applying dynamic balancing concepts to address engineering challenges related to vibration in rotating systems.		5.9Numerical Problem 5.10 Inertia effect of crank and connecting rod 5.11Balancing of single cylinder engine 5.12 Numerical problem	

SW-5Suggested Sessional Work (SW):

a. **Assignments:**
   1. Explain the concept of balancing in reciprocating engine
   2. Explain the balancing of in line 4 stroke engine.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Lecture (LI)	Sessional Work (SW)	Self Learning (S l)	Total hour (Cl+LI+SW+SI)
PCC-ME-205 .1: Demonstrate a clear understanding of fundamental concepts related to kinematics and dynamics of machines. and enumerate different link-based mechanisms with basic understanding of motion.	12	08	01	01	22
PCC-ME-205 .2: Student will be able to understand fundamentals of gear theory which will be the prerequisite for gear design. Student will be able to perform force analysis of Spur, Helical, Bevel, Worm and Worm gear. .	12	06	01	01	20
PCC-ME-205 .3:The student will analyze the different type of Governor and applicability in practical application The student will analyze the gyroscopic couple or effect for stabilization of Ship Aero plane and Four-wheeler vehicles	12	06	01	01	20
PCC-ME-205 .4: Student will be able to design cam profile for given follower motions and understand cam Jump phenomenon, advance cam curves	12	04	01	01	18
PCC-ME-205 .5: Understand the principles of balancing rotating and Reciprocating masses and the importance of stability in machine design	12	06	01	01	20
Total Hours	60	30	05	05	100

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**PCC-ME-205 .**1: Demonstrate a clear understanding of fundamental concepts related to kinematics and dynamics of machines. and enumerate different link-based mechanisms with basic understanding of motion.	03	01	01	05
CO-2	**PCC-ME-205 .**2: Student will be able to understand fundamentals of gear theory which will be the prerequisite for gear design. Student will be able to perform force analysis of Spur, Helical, Bevel, Worm and Worm gear.	02	06	02	10
CO-3	**PCC-ME-205 .**3:The student will analyze the different type of Governor and applicability in practical application The student will analyze the gyroscopic couple or effect for stabilization of Ship Aero plane and Four-wheeler vehicles	03	07	05	15
CO-4	**PCC-ME-205 .**4: Student will be able to design cam profile for given follower motions and understand cam Jump phenomenon, advance cam curves	-	10	05	15
CO-5	**PCC-ME-205 .**5: Understand the principles of balancing rotating and Reciprocating masses and the importance of stability in machine design	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Kinematic and Dynamics of machinewillbeheldwithwrittenexaminationof50marks

Note. Detailed Assessmentrubricneedtobepreparedbythecoursewiseteachersforabovetasks.
Teacherscanalsodesigndifferenttasksasperrequirement,forendsemesterassessment.

Suggested Instructional/Implementation Strategies:

3. Improved Lecture
4. Tutorial
5. Case Method
6. Group Discussion
7. Role Play
8. Visitto cement plant
9. Demonstration
10. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
11. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition& Year
1	Theory of Machines	Ballaney P L	Khanna	2003
2	Theory of Machines	Rattan S S	TMH	3rd and 2009
3	Theory of Machines	R S Khurmi	S. Chand Publication.	2022
4	Theory of Machines	Sadhu Singh	TMH	3rd and 2011
5	Theory of Machines	A GHOSH	East west	2015
5	Training Manual			
6	Training Manual			
7	Lecture note provided by Dept. of Mechanical Engineering AKS University, Satna.			

Curriculum Development Team

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<u>**Cos,Pos and PSOs Mapping**</u>

Course Title: B.Tech Mechanical Engineering

Course Code: PCC-ME-205

Course Title: Kinematic and Dynamics of machine

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO1 1	PO1 2	PSO1	PSO2	PSO3	PSO4
	Engineeringknowledge	Problem analysis	Design/development ofsolutions	Conduct investigations ofcomplex problems	Modentoolusage	The engineer and society	Environmentandsustainability:	Ethics	Individualandteamwork:	Communication:	Projectmanagement andfinance:	Life-longlearning	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computation Modeling and Simulation.	Product Innovation and Development
PCC-ME-205 .1: Demonstrate a clear understanding of fundamental concepts related to kinematics and dynamics of machines. and enumerate different link-based mechanisms with basic understanding of motion.	1	1	2	2	2	2	3	1	2	2	1	2	2	2	1	-
PCC-ME-205 .2: Student will be able to understand fundamentals of gear theory which will be the prerequisite for gear design. Student will be able to perform force analysis of Spur, Helical, Bevel, Worm and Worm gear.	1	2	2	2	1	2	2	1	1	1	2	3	2	2	2	1

PCC-ME-205 .3: The student will analyze the different type of Governor and applicability in practical application The student will analyze the gyroscopic couple or effect for stabilization of Ship Aero plane and Four-wheeler vehicles	**2**	**2**	**1**	**1**	**2**	**2**	**2**	**1**	**1**	**2**	**1**	**2**	**2**	**1**	**2**	**2**
PCC-ME-205 .4: Student will be able to design cam profile for given follower motions and understand cam Jump phenomenon, advance cam curves	**3**	**2**	**2**	**-**	**3**	**1**	**3**	**1**	**2**	**1**	**-**	**2**	**3**	**3**	**3**	**2**
PCC-ME-205 .5: Understand the principles of balancing rotating and Reciprocating masses and the importance of stability in machine design	**1**	**2**	**2**	**-**	**1**	**1**	**3**	**1**	**1**	**1**	**2**	**2**	**3**	**3**	**1**	**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 PSO1,2,3,4,5	**CO-1 PCC-ME-205 .**1: Demonstrate a clear understanding of fundamental concepts related to kinematics and dynamics of machines. and enumerate different link-based mechanisms with basic understanding of motion.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**Unit-1.0 Simple Mechanism and Kinematic analysis** 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	As mentioned in Page number 2to6
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	**CO-2 PCC-ME-205 .**2: Student will be able to understand fundamentals of gear theory which will be the prerequisite for gear design. Student will be able to perform force analysis of Spur, Helical, Bevel, Worm and Worm gear.	SO2.1 SO2.2 SO2.3 SO2.4		**Unit-2.0GEAR AND GEAR TRAIN** 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	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	**CO-3 PCC-ME-205 .**3: The student will analyze the different type of Governor and applicability in practical application The student will analyze the gyroscopic couple or effect for stabilization of Ship Aero plane and Four-wheeler vehicles	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		**Unit-3.0 Governors and Gyroscope** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.83.9,3.10,3.11, 3.12,3.13,3.14,3.15,3.16	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	**CO-4PCC-ME-205 .**4: Student will be able to design cam profile for given follower motions and understand cam Jump phenomenon, advance cam curves	SO4.1 SO4.2 SO4.3 SO4.4		**unit-4.0 Cam and Follower** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10,4.11	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	**CO-5PCC-ME-205 .**5: Understand the principles of balancing rotating and Reciprocating masses and the importance of stability in machine design	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5 SO5.6		**Unit-5.0 Static and dynamic balancing** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11	

Semester-IV

Course Code: **PCC-ME204**

Course Title: 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:

PCC-ME204.1: Understand various manufacturing processes, selecting appropriate methods for different material, optimizing manufacturing efficiency and ensuring product quality

PCC-ME204.2: Acquire fundamental knowledge and design widely used and very important primary manufacturing processes such as casting, forming, forging rolling, extrusion

PCC-ME204.3:: Acquire knowledge about the various tools, equipment, machinery and operations required for material removal processes

PCC-ME204.4.: understand the unconventional machining processes, like EDM,EBM, LBM etc.

PCC-ME204.5.: 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:

Board of Study	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)	**PCC-ME204**	Manufacturing Process	4	2	1	1	8	5

AKS University

Faculty of Engineering and Technology

Department of Mechanical Engineering

Curriculum of B.Tech.(Mechanical 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

Board of Study	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)
ESC	**PCC-ME204**	**Manufacturing Process**	15	20	5	5	5	50	50	100

Practical:

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV + AT)		
ESC	**PCC-ME204-L**	**Manufacturing Process-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), culminatingin the overall achievement of Course Outcomes (COs) upon the course's conclusion.

PCC-ME204.1:: Understand various manufacturing processes, selecting appropriate methods for different material, optimizing manufacturing efficiency and ensuring product quality

Approximate Hours

Item	Appx. Hrs
Cl	12
LI	06
SW	1
SL	1
Total	20

Session Outcomes (SOs)	**LaboratoryInstruction (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. **SO1.4** Study examples showcasing how geometry, material, and process choices impact manufacturability and product quality **SO1.5** Learn criteria for selecting manufacturing processes, including considerations for volume, materials, and cost-effectiveness.	1.1 Safety aspects pertaining to common manufacturing PROCESS. 1.2 Introduction of tools and machines used in each processes. . 1.3 Drawing of a simple work piece for carrying out various milling/drilling operations	**SUnit-1.0 Manufacturing processes an classification:** Introduction of manufacturing processes 1.1 Define manufacturing And various methods 1.2 introduction of additives 1.3 subtractive process 1.4 shaping processes 1.5 Advantages of additives, subtractive and shaping processes 1.6 Limitations of additives, subtractive and shaping processes 1.7 Effect of material on product quality and cost 1.8 Effect of process on product quality 1.9 Effect of process on cost 1.10 Part design for manufacturability; 1.11 Process selection criteria 1.12 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
i.

PCC-ME204.2: 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	14
LI	06
SW	01
SL	02
Total	23

Session Outcomes (SOs)	**LaboratoryInstruction (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 ther most 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	2.1 Demonstration of Metal casting process 2.2 Demonstration of forging process 2.3 Study of rolling , sheet forming(Shearing, deep drawing and bending) process	Unit-2.0 Material Shaping Processes 2.1 Introduction of Material Shaping Processes **2.2** Introduction of metal casting process 2.3 Types of metal casting process 2.4 Introduction of forming process 2.5 Metal rolling processes 2.6 Metal forging processes 2.7 Metal drawing processes 2.8 Metal extrusion processes 2.9 sheet forming (shearing, deep drawing, bending) processes 2.10 Thermoplastic processes 2.11 Thermo set plastic	**1** Metal extrusion processes 2 Metal injection molding

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		processes 2.12 Introduction of Powder metallurgy 2.13 Metal injection molding 2.14 Glass and composite processes (layup).	

SW-2 Suggested Sessional Work (SW):

a. Assignments:
Thermoplastic processes

PCC-ME204.3: : Acquire knowledge about the various tools, equipment, machinery and operations required for material removal processes

Approximate Hours

Item	AppX Hrs
Cl	12
LI	06
SW	1
SL	2
Total	21

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,	3.1 Demonstration of material removal process 3.2Demonstration of single point cutting tools 3.3 Demonstration of multi point cutting tools	**Unit-3.0 Material Removal Processes** 3.1 Introduction of material removal processes 3.2 introduction of Turning process 3.3Introduction of Drilling process 3.4 Milling process 3.5 grinding process	1. Milling process 2 surface finish, accuracy

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.		3.6 finishing processes 3.7 Single and multi-point cutting tools 3.8 Cutting tool materials 3.9 Cutting fluids 3.10 Material removal rates 3.11 surface finish, accuracy 3.12 integrity and mach inability.	

SW-3 Suggested Sessional Work (SW):

a. Assignments:

I. Explain single and multi-point cutting tools

PCC-ME204.4.: understand the unconventional machining processes, like EDM,EBM,LBM etc

Approximate Hours

Item	Appx. Hrs
Cl	12
LI	06
SW	1
SL	1
Total	20

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	4.1 Study of abrasive jet machining 4.2 study of ultrasonic machining 4.3 study of plasma arc machining	Unit-4.0 Other (unconventional) Manufacturing Processes 4.1Introduction of un conventional manufacturing processes 4.2 Abrasive Jet Machining 4.3 Water Jet Machining	1. Micro and nano manufacturing

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 traditional manufacturing for a comprehensive approach.		4.4 Ultrasonic Machining 4.5 Electrical Discharge Machining 4.6 Wire EDM 4.7 Electro-Chemical Machining 4.8 Laser Beam Machining 4.9, Plasma Arc Machining 4.10 Electron Beam Machining; 4.11Micro manufacturing 4.12 Nano manufacturing	

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**

i. Explain the procedure of water Jet Machining.

PCC-ME204.5.: 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	10
LI	06
SW	01
SL	01
Total	18

Session Outcomes (SOs)	LaboratoryInstruction (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 usage, safety, and application techniques. **SO5.5** learn about different types of adhesives, surface preparation, and bonding considerations	5.1Demonstration of arc welding 5.2 Demonstration of MIG welding 5.3 Demonstration of TIG welding	**Unit-5.0 Joining and Fastening Processes** 5.1Introduction 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 5.9 Solid state joining 5.10Adhesive	**1.** GTAW (TIG

SW-5 Suggested Sessional Work (SW):

a. Assignments:

1. Explain shielded metal arc welding

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)
PCC-ME204.1: Understand various manufacturing processes, selecting appropriate methods for different material, optimizing manufacturing efficiency and ensuring product quality.	12	06	01	01	20
PCC-ME204.2: Acquire fundamental knowledge and design widely used and very important primary manufacturing processes such as casting, forming, forging rolling, extrusion.	14	06	01	02	23
PCC-ME204.3: : Acquire knowledge about the various tools, equipment, machinery and operations required for material removal processes**.**	12	06	01	02	21
PCC-ME204.4.: understand the unconventional machining processes ,like EDM,EBM,LBM etc.	12	06	01	01	20
PCC-ME204.5.: 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.	10	06	01	01	18
Total Hours	60	30	05	07	102

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. Visit to cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whatsapp, Mobile, Online sources)
9. 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

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Cos.POs and PSOs Mapping

Course Title: B. Tech Mechanical Engineering

Course Code : PCC-ME204

Course Title: Manufacturing Process

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
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	1	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	31	2	1	2	2	1	1	1	2	3	2	2	2	1

CO3 : Acquire 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**	**2**	**2**
CO 4: understand the unconventional machining processes ,like EDM,EBM,LBM etc.	**3**	**2**	**2**	**-**	**3**	**1**	**3**	**1**	**2**	**1**	**-**	**2**	**3**	**3**	**3**	**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**	**2**	**2**	**-**	**1**	**1**	**3**	**1**	**1**	**1**	**2**	**2**	**3**	**3**	**1**	**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	1.1 1.2 1.3	**Unit-1.0 Manufacturing Processes and Classification** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11, 1.12	As mentioned in page number 4 to 11
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	2.1 2.2 2.3	**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	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO3 : Acquire knowledge about the various tools, equipment, machinery and operations required for material removal processes .	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	3.1 3.2 3.3	**Unit-3 : Material Removal Processes** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10 3.11,3.12	
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	4.1 4.2 4.3	**Unit-4 : Other (unconventional) Manufacturing Processes** 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10 4.11,4.12	
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	5.1 5.2 5.3	**Unit 5: Joining and Fastening Processes** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10	

Semester-V

CourseCode:	HSMC304
CourseTitle:	Finance&Accounting
Pre-requisite:	StudentshouldhavebasicknowledgeofrecordingBusiness transaction under appropriate accounts in termof money
Rationale:	'It'sallaboutthemoney!' The students studying Financial accounting under the commerce should possess to develop the knowledge and skills to manage the financial affairs of individuals, communities, and businesses. StudentswilldeveloptheknowledgeandskillsnecessarytoPrepare and maintain financial records, Manage financial affairs, Act with integrity and Contribute to the wider community. Accountinggivesstudentsthetoolstomakereallifefinancial decisions in a constantly changing and uncertain world and enhances financial literacy

CourseOutcomes:

HSMC304.1: Acquire the knowledge in accounting systemof maintenance of journal, ledger, Trial balance and final account.

HSMC304.2: AcquirethebasicconceptofaccountingofdepreciationandRoyalty.

HSMC304.3: Exposed to various provision of hire purchase system and evaluate del credere commission, normal and abnormal loss, value of unsold stock in consignment account.

HSMC304.4: Familiarize and understand the basic accounting concepts ofdifferent type of branch and the Evaluate the unrealized profit under the departmental accounting.

HSMC304.5: Develop the application skills regarding the dissolution of a firm in case ofinsolvency

Schemeof Studies:

Boardof Study	Course Code	CourseTitle	Schemeofstudies (Hours/Week)					TotalCredits (C)
			Cl	LI	SW	SL	TotalStudyHours (CI+LI+SW+SL)	
HSMC	HSMC 304	Finance&Accounting	3	0	2	1	6	3

Legend: **CI:**ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)and Tutorial (T) and others),
LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop, field or other locations using different instructional strategies)
SW: SessionalWork(includesassignment,seminar,andminiprojectetc),
SL: SelfLearning,
C:Credits.

Note: SW& SL hastobeplannedandperformedunderthe continuousguidanceandfeedbackof teacher to ensure outcome of Learning.

SchemeofAssessment:

Theory

Board ofStudy	Course Code	CourseTitle	SchemeofAssessment(Marks)							
			ProgressiveAssessment(PRA)						EndSemesterAssessment	Total Marks
			Class/Home Assignment 5 number 3marks each (CA)	ClassTest2 (2 best outof3) 10marks each(CT)	Seminarone (SA)	Class Activityany one (CAT)	ClassAttendance (AT)	TotalMarks (CA+CT+SA+CAT +AT)	(ESA)	(PRA+ ESA)
HSMC	HSMC304	Financial Accounting	15	20	5	5	5	50	50	100

Course-CurriculumDetailing:

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 masteryofSessionOutcomes(SOs), culminating inthe overallachievement ofCourse

Outcomes (COs) upon the course's conclusion

TopicCovered:

HSMC304.1: Acquire the knowledge in accounting systemof maintenance of journal, ledger, Trial Balance and final account.

ApproximateHours

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

SessionOutcomes (SOs)	(LI)	ClassroomInstruction (CI)	(SL)
SO1.1 Understand the Conceptandnatureof financial accounting principles **SO1.2**Understandthe Concept of Double Entry System, PreparationofJournal **SO1.3**Understandtheconcept Sub division ofJournal **SO1.4**PreparationofLedger and Trial Balance **SO1.5**PreparationofFinal A/c with Adjustment		**Unit-1.0TheoreticalFramework and Accounting Process** Conceptandnatureoffinancialaccounting Natureoffinancialaccountingprinciples Basicconceptsandconventions Salient features of Accounting StandardAS-11.5.ConceptandPrincipalof double Entry Classificationofaccount MeritanddemeritofdoubleEntrySystem Rulesregardingjournalentryof transaction SubdivisionofJournal	1. Classification of account and golden rules of journal entry 2. Items Debited and credited in tradingandprofit & loss account andthelistofasset and liabilities

SW-1SuggestedSessionalWork(SW):

a. Assignments: Modernapproachesofjournalentryforthebusinesstransactionand Preparation of ledger and triple columnar cash book.

b. MiniProject: AscertainmentofCreditPurchasesCreditSalesandAscertainmentof Missing InformationthroughSummaryofCash

c. OtherActivities (Specify):

Diagramfortheeffectoftheitemofadjustmentwhengivenoutsideoftrailbalance.

HSMC304.2: AcquirethebasicconceptofaccountingofdepreciationandRoyalty

ApproximateHours

Item	AppxHours
Cl	10
LI	0
SW	2
SL	1
Total	13

SessionOutcomes (SOs)	**(LI)**	**ClassroomInstruction (CI)**	**(SL)**
SO2.1 Concept Meaning &terminology of royalty **SO2.2** Understanding abouttheshortworking and right ofShort workingrecouped **SO2.3**Preparation of landlord account short working a/c androyaltyaccount **SO2.4**Understandingthe concept &method ofdepreciationwith characteristics **SO2.5**Preparationofasset accountin various conditionmethods	.	**Unit2.0AccountingforDepreciationandRoyalty** 2.1Concept and meaning of Royalty, withterminology Conceptofminimumrentshortworking Accountingprocessforroyalty JournalEntryinthebookofLessee Formatoflandlordandshortworkinga/c PPunderthechangingrateofminimumrent PPwhenrightofshortworkingrecouped given PPwhenpartlyshorting recouped PPincaseoflock out and strike Accountingforroyaltyofpatent	1. Terminology of royalty like less or lessee minimum rent dead rent and shortworking 2. Accounting process of depreciation in differentmethod of depreciation with practical aspect

SW-2SuggestedSessionalWork(SW):

a. Assignments: Typesofroyaltyand the methodofcalculationofroyalty in caseoftrade Mark, Patent and copy Wright

b. MiniProject:IRCTCRailwayBookingSystemClone

c. OtherActivities(Specify): DistinguishbetweenStraight LineMethodandDiminishing Balance Method of Depreciation

HSMC304.3: Exposed to various provision of hire purchase system and evaluate del credere commission, normal and abnormal loss, value of unsold stock in consignment account.

ApproximateHours

Item	AppxHours
Cl	8
LI	0
SW	2
SL	1
Total	11

SessionOutcomes (SOs)	**(LI)**	**ClassroomInstruction (CI)**	**(SL)**
SO3.1 Meaning and concept of hire purchase with cum and Ex interest installment **SO3.2**Practical problem related to calculation of cash price of asset **SO3.3**Understanding the calculation of rate of interest and default of payment **SO3.4**Understandingabout commission abnormal lossand calculationof unsold stock **SO3.5**Preparation of consignmentaccountin different situation of normal loss and abnormalloss	.	**Unit-3:AccountingforHirePurchaseand Consignment** 3.1MeaningofhirepurchaseSystemandhire purchase contract Concept ofcumandExinterestinstallment Accountingforcum-interestandexinterest installment, ConceptofCalculationofcashpriceofasset PracticalproblemrelatedwithCalculationof cash price ConceptCalculationofinterestwhenrateof interest not given PPofCalculationofinterest whenrateof interest not given Concept andmeaningofdefaultofpayment	1. Provisionof Hirepurchase Systemregarding Repossession of asset in case of default ofpayment 2. Concept of discount of bill discountedwhen billsprovidedby Consignee to Consignor

SW-3SuggestedSessionalWork(SW):

a. Assignments: DiscusstheAdvantagesand featuresofHirePurchaseSystemandexplain The Accounting Treatment in the Hire Purchase System

b. MiniProject: ContentsofHirePurchaseAgreementAccordingtotheHirePurchase Act, 1972 (Section 4),

c. OtherActivities(Specify): prepareaflowchartshowingthedifferent terminologyused in Consignment agreement

HSMC304.4: Familiarizeandunderstandthebasic accountingconceptsofdifferenttypeof branch and the Evaluate the unrealized profit under the departmental accounting.

ApproximateHours

Item	AppxHours
Cl	9
LI	0
SW	2
SL	1
Total	12

SessionOutcomes (SOs)	(LI)	ClassroomInstruction (CI)	(SL)
SO4.1 Understanding about the concept and types of branches **SO4.2**Preparation ofBranch account in case of dependent and independent branches **SO4.3**Understanding about the foreign branch and preparation of final account of foreign branch **SO4.4**Understandingabout the department and basis of allocationof joint expenses in case of Department **SO4.5**Preparation of departmentaltrading and profit and loss account in different situations		**Unit-4:Accounting for Branch** Conceptmeaning&Characteristicsofbranch TypesofbranchlikeDependentandindependent Conceptofdependentbranchesandtypes 4.5.Accounting ofdependentbranches Numericalquestionofdependentbranches StockandDebtorSystemofdependentbranches WholesaleandRetailBranches AccountingtreatmentofIndependentbranches Numerical question of Independent branches	1. System of calculation of profit or loss ofadependent Branch Inter departmental transaction and inter branches transactionwith Entry

SW-4SuggestedSessionalWork(SW):

a. Assignments: Writethe listofItemconvertedfromthedifferent typeofexchangeratein Case of the foreign branch

b. MiniProject: Collect thelistofthebranchesofthepublicsectorBankandPrivatesector bankworkinginSatnadistrictwithminor Introduction

c. OtherActivities(Specify): preparealist ofdepartmentalstore situatedintheSatnadistrict and observe the working of such departmental store

HSMC304.5: Develop theapplicationskillsregardingthedissolutionofafirmincaseof insolvency

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

SessionOutcomes (SOs)	(LI)	ClassroomInstruction (CI)	(SL)
SO5.1 Understand about the concept of dissolution of firm and preparation of Realization account and capital account **SO5.2**Preparation ofnecessary account and treatment when all partner being solvent **SO5.3**Preparation of necessary account and treatment in case of insolvency of partners **SO5.4**Understanding about the Sale to a limited companyand Preparation of necessary account **SO5.5**Understanding aboutthe Amalgamation of firm and Preparation of necessary account		**Unit5:AccountingforDissolutionofthe Partnership Firm** MeaningandconceptofDissolutionofthe Partnership Firm JournalEntryincaseofDissolutionofthe Partnership PreparationofRealizationAccount PreparationofCapitalaccount AccountingofDissolutionofthePartnership Firm AccountingofDissolutionofPartnership Firm when asset taken be partner MeaningofInsolvencyofaPartner Garnerv/sMurreyrule AccountingofDissolutionofthePartnership Firm Including Insolvency of partners	**1.**Comparision betweenGarner vs murrey rule &ruleofIndian partnership act for Insolvent partner Howtoprevent amalgamation a cut throat comp- etition between two similar nature business

SW-5SuggestedSessionalWork(SW):

a. Assignments: procedureofcreationand dissolutionofaPartnershipFirms

b. MiniProject: Preparereportonthebusinessorcompaniesamalgamatedin India inlast 5 years including the merger of banks

BriefofHourssuggestedfortheCourseOutcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Totalhour (Cl+SW+Sl)
HSMC304.1: Acquire the knowledge in accounting system of maintenance of journal, ledger, Trial balance and final account	9	2	1	12
HSMC304.2: Acquirethebasicconceptofaccounting of depreciation and Royalty	10	2	1	13
HSMC304.3: Exposed to various provision of hire purchase system and Evaluate del credere commission, normalandabnormalloss,valueofunsoldstockin consignmentaccount.	8	2	1	11
HSMC304.4: Familiarize and understand the basic accounting concepts of different type of branch and the Evaluatetheunrealizedprofitunderthedepartmental	9	2	1	12
HSMC304.5: Developtheapplicationskillsregarding the dissolution of a firm in case of insolvency	9	2	1	12
TotalHours	45	10	05	60

SuggestionforEndSemesterAssessment

SuggestedSpecificationTable(ForESA)

CO	**UnitTitles**	**MarksDistribution**			**Total Marks**
		R	**U**	**A**	
CO-1	Acquire the knowledge in accounting system of maintenanceofjournal,ledger,Trialbalanceand final account	01	01	03	05
CO-2	Acquirethebasicconceptofaccounting of depreciationandRoyalty	01	01	03	05
CO-3	Exposed to various provision of hire purchase system and evaluate del cruder commission, normalandabnormalloss,valueofunsoldstockin consignmentaccount	-	03	10	13
CO-4	Familiarize and understand the basic accounting concepts of different type of branch and the Evaluatetheunrealizedprofitunderthe departmentalaccounting	-	03	10	13
CO-5	Developtheapplicationskillsregardingthe dissolution of a firm in case of insolvency	01	03	10	14
Total		03	12	36	50

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

Theendofsemester assessment for FinancialAccounting willbeheld withwrittenexaminationof 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.

SuggestedInstructional/ImplementationStrategies:

1. Improved Lecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. Brainstorming

SuggestedLearningResources:

(a)Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Advanced Accounts.Vol.-I.	Shukla, M.C., T.S. GrewalandS.C.Gupta	S.Chand&Co.,	Revisededition 21edition2020
2	FinancialAccounting	Maheshwari,S.N.and S.K.Maheshwari	VikasPublishing House	
3	FinancialAccounting	ShuklaS.M.	SahityaBhavan Publication House Agra	
4	Lecturenoteprovidedby Dept.ofCommerceAKSUniversity,Satna.			

AKSUniversity

FacultyofEngineeringandTechnology

DepartmentofMechanicalEngineering

CurriculumofB.Tech(Mechanical Engineering)Program

(Revisedason01August2023)

Cos, Pos and PSOs Mapping

Course Title: B.TechME
CourseCode:HSMC304
CourseTitle:Finance&Accounting

CourseOutcomes	ProgramOutcomes										ProgramSpecificOutcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
	Commerceand business-related areas	Solvingtheproblems	Profession related scenarios	Start-upsandentrepreneurialventures:	Leadershipqualities	Communicationthroughdifferent modes	Advanceresearchinthefieldofcommerce	Decision making	Pathwaysprograms	Environmentandsustainability:	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation	Product Innovation and Development
CO.1: Acquire the knowledge inaccounting system ofmaintenance of journal, ledger,Trial balance and final account.	3	2	1	1	1	1	3	1	1	**1**	**3**	**3**	**1**	**2**
CO.2:Acquirethebasicconceptofaccounting of depreciation andRoyalty.	3	2	**1**	**1**	**1**	**1**	3	1	**1**	**1**	**2**	**3**	**1**	**1**
CO.3:Exposedtovariousprovisionof hire purchase system andevaluatedelcrederecommission,normal and abnormal loss	3	2	**1**	**2**	**1**	**1**	3	1	**2**	**1**	**3**	**3**	**2**	**1**
CO.4:Familiarizeandunderstandthebasic accountingconceptsofdifferenttype of branch and theEvaluate the unrealized profit	3	2	**1**	**3**	**1**	**1**	3	1	**1**	**1**	**3**	**3**	**2**	**1**

accounting.														
CO.5:Developtheapplicationskillsregarding the dissolution of a firmin case of insolvency	3	2	**1**	**1**	**1**	**1**	3	1	**1**	**1**	**1**	**2**	**3**	**1**

Legend:1–Slight(Low),2–Medium,3–High Course

Curriculum Map:

POs&PSOsNo.	CosNo.&Titles	SOsNo.	(LI)	ClassroomInstruction (CI)	Self-Learning (SL)
PO1,2,3,4,5,6 7,8,9,10, PSO1,2,3,4,5	CO-1:Acquiretheknowledgeinaccounting system of maintenance of journal, ledger,Trialbalanceand finalaccount.	SO1.1SO 1.2SO1.3 SO1.4 SO1.5		Unit 1.Theoretical Framework and Accounting Process 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.81.9	As mentionedin pagenumber 18 to22
PO1,2,3,4,5,6 7,8,9,10, PSO1,2,3,4,5	CO2:Acquirethebasicconceptofaccountingof depreciation and Royalty	SO2.1SO 2.2SO2.3 SO2.4 SO2.5		Unit-2 Accounting for Depreciation and Royalty 2.1,2.2,2.3,2.4,2.5,2.6, 2.7, 2.8,2.9,2.10,	
PO1,2,3,4,5,6 7,8,9,10, PSO1,2,3,4,5	CO3 :Exposed to various provision of hire purchase system and evaluate del credere commission, normalandabnormalloss,valueofunsoldstockin consignment account.	SO3.1SO 3.2SO3.3 SO3.4 SO3.5		Unit-3 :Accounting for Hire Purchase and Consignment 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,	

PO1,2,3,4,5,6 7,8,9,10, PSO1,2,3,4,5	CO 4: Familiarize and understand the basic accountingconceptsofdifferenttypeofbranch andtheEvaluatetheunrealizedprofitunderthe departmental accounting.	SO4.1SO 4.2SO4.3 SO4.4 SO4.5		Unit-4Accountingfor Branch and Department : 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8, 4.9	
PO1,2,3,4,5,6 7,8,9,10, PSO1,2,3,4,5	CO5:Developtheapplicationskillsregardingthe dissolution of a firm in case of insolvency	SO5.1SO 5.2SO5.3 SO5.4 SO5.5		Unit5:Accountingfor Dissolution of the Partnership Firm 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8, 5.9	

Semester-V

Course Code: **HSMC301**

Course Title: INDUSTRIAL PSYCHOLOGY

Pre- requisite: Basic understanding of psychology, research methods, statistics, and organizational dynamics is essential for studying workplace behavior in industrial psychology.

Rationale: Industrial psychology explores the interaction between individuals and their work environment. By applying psychological principles, it aims to optimize productivity, job satisfaction, and organizational effectiveness. This subject examines topics such as employee selection, motivation, leadership, and organizational culture, offering insights to enhance workplace dynamics and foster individual and collective well-being.

Course Outcomes:

After completing this course, the student will be able to:

HSMC301.1 Understanding of key concepts, theoretical perspectives, and trends in industrial psychology

HSMC301.2 Evaluate the problems thorough and systematic competency mode

HSMC301.3 Analyze the problems present in environment and design a job analysis method.

HSMC301.4 Create a better work environment for better performance.

HSMC301.5 Design a performance appraisal process and form for the human behavior.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
HSMC	**HSMC301**	INDUSTRIAL PSYCHOLOGY	3	0	2	2	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 outcome of Learning.

Scheme of Assessment:

Theory

Board of Study	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)
HSMC	HSMC301	INDUSTRIAL PSYCHOLOGY	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.

HSMC301.1 Understanding of key concepts, theoretical perspectives, and trends in industrial psychology.

Approximate Hours

Item	Appx. Hrs
Cl	09
LI	
SW	01
SL	01
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Define industrial psychology, its history, and relevance. **SO1.2** Identify individual differences in abilities and attitudes. **SO1.** Evaluate employee selection methods and assessments. **SO1.4** Apply motivational theories to enhance engagement. **SO1.5** Analyze leadership styles and organizational dynamics for effective management.		**Unit-1.0** Introduction 1.1 Introduction of industrial Psychology 1.2 The role of the psychologist in industry 1.3 The field of occupational Psychology 1.4 Study of behavior in work situation 1.5 Applications of Psychological principles to problems of selection 1.6 Applications of Psychological principles to problems of Placement 1.7 Applications of Psychological principles to problems of Counseling 1.8 Applications of Psychological principles to problems of training.	**1** Applications of Psychological principles to problems of selection

SW-1 Suggested Sessional Work (SW):

Assignments:
The field of occupational Psychology

HSMC301.2 Evaluate the problems thorough and systematic competency mode

Approximate Hours

Item	Appx. Hrs
CI	10
LI	
SW	01
SL	01
Total	12

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO2.1 Evaluate the problems thorough and systematic competency mode **SO2.2** Explore teamwork dynamics and communication strategies in industrial settings. **SO2.3** Learn about psychological assessment methods for effective employee placement. **SO2.4** Identify factors influencing employee motivation and satisfaction. **SO2.5** Address issues of fatigue, boredom, and accidents through proactive measures.		Unit-2.0 Design of Work Environment 2.1 Human engineering techniques of job analysis 2.2 physical environment techniques of job analysis 2.3 Social environment 2.4 Group dynamics in Industry Personal psychology 2.5 Technique of selection 2.6 Technique of training 2.7 promotion, counseling, job motivations 2.8 job satisfaction 2.9 Special study of problem of fatigue 2.10 Special study of problem of boredom and accidents.	**1** Special study of problem of fatigue

SW-2 Suggested Sessional Work (SW):

a. Assignments: physical environment techniques of job analysi

HSMC301.3 Analyze the problems present in environment and design a job analysis method.

Approximate Hours

Item	Appx Hrs
Cl	06
LI	
SW	01
SL	01
Total	08

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Grasp consumer behavior basics and how advertising shapes choices. **SO3.2** Learn to optimize product design and workplace environments using psychology. **SO3.** Develop skills to analyze and target consumer preferences effectively. **SO3.4** Assess advertising effects on perceptions and purchase decisions. **SO3.5**Implement strategies for improving workplace morale and productivity.		**Unit-3.0 Understanding Consumer Behavior** **3.1** Consumer behavior 3.2 study of consumer preference 3.3 Effects of advertising 3.4 Industrial morale 3.5 The nature and scope of engineering psychology 3.6 Engineering psychology, application to industry	1 study of consumer preference

SW-3 Suggested Sessional Work (SW):

Assignments: Engineering psychology, application to industry

HSMC301.4 Create a better work environment for better performance.

Approximate Hours

Item	AppX Hrs
CI	11
LI	
SW	01
SL	01
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Define and grasp the significance of efficiency in the workplace. Work Curve Characteristics: Explore the typical features of the work curve and its implications for productivity. **SO4.2** Discuss different work methods, hours, nature, and factors affecting efficiency..		Unit-4.0 **Work Methods** **4.1** Efficiency at work, the concept of efficiency 4.2 The work curve, its characteristics 4.3 The work methods; hours of work 4.4 Nature of work, fatigue and boredom, rest pauses 4.5 The personal factors; age abilities, interest, job satisfaction 4.6 working environment, noise, illumination, atmospheric conditions 4.7 increasing efficiency at work 4.8 improving the work methods 4.9 Time and motion study 4.10 contribution and failure resistance to time and motion studies 4.11 Need for allowances in time and motion study	**1** Time and motion study

SO4.3 Identify how personal factors like age, abilities, and environmental factors such as noise impact work efficiency..			

SW-4 Suggested Sessional Work (SW):

a. **Assignments: working environment, noise, illumination, atmospheric conditions**

HSMC301.5 Design a performance appraisal process and form for the human behavior.

Approximate Hours

Item	AppX Hrs
Cl	09
LI	
SW	01
SL	01
Total	11

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO5.1 - Identify key factors influencing job design and explain how human factors contribute to safety and efficiency. **SO5.2** - Introduce engineering		**Unit-5.0 Work and Equipment Design** **5.1** Criteria in evaluation of job-related factor 5.2 job design 5.3 Human factors 5.4 Engineering information, input processes 5.5 Mediation processes, action processes 5.6 Methods design, work space and its arrangement 5.7 Human factors in job design. Accident and Safety	1 Human factors in job design. Accident and Safety

principles relevant to work design and demonstrate their practical application. **SO5.3 -** Analyze workplace accident causes and develop prevention strategies . **SO5.4** Explore methods design techniques and workspace layout considerations to enhance safety. **SO5.5** Discuss the benefits of involving workers in job design decisions and strategies for integrating human factors principles.		5.8 Human and economic costs of accidents, accident record and statistics 5.9 The causes of accidents situational and individual factors related to accident reduction	

SW-5 Suggested Sessional Work (SW):

a. **Assignments:** Engineering information, input processes

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Lecture (LI)	Sessional Work (SW)	Self Learning (SI)	Total hour (Cl+LI+SW+SI)
HSMC301.1 Understanding of key concepts, theoretical perspectives, and trends in industrial psychology	09		01	01	11
HSMC301.2 Evaluate the problems thorough and systematic competency mode	10		01	01	12
HSMC301.3 Analyse the problems present in environment and design a job analysis method	06		01	01	08
HSMC301.4 Create a better work environment for better performance	11		01	01	13
HSMC301.5 Design a performance appraisal process and form for the human behavior.	09		01	01	11
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	**Introduction of industrial psychology**	03	01	01	05
CO-2	**Design of Work Environments**	02	06	02	10
CO-3	**Understanding Consumer Behavior**.	03	07	05	15
CO-4	**Work Methods**	03	05	07	15
CO-5	**Work and Equipment Design**.	03	02	-	05
Total		14	21	15	50

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

The end of semester assessment for I**ndustrial psychology** 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	Industrial Psychology	Tiffin, J and McCormic E.J	Prentice Hall	6th Edn 1975
2	Human Factors Engineering and Design	McCormic E.J	McGraw Hill	4th Edn.,1976.
3				
4				
5	Training Manual			
6	Training Manual			
7	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna .			

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Cos,POs and PSOs Mapping

Course Title: M. Tech Mechanical Engineering

Course Code : HSMC301

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	PSO 3	PSO 4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
CO1 Understanding of key concepts, theoretical perspectives, and trends in industrial psychology ode . .	3	1	2	2	2	2	3	1	2	2	1	2	2	2	1	2-
CO2 Evaluate the problems thorough and systematic competency mode	2	2	31	2	1	2	2	1	1	1	2	3	2	2	2	1
CO3 : Analyse the	2	2	1	1	2	2	2	1	1	2	1	2	2	1	2	2

problems present in environment and design a job analysis method.																
CO 4: Create a better work environment for better performance.	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2
CO 5: Design a performance appraisal process and form for the human behavior	2	2	2	-	1	1	3	1	1	1	2	2	3	3	1	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 : Understanding of key concepts, theoretical perspectives, and trends in industrial psychology code .	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1. Design a performance appraisal process and form for the human behavior 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,	As mentioned in page number 4 to 11
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 2 Evaluate the problems thorough and systematic competency mode	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	3	Unit-2 **Design of Work Environments** 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, 3, 4	CO3 **:** Analyse the problems present in environment and design a job analysis method**.** .	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 : **Understanding Consumer Behavior** 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, 3, 4	CO 4 Create a better work environment for better performance c.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		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	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 5: Design a performance appraisal process and form for the human behaviour	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit 5: **Work and Equipment Design** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,.5.9	

Semester-V

Course Code:	PCC-ME 301
Course Title:	Machine Element and System Design
Pre-requisite:	Students should have a good knowledge of subjects such as Mathematics, Engineering Mechanics, Strength of Materials, Theory of Machines, Workshop Processes and Engineering Drawing.
Rationale:	Machine design is the single most important activity in the mechanical industries. Success or failure of a company has its roots in product design, whether it is done in-house or contracted out. It is here that manufacturing costs and profits are determined. Even the best of manufacturing facilities are of little use if the design of a product is inherently faulty.

Course Outcomes:

ME 301.1 Student will be able to define different phases in design process, standardization of parts, stress concentration of machine parts.

ME 301.2: Students will be able to design different types of riveted joints, cotter and knuckle joint, threaded and welding joints.

ME 301.3: Students will be able to design helical spring with axial loading and subjected to fatigue loadings.

ME 301.4: Students will be able to design shafts based on strength, rigidity and critical speed.

ME 301.5: Students will be able to design different types of rigid and flexible coupling.

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Scheme of Studies:

Board of Study	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)	Me 301	Machine Element and System Design	4	0	1	1	6	4

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

Board of Study	Couse Code	Course Title	Scheme of Assessment(Marks)							
			Progressive Assessment(PRA)						End Semester Assessment	Total Marks
			Class/Ho meAssign ment5nu mber 3mar ksea ch (CA)	ClassTest 2 (2bestout of3) 10marks each(CT)	Seminar one (SA)	Class Activity any one (CAT)	ClassAttendan ce (AT)	TotalMarks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
PCC	**ME 301**	Machine Element and System Design	15	20	5	5	5	50	50	100

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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.

ME 301.1 Student will be able to define different phases in design process, standardization of parts, stress concentration of machine parts.

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)
SO1.1 Understand design steps, preferred numbers, stresses, and calculations including shear, bending, and torsional stresses. SO1.2 Analyze fatigue, endurance, modifying factors, and surface strength considerations for enhanced fatigue resistance. SO1.3 Explain failure theories and factors affecting endurance limit stress and safety considerations in design engineering. .	.	**Unit-1.0 Introduction to Design** 1.1 Definition, steps in design process . 1.2 preferred numbers, standards and codes in design 1.3 shear, bending and torsional stresses, combined stresses, stress concentration factor 1.4 Fatigue- Introduction to design for fatigue strength. Endurance and modifying factors. Surface strength. 1.5 Theories of Failure 1.6 Guest's Theory 1.7 Rankine's Theory 1.8 St. Venant's Theory 1.9 Haigh's Theory, and Von Mises 1.10 Shock and impact loads, fatigue loading 1.11 endurance limit stress factors affecting endurance limit, 1.12 factor of safety	1.Hencky Theory 2. Von Mises

SW-1Suggested Sessional Work (SW):

a. Assignments:

i. Explain shear, bending and tensional stresses, combined stresses, stress concentration factor

ME 301.2: Students will be able to design different types of riveted joints, cotter and knuckle joint, threaded and welding joints.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	2
SL	2
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO2. 1 Define thread terminology, standards, and identify different types of threads used in engineering applications. **SO2.2** Analyze stresses in screw threads, understand the effect of initial tension in bolted joints. **SO2.3** Design bolts for static and fatigue loading, and evaluate gasketed joints and power screws for engineering applications.	.	Unit-2.0 Threaded Joints 2.1 Terminology, thread standards 2.2 types of threads 2.3 stresses in screw threads. 2.4 Bolted joints- effect of initial tension 2.5 eccentric loading 2.6 design of bolts for static and fatigue loading 2.7 gasketed joints 2.8 power screws 2.9 Design of riveted joints 2.10 . Material for rivets, modes of failure 2.11 efficiency of joint 2.12 design of boiler	1. tank joints 2. structural joints

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SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. design of bolts for static and fatigue loading

.

ME 301.3: Students will be able to design helical spring with axial loading and subjected to fatigue loadings.

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)
SO3.1 Understand Gib, Cotter, and Knuckle joints, and analyze their structural characteristics and applications. **SO3.2** Design couplings, single and multiple plate clutches, and centrifugal plate clutches for engineering applications. **SO3.3** Introduce braking systems, design band brakes, shoe brakes, and disc brakes for various mechanical setups.	.	**Unit-3.0 : Cotter and Knuckle joints** **3.1** Gib joints 3.2 Cotter Joint 3.3 analysis of knuckle joint 3.4 Design of coupling 3.5 Design of single plate clutch 3.6 Design of multiple plate clutch 3.7 Design of centrifugal plate clutch 3.8 Introduction of brake 3.9 Design of band brake 3.10 Design of shoe brake 3.11 Design of Disc Brake 3.12 Tutorial 1	1. Design of Axles

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SW-3Suggested Sessional Work (SW):

a. Assignments:

i. Design of single plate clutch

ME 301.4: Students will be able to design shafts based on strength, rigidity and critical speed.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	2
SL	2
Total	16

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Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO4. 1 Classify springs and identify materials, analyze stresses, and deflections in helical springs under axial loading. **SO4. 2** Understand the effects of curvature, resilience, and surging in helical springs under static and fatigue loading. **SO4. 3** Design flat, semi-elliptical laminated leaf springs, and sliding bearings considering critical frequency and end construction.	.	**Unit-4.0 :** Springs 4.1 classification, spring materials 4.2 stresses and deflection of helical springs 4.3 axial loading, curvature effect, resilience 4.4 static and fatigue loading, surging, 4.5 critical frequency, concentric springs, end construction 4.6 Leaf springs- Flat springs 4.7 semi elliptical laminated leaf springs 4.8 design of leaf springs 4.9 nipping 4.10 Design of sliding bearings 4.11 Tutorial 1 4.12 Tutorial 2	1. Design of rolling contact bearings

SW-4Suggested Sessional Work (SW):

a. **Assignments:**

i. Design of sliding bearings

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ME 301.5: Students will be able to design different types of rigid and flexible coupling

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO5. 1 Analyze material properties and design considerations for shafts in engineering applications. **SO5. 2** Identify causes of failure in shafts and design them based on strength considerations. **SO5. 3** Understand rigidity, critical speed, and design shafts for static, fatigue, repeated, and reversed bending loads.		**Unit 5.0** Shafting 5.1 material, design considerations 5.2 causes of failure in shafts 5.3 design based on strength 5.4 rigidity and critical speed 5.5 design for static and fatigue loads 5.6 repeated loading 5.7 reversed bending 5.8 Design of Coupling 5.9 selection, classification. 5.10 Tutorial -1 5.11Tutorial-2 5.12 Tut5orial -3	1. rigid and flexible coupling 2. design of keys and pins

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. design for static and fatigue loads

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
ME 301.1: Student will be able to define different phases in design process, standardization of parts, stress concentration of machine parts. .	12	2	1	15
ME 301.2: Students will be able to design different types of riveted joints, cotter and knuckle joint, threaded and welding joints.	12	2	2	16
ME 301.3: Students will be able to design helical spring with axial loading and subjected to fatigue loadings.	12	2	1	15
ME 301.4: Students will be able to design shafts based on strength, rigidity and critical speed.	12	2	2	16
ME 301.5 Students will be able to design different types of rigid and flexible coupling.	12	1	1	14
Total Hours	60	9	7	76

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Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction to Design	03	01	01	05
CO-2	Threaded Joints	02	06	02	10
CO-3	Cotter and Knuckle joints	03	07	05	15
CO-4	Springs	-	10	05	15
CO-5	Shafting	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Machine Element and System Design 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. Visit to cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog , Facebook, Twitter, Whats-app, Mobile, Online sources)
9. Brainstorming

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Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher
1	mechanical engineering design	Budynas, R. G., & Nisbett, J. K.. Shigley's	McGraw-Hill.
2	Machine design	Norton, R. L.	Prentice Hall
3	Design of machine elements	Spotts, M. F., Shoup, T. E., & Hornberger, L. E.	Pearson /Prentice Hall
4	Design of Machine Elements	Bhandari, V. B	McGraw-Hill Education (India) Pvt Ltd.

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Cos, Pos and PSOs Mapping

Course Title: B.Tech. Mechanical

Course Code : ME 301

Course Title: Machine Element and System Design

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	Conductinvestigations of complex problems	Modern Tool usage	Theengineerandsociety	Environment and sustainability:	Ethics	Individual andteamwork:	Communication:	Project management and finance:	Life-longlearning	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
C01 Student will be able to define different phases in design process, standardization of parts, stress concentration of machine parts.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO 2 : Students will be able to design different types of riveted joints, cotter and knuckle joint, threaded and welding joints.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3 : Students will be able to design helical spring with axial loading and subjected to fatigue loadings.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO4: Students will be able to design shafts based on strength, rigidity and critical speed.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO5: Students will be able to design different types of rigid and flexible coupling.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	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 PSO1,2,3,4,	CO-1: Student will be able to define different phases in design process, standardization of parts, stress concentration of machine parts.	SO1.1 SO1.2 SO1.3		Unit-1.0 **Introduction of Mechatronics and its block diagram representation** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11,1.12	As mentioned in Page number 2 to 6
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	CO 2 : Students will be able to design different types of riveted joints, cotter and knuckle joint, threaded and welding joints.	SO2.1 SO2.2 SO2.3		Unit-2.0 Selection of Sensors & Actuators 2.1,2.2,2.3,2.4,2.5,2.6,2.7, 2.8,2.9,2.10,2.11,2.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	CO3: Students will be able to design helical spring with axial loading and subjected to fatigue loadings.	SO3.1 SO3.2 SO3.3		Unit-3.0 : Data Acquisition, Signal Conditioning & Microcontroller System 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,3.11, 3.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	CO 4: Students will be able to design shafts based on strength, rigidity and critical speed.	SO4.1 SO4.2 SO4.3		Unit-4.0 : Pneumatics and hydraulics 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10,4.11, 4.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	CO 5: Students will be able to design different types of rigid and flexible coupling.	SO5.1 SO5.2 SO5.3		**Unit 5.0 Control System** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11,5.12	

Semester-V

CourseCode: PCC-ME-303

CourseTitle: Measurement and Metrology

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 Out comes:

PCC-ME-303 **.**1: Student gain a comprehensive understanding of fundamental measurement principles, including precision, accuracy, and units of measurement.

PCC-ME-303 **.**2 student understood the suitable instrument for measurement of temperature, pressure and flow

PCC-ME-303 **.**3:Learn techniques and methodologies in metrology for calibration, inspection, and quality control purposes

PCC-ME-303 **.**4: Understood the different equipment for measurement of various mechanical properties.

PCC-ME-303 **.**5: Student get the knowledge about Electrical measurement and various measuring instrument related to it

AKS University

Faculty of Engineering and Technology

Department of Mechanical Engineering

Curriculum of B.Tech (Mechanical Engineering) Program

(Revised as on 01 August 2023)

Scheme of studies:

Board of Study	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)	PCC-ME-303	Measurement and Metrology	1	4	1	1	7	3

Legend: **CI:**ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)andothers),
LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop,fieldorothe rlocationsusingdifferentinstructional strategies)
SW: SessionalWork(includesassignment,seminar,miniprojectetc.),
SL: SelfLearning,
C: Credits.

Note:

SW&SLhastobeplannedandperformedunderthecontinuousguidanceandfeedbackofteachertoe nsureoutcomeof Learning.

Scheme of Assessment:

Theory

Board of Study	Couse Code	Course Title	Scheme of Assessment(Marks)							
			Progressive Assessment(PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment 5number 3 marks each (CA)	Class Test2 (2bestout of3) 10 marksea ch(CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
PCC	PCC-ME-303	Measurement and Metrology	15	20	5	5	5	50	50	100

Practical

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV + AT)		
PPC	PCC-ME-303-L	Manufacturing Practice Workshop 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). Asthecourseprogresses,studentsshouldshowcasetheirmasteryofSessionOutcomes(SOs),culminatingint heoverallachievementofCourseOutcomes(COs)uponthecourse'sconclusion.

PCC-ME-303 .1: **Student gain a comprehensive understanding of fundamental measurement principles, including precision, accuracy, and units of measurement.**

Approximate Hours

Item	AppX Hrs
CI	13
LI	06
SW	02
SL	02
Total	23

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Develop a fundamental understanding of measurement concepts, including precision, accuracy, and the importance of standardized units. SO1.2. Understand the importance of instrument calibration and gain practical knowledge of calibration procedures. SO1.3. Apply measurement principles to real-world scenarios, emphasizing hands-on experience and problem-solving skills SO1.4. Apply displacement measurement techniques to engineering scenarios, including structural health monitoring, robotics, and mechanical systems. SO1.5. Familiarize	Unit-1.0 Introduction to Measurement System 1.1Measure the dimensions of standard objects using vernier calipers and micrometers Demonstrate the use of a ruler and tape measure for basic length measurements. Use a dial gauge to measure linear displacements.	**Unit-1.0 Introduction to Measurement System** Definition-basic principles of measurement measurement systems Generalized configuration and functional description ofmeasuring instruments. Static performance characteristics. Dynamic performance characteristics. Errors in measurement. Sources of error Classification and methods to eliminate errors Measurement of Displacement: Variable resistance-linear motion potentiometer. Variable inductance LVTD variable capacitance	1What are the Basic element of measurement system 2.What are the different technique used for the measurement of displacement.

oneself with different instruments and techniques used for measuring displacement, such as linear variable differential transformers (LVDTs), potentiometers, and optical encoders.		1.13 photo-electric transducers	

Faculty of Engineering and Technology
Department of Mechanical Engineering
Curriculum of B.Tech. (Mechanical Engineering) Program
(Revised as on 01 August 2023)

SW-1Suggested Sessional Work (SW):

a. Assignments:

i. Explain the working of Potentiometer
ii. Explain static and dynamic characteristic

PCC-ME-303 .2 student understood the suitable instrument for measurement of temperature, pressure and flow

Approximate Hours

Item	Appx Hrs
Cl	12
LI	08
SW	03
SL	02
Total	25

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Understand principles and techniques for measuring temperature using various instruments like thermocouples, thermistors, and infrared sensors. SO2.2 Gain proficiency in measuring pressure using devices such as pressure gauges, manometers, and transducers, considering calibration and precision. SO2.3. Learn methodologies for measuring flow rates in fluids using instruments like flow meters, orifices, and venturis, with an emphasis on accuracy and applicability. SO2.4. Apply measurement techniques to industrial settings, considering the role of temperature, pressure, and	**Unit-2.0Measurement of Temperature, Pressure and Flow rate.** Demonstrate the application of different types of thermometers for temperature measurement. Demonstrate the application of different types ofmanometers for pressure measurement Demonstrate the application of Burdon tube pressure gauge for pressure measurement. Study of venturi meter, orifice meter and rotameter for flow measurement	**Unit-2.0Measurement of Temperature, Pressure and Flow rate.** Measurement of Temperature Classification, various principles of measurement Resistance Temperature Detector (RTD) thermistor, thermocouple, pyrometers. Measurement of Pressure Classification of pressure measurement devices Bourdon tube pressure Gauge thermal conductivity gauges Mcleod and ionization pressure gauge Flow measurement rotameter, hot wire anemometer	1. Explain the function of RTD 2. Explain the function of thermocouple

flow rate in processes like manufacturing, energy, and chemical engineering.		2.12 magnetic flow meter.	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Explain the working of Bourdon tube pressure Gauge.
2. Explain the function of Mcleod and ionization pressure gauge
3. Write the principle and working of rot meter.

PCC-ME-303 .3: **Learn techniques and methodologies in metrology for calibration, inspection, and quality control purposes**

Approximate Hours

Item	AppX Hrs
CI	15
LI	06
SW	02
SL	03
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1Develop a clear understanding of limits and fits in engineering, including the role they play in ensuring proper assembly and functionality. SO3.2. Gain proficiency in tolerance concepts, understanding how variations in dimensions impact the functionality and interchangeability of mechanical components. SO3.3. Apply limits, fits, and tolerances in the design process, considering factors such as material properties, manufacturing processes, and functional requirements. SO3.4. Explore how limits, fits, and tolerances influence the selection of manufacturing processes	**Unit-3.0 Limits, Fit and Tolerances:** 3.1 Collect measurement data and calculate mean, median, and standard deviation Measure dimensions of a sample product and assess compliance with tolerances. Discuss the significance of normal distribution in metrology	**Unit-3.0 Limits, Fit and Tolerances:** Systems of Limits and Fits: Introduction , normal size, tolerance limits, deviations. allowance, fits and their types unilateral and bilateral tolerance system hole and shaft basis system interchangeability and selective assembly Indian Standard Institution system (BIS). International standard system 3.9. Taylor's principle, plug, ring and snap gauges Linear, Angular and Optical Measuring	1. Write the short note on unilateral and bilateral tolerance system 2. Write the short note on bevel protractor, angle slip gauges 3. Write the short note on Slip gauges, dial test indicators

and impact the overall quality of produced components.		Instruments Slip gauges, dial test indicators bevel protractor, angle slip gauges. bevel protractor, angle slip gauges optical flat, N.P.L Flatness interferometer, Profile Projector	

SW-3Suggested Sessional Work (SW):

a. Assignments:

1. What is a gauge? Explain the working of Go and No-Go gauge for hole and shaft
2. What is metrology? What are different types of measurement standards?

PCC-ME-303 .4: Understood the different equipment for measurement of various mechanical properties.

Approximate Hours

Item	AppX Hrs
CI	14
LI	06
SW	02
SL	02
Total	24

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Grasp fundamental concepts such as precision, accuracy, and error analysis in mechanical measurements. SO4.2. Proficiently use a range of mechanical measurement instruments for precise and accurate readings SO4.3. Apply mechanical measurement techniques to address engineering challenges in diverse industries.	**Unit-4.0 Mechanical Measurements and Equipment** Explore non-contact measurement methods such as laser scanning or optical measurement systems. Use a Coordinate Measuring Machine (CMM) for three-dimensional measurement Discuss the application of metrology in 3D printing and additive manufacturing	**Unit-4.0 Mechanical Measurements and Equipment** 4.1-Dimensional metrology. Vernier Caliper Micrometers LVDT Form metrology – form tester, surface profiler. CMM 3D scanning Surface metrology Optical microscopes Laser scanning microscopes. 4.11Electron microscopy (SEM/TEM) X-ray microscopy, Raman spectroscopy Tool wear, workpiece quality Process metrology.	1. Explain the following a. Vernier Caliper b. Micrometers c. LVDT 2. write short note on a. 3D scanning b. Laser scanning microscopes.

SW-4Suggested Sessional Work (SW):

a. Assignments:

1. Explain the following
   a. Electron microscopy (SEM/TEM)
   b. X-ray microscopy, Raman spectroscopy
2. Write short note on Process metrology.

PCC-ME-303 .5: **Student get the knowledge about Electrical measurement and various measuring instrument related to it**

Approximate Hours

Item	Appx Hrs
Cl	09
LI	04
SW	02
SL	02
Total	17

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO5.1. Grasp fundamental concepts related to electrical measurements, including voltage, current, resistance, and power. SO5.2. Proficiently use electrical measurement instruments such as voltmeters, ammeters, multimeters, and oscilloscopes. SO5.3. Apply electrical measurement techniques to solve engineering problems, especially in the design, analysis, and troubleshooting of electrical circuits. SO5.4. Explore the integration of electrical measurement instruments into control systems for automation and monitoring.	**Unit 5 Electrical Measurements and Instruments** Demonstrate different type of Transducers such as strain gages, displacement transducers. Demonstrate Interfacing transducers to electronics control and measuring system.	**Unit 5 Electrical Measurements and Instruments** Signal generators and analysis. Wave analyzer, Spectrum analyzer. Frequency counters – measurement errors. Extending the frequency range. Transducers – types, strain gages, displacement transducers. Digital data acquisition system. Interfacing transducers to electronics control and measuring system. Isolation amplifier. 5.9Computer controlled test system	1. What do you mean by transfer function? Explain 2. Write differences between open loop and close loop control system.

SW-5Suggested Sessional Work (SW):

a. Assignments:

1. Explain Wave analyzer, Spectrum analyzer.
2. Explain the Digital data acquisition system.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Lecture (LI)	Sessional Work (SW)	Self-Learning (SI)	Total hour (Cl+LI+SW+SI)
PCC-ME-303.1 Student gain a comprehensive understanding of fundamental measurement principles, including precision, accuracy, and units of measurement.	13	06	02	02	23
PCC-ME-303.2: student understood the suitable instrument for measurement of temperature, pressure and flow.	12	08	03	02	25
PCC-ME-303.3: Learn techniques and methodologies in metrology for calibration, inspection, and quality control purposes.	15	06	02	03	18
PCC-ME-303.4: Understood the different equipment for measurement of various mechanical properties.	14	06	02	02	27
PCC-ME-303.5: Student get the knowledge about Electrical measurement and various measuring instrument related to it.	09	04	02	02	17
Total Hours	63	30	11	11	110

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	PCC-ME-303.1 Student gain a comprehensive understanding of fundamental measurement principles, including precision, accuracy, and units of measurement.	03	01	01	05
CO-2	PCC-ME-303.2: student understood the suitable instrument for measurement of temperature, pressure and flow.	02	06	02	10
CO-3	PCC-ME-303.3: Learn techniques and methodologies in metrology for calibration, inspection, and quality control purposes	03	07	05	15
CO-4	PCC-ME-303.4: Understood the different equipment for measurement of various mechanical properties.	-	10	05	15
CO-5	PCC-ME-303.5: Student get the knowledge about Electrical measurement and various measuring instrument related to it.	03	02	-	05
Total		11	26	13	50

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

TheendofsemesterassessmentforMeasurement and Metrologywillbeheldwithwrittenexaminationof50marks

Note.DetailedAssessmentrubricneedtobepreparedbythecoursewiseteachersforabovetasks.
Teacherscanalsodesigndifferenttasksasperrequirement,forendsemesterassessment.

Suggested Instructional/Implementation Strategies:

3. Improved Lecture
4. Tutorial
5. Case Method
6. Group Discussion
7. Role Play
8. Visit to cement plant

9. Demonstration
10. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
11. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition& Year
1	Measurement Systems	E.O Doebelinand Dhanesh Manik	McgrawHill	2017
2	Metrology & Measurement	Bewoor& Kulkarni,	TMH	2009
3	Engineering Metrology and Instrumentation	R. K Rajpoot	S.K Kateria and Sons	2013
4	Engineering Metrology	I C Gupta	Dhanpat Rai	2018
5	Metrology And Measurements	A Anderson And Karthick Ysv	Air Walk	2016
5	TrainingManual			
6	TrainingManual			
7	Lecturenoteprovidedby Dept.ofMechanical Engineering,AKSUniversity,Satna.			

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Cos,POsandPSOsMapping

CourseTitle:B.Tech Mechanical Engineering

CourseCode: PCC-ME-303

CourseTitle:Engineering Graphics and Design

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineeringknowledge	Problemanalysis	Design/developmentofsolutions	Conductinvestigationsofcomplexproblems	Moderntoolusage	Theengineerandsociety	Environmentandsustainability:	Ethics	Individualandteamwork:	Communication:	Projectmanagementandfinance:	Life-longlearning	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Manufacturing Processes and Automation Computational Modeling and Simulation.	Computational Modeling and Simulation. Product Innovation and Development Pr In an De t
PCC-ME-303.1 Student gain a comprehensive understanding of fundamental measurement principles, including precision, accuracy, and units of measurement.	1	1	2	2	2	2	3	1	2	2	1	2	2	2	1	-
PCC-ME-303.2: student understood the suitable instrument for measurement of temperature, pressure and flow.	1	2	2	2	1	2	2	1	1	1	2	3	2	2	2	1
PCC-ME-303.3: Learn techniques and methodologies in metrology for calibration, inspection, and quality control purposes	2	2	1	1	2	2	2	1	1	2	1	2	2	1	2	2
PCC-ME-303.4: Understood the different equipment for measurement of various mechanical properties.	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2

PCC-ME-303.5: Student get the knowledge about Electrical measurement and various measuring instrument related to it.	**1**	**2**	**2**	**-**	**1**	**1**	**3**	**1**	**1**	**1**	**2**	**2**	**3**	**3**	**1**	**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 PSO1,2,3,4,5	CO1:PCC-ME-303.1 Student gain a comprehensive understanding of fundamental measurement principles, including precision, accuracy, and units of measurement.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0Introduction to Measurement System: 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11,1.12,1.1.13	As mentioned in page number 2to6
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO 2:PCC-ME-303.2: student understood the suitable instrument for measurement of temperature, pressure and flow.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2**Measurement of Temperature, Pressure and Flow rate.** 2.1,2.2,2.3,2.4,2.5,2.6,2.7, 2.8,2.9,2.10,2.11,2.12	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO3 :PCC-ME-303.3: Learn techniques and methodologies in metrology for calibration, inspection, and quality control purposes .	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		**UNIT 3 Limits, Fit and Tolerances:** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8.3.9,3.10,3.11,3.12,3.13,3.14,3.15	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO 4: PCC-ME-303.4: Understood the different equipment for measurement of various mechanical properties.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		**UNIT 4 Mechanical Measurements and Equipment:** 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	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO 5: PCC-ME-303.5: Student get the knowledge about Electrical measurement and various measuring instrument related to it.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit5**Electrical Measurements and Instruments**: 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	

Semester-V

Course Code: PCC-ME 302

Course Title: Mechatronics

Pre-requisite: Students should have basic knowledge of mathematics (geometry, trigonometry, and calculus), physics, computer science (especially computer-aided design), and mechanical drawing and shop.

Rationale: The rationale for studying mechatronics lies in its interdisciplinary nature, combining mechanical, electrical, and computer engineering. It equips students to design, develop, and operate advanced systems, fostering innovation in robotics, automation, and smart technologies essential for today's industrial and technological evolution.

Course Outcomes:

ME 302.1: Identify key elements of mechatronics and its representation by block diagram.

ME 302.2: Understand the concept of sensors and use of interfacing systems.

ME 302.3: Understand the concept and applications of different actuators

ME 302.4: Illustrate various applications of mechatronic systems.

ME 302.5: Develop PLC ladder programming and implementation in real life problem.

Scheme of Studies:

Board of Study	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)	ME 302	Mechatronics	4	2	1	1	8	5

Legend: **CI:** Class room 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.

Scheme of Assessment:

Theory

Board of Study	Couse Code	Course Title	Scheme of Assessment(Marks)							
			Progressive Assessment(PRA)						End Semester Assessment	Total Marks
			Class/Ho meAssign ment5nu mber 3mar ksea ch (CA)	ClassTest 2 (2bestout of3) 10marks each(CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
PCC	**ME 302**	Mechatronics	15	20	5	5	5	50	50	100

Practical

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV + AT)		
PCC	ME 302-L	Mechatronics - 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.

ME 302.1: Identify key elements of mechatronics and its representation by block diagram.

Approximate Hours

Item	AppX Hrs
CI	09
LI	6
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO1. 1Define key mechatronics elements and applications across diverse sectors. **SO1.2** Construct and analyze block diagrams representing mechatronic systems, integrating transfer function concepts. **SO1.3** Apply reduction methods and numerical treatments for complex system block diagrams. .	1.1 Introduction to Mechatronics 1.2 Assembly language programming of 8085 – Addition – Subtraction – Multiplication – Division – Sorting – Code Conversion 1.3 Study of mechatronics	**Unit-1.0 Introduction of Mechatronics and its block diagram representation:** 1.1 Key elements of mechatronics 1.2 Applications of Mechatronics domestic, industrial etc. 1.3 Representation of mechatronic system in block diagram 1.4 transfer function for each element of mechatronic system, 1.5 Reduction methods and its numerical 1.6 Tutorial 1 1.7 Tutorial 2 1.8 Tutorial 3 1.9 Tutorial 4	1. Reduction methods and its numerical treatment for represented block diagram.

SW-1Suggested Sessional Work (SW):

a. **Assignments:**
   i. Applications of Mechatronics

ME 302.2: Understand the concept of sensors and use of interfacing Systems.

Approximate Hours

Item	AppX Hrs
CI	14
LI	6
SW	1
SL	2
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO2. 1 **Select sensor based on specific needs and performance metrics for diverse measurements.** **SO2.2** Evaluate actuators for various applications considering performance and safety. SO2.3 Differentiate mechano-electrical actuators by principles and selection criteria. SO2.4Master sensor selection aligned with displacement, temperature, acceleration, force/pressure needs. SO2.5 Apply actuator principles to choose optimal types for operational requirements and safety..	2.1 Stepper motor interface 2.2 Traffic light interface. 2.3 Study of sensors for automotives	Unit-2.0 Selection of Sensors & Actuators 2.1 Introduction of sensors 2.2 Criteria for selection of sensors based on requirements 2.3 principle of measurement 2.4 sensing method 2.5 performance chart etc. (Displacement, temperature, acceleration, force/pressure) based on static and dynamic characteristics. 2.6 Introduction of Actuators 2.7 Selection of actuators based on principle of operation 2.8 performance characteristics 2.9 maximum loading conditions, safety etc 2.10 . Principle and selection of mechano-electrical actuators 2.11 DC motors 2.12 Stepper Motors 2.13 Tutorial 1 2.14 Tutorial 2	1. Solenoid Actuators 2. Servo Motors

SW-2 Suggested Sessional Work (SW):

a. Assignments:
1. BLDC.

ME 302.3: Understand the concept and applications of different actuators

Approximate Hours

Item	AppX Hrs
Cl	12
LI	6
SW	2
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO3.1 Understand bit accuracy/width and sampling speed in relation to precision and rate of signal capture. SO3.2 Grasp sampling theorem, aliasing, and the Nyquist criteria for accurate signal reconstruction. SO3.3 Comprehend ADC using successive approximation and sample and hold circuitry. SO3.4 Explore DAC functionality using R-2R circuits, focusing on resolution in digital-to-analog conversion. SO3.5 Learn signal filters (low-pass, high-pass, band-pass) through simplified circuit diagrams for practical implementation.	3.1 Speed control of DC motor. 3.2 Study of various types of transducers. 3.3 A/D and D/A conversion.	**Unit-3.0 : Data Acquisition, Signal Conditioning & Microcontroller System Theory** **3.1** Concept of Bit accuracy/width 3.2 Concept of Sampling speed 3.3 Concept of sampling theorem, aliasing 3.4 Nyquist criteria 3.5 ADC (Analog to Digital Convertor) Successive approximation method and sample and hold circuitry 3.6 DAC (Digital to Analog Convertor) R-2R circuit 3.7 DAC resolution 3.8 Signal Filters: Low pass 3.9 High Pass and Band Pass 3.10 Tutorial 1 3.11 Tutorial 2 3.12 Tutorial 3	1. Circuit diagrams for simple cases.

SW-3Suggested Sessional Work (SW):

a. Assignments:

i. Concept of sampling theorem, aliasing

ME 302.4: Illustrate various applications of mechatronic systems.

Approximate Hours

Item	Appx Hrs
CI	10
LI	6
SW	2
SL	2
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO4. 1 Identify valves, actuators, and auxiliary elements in hydraulic and pneumatic systems, using ISO symbols. **SO4.** 2 Design circuits with up to two cylinders in pneumatic, electro-pneumatic, and hydraulic systems. **SO4.** 3 Apply electro hydraulic principles to create integrated circuit designs. **SO4.** 4 Select and apply components for specific applications in hydraulic and pneumatic systems. **SO4.** 5 Create functional circuit designs, integrating diverse components and ISO symbols.	4.1 Study of hydraulic, pneumatic and electro-pneumatic circuits. 4.2 Modelling and analysis basic hydraulic, pneumatic and electrical circuits using software. 4.3 Study of different types of pneumatic and hydraulic valve.	**Unit-4.0 : Pneumatics and hydraulics** 4.1 Introduction of Hydraulic devices 4.2 Introduction of pneumatic devices 4.3 Different types of valves 4.4 Actuators and auxiliary elements in Pneumatics 4.5 Actuators and auxiliary elements in hydraulics 4.6 applications and use of ISO symbols 4.7 Synthesis and design of circuits (up to 2 cylinders) 4.8 electro- pneumatics and hydraulics 4.9 Tutorial 1 4.10 Tutorial 2	1. electro hydraulics

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ME 302.5 Develop PLC ladder programming and implementation in reallife problem.

Item	AppX Hrs
Cl	15
LI	0
SW	1
SL	1
Total	17

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO5. 1 Master control system design methods (Root Locus, Frequency Response), analyzing stability with Nyquist and Bode diagrams. **SO5.** 2 Apply P, I, D actions in control systems, creating P, PI, PD, and PID setups while assessing transient response. **SO5.** 3 Understand transient response metrics (overshoot, rise time, delay time, steady-state error), practice PID tuning methods like manual and Zigler. **SO5.4** Learn discrete control systems and PLC theory: architecture, ladder logic, timers, counters, with practical programming examples. **SO5.** 5 Gain expertise in designing control systems and PLC programming for diverse logic functions.	5.1 Study of PLC and its applications. 5.2 Study of image processing 5.3 Study of PID controller	**Unit 5.0 Control System** 5.1 Control system design and analysis by Root Locus Method 5.2 Control system Design by Frequency response method 5.3 stability margin 5.4 Nyquist diagram 5.5 Bode diagram P 5.6 I and D control actions 5.7 P, PI, PD and PID control systems 5.8 Transient response:- Percentage overshoot 5.9 Rise time, Delay time 5.10 Steady state error, PID tuning (manual), Zigler Method. 5.11 Discrete Control System PLC (Programming Logic Control) Theory 5.12 Introduction to PLC 5.13 Introduction to Architecture 5.14 Ladder Logic programming for different types of logic gates 5.15 Tutorial 1	1. Latching, Timers, Counter 2. Practical Examples of Ladder Programming

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. P, PI, PD and PID control systems

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
ME 302.1: Identify key elements of mechatronics and its representation by block diagram. .	9	2	1	12
ME 302.2: Understand the concept of sensors and use of interfacing systems.	14	1	2	17
ME 302.3: Understand the concept and applications of different actuators	12	2	1	15
ME 302.4: Illustrate various applications of mechatronic systems.	10	2	2	14
ME 302.5 Develop PLC ladder programming and implementation in reallife problem.	15	1	1	17
Total Hours	60	8	7	75

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction of Mechatronics and its block diagram representation	03	01	01	05
CO-2	Selection of Sensors & Actuators	02	06	02	10
CO-3	Data Acquisition, Signal Conditioning & Microcontroller System Theory	03	07	05	15
CO-4	Pneumatics and hydraulics	-	10	05	15
CO-5	Control System	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Mechatronics 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. Visit to cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog , Face book, Twitter, What-app, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher
1	Mechatronics	Kenji Uchino and Jayne R. Giniewicz	Marcel Dekker, Inc
2	Applied Mechatronics	A. Smaili and F. Mrad	OXFORD university press
3	Introduction to Mechatronics and Measurement Systems	Alciatore and Histand	Tata McGraw-Hill
4	Mechatronics System Design	Shetty and Kolk	Cengage Learning, India Edition

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Cos, Pos and PSOs Mapping

Course Title: B.Tech. Mechanical

Course Code : ME 302

Course Title: Mechatronics

Course Outcomes	ProgramOutcomes												ProgramSpecificOutcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/developmentof solutions	Conductinvestigations of complex problems	Modern Tool usage	Theengineeraandsociety	Environment and sustainability:	Ethics	Individual andteamwork:	Communication:	Project management and finance:	Life-longlearning	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
C01 Identify key elements of mechatronics and its representation by block diagram.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO 2 : Understand the concept of sensors and use of interfacing systems.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3 : Understand the concept and applications of different actuators	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO4: Illustrate various applications of mechatronic systems.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO5: Develop PLC ladder programming and implementation in real life problem.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	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 PSO1,2,3,4,	CO-1: Identify key elements of mechatronics and its representation by block diagram.	SO1.1 SO1.2 SO1.3		Unit-1.0 **Introduction of Mechatronics and its block diagram representation** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	As mentioned in Page number 2 to 6
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	CO 2 : Understand the concept of sensors and use of interfacing Systems.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2.0 Selection of Sensors & Actuators 2.1,2.2,2.3,2.4,2.5,2.6,2.7, 2.8,2.9,2.10,2.11,2.12,2.13,2.13,2.14	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	CO3: Understand the concept and applications of different actuators	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3.0 : Data Acquisition, Signal Conditioning & Microcontroller System 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,3.11, 3.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	CO 4: Illustrate various applications of mechatronic systems.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4.0 : Pneumatics and hydraulics 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,	CO 5: Develop PLC ladder programming and implementation in real life problem.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		**Unit 5.0 Control System** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11,5.12 ,5.13,5.14,5.15	

CourseCode: HSMC302

CourseTitle: OperationsResearch

Pre-requisite: Studentshouldhavebasicknowledgeofmathematicsandbusiness 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 solutionsofthebusinessoperationsproblems;hencethestudyofoperations researchisveryimportanttomanagementstudents.

CourseOutcomes:

HSMC302.1: Thestudentwilldemonstratetheprocessofproblemsolvingin Operations Research.

HSMC 302.2: The student will apply the linear programming problem method to solve the various business management problems quantitatively.

HSMC302.3: Thestudentwillusethetransportationandassignmenttechniquestosolvethe transportation and assignment problems quantitatively.

HSMC302.4: Thestudent will applynetwork analysistechniqueslike PERT andCPMto solvethe scheduling of activities and resource allocation related problems.

HSMC302.5: Thestudentwillcalculatetheoptimumvalueofgameandoptimumreplacement period using game theory and replacement theory respectively.

SchemeofStudies:

Code	Course Code	CourseTitle	Schemeofstudies(HoursperWeek)					TotalCredits (C)
			CI	LI	SW	SL	TotalStudyHours (CI+LI+SW+SL)	
Program (HSMC)	HSMC 302	Operations Research	3	0	1	1	5	3

Legend: **CI:**ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)andothers),
LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop, field or other locations using different instructional strategies)
SW: SessionalWork(includesassignment,seminar,mini projectetc.),
SL: SelfLearning,
C:Credits.

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

SchemeofAssessment:

Theory

Boardof Study	Couse Code	CourseTitle	Schemeof Assessment(Marks)							
			ProgressiveAssessment(PRA)						EndSemesterAssessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5number 3marksea ch (CA)	ClassTest2(2bestout Of3) 10mark seach (CT)	Seminar one (SA)	ClassActivityan yone (CAT)	ClassAttendance (AT)	TotalMarks (CA+CT+SA+CAT+AT)		
(HSMC)	HSMC 302	OperationsResearch	15	20	5	5	5	50	50	100

Course-CurriculumDetailing:

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 ClassroomInstruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and SelfLearning (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.

HSMC302.1: Thestudentwilldemonstratetheprocessofproblemsolvingin OperationsResearch.

ApproximateHours

Item	AppXHrs
CI	07
LI	0
SW	1
SL	1
Total	9

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**ClassroomInstruction (CI)**	**SelfLearning (SL)**
SO1.1 Studentwillexplainabout the development of Operations Research **SO1.2** Studentwillexplainabout the characteristics and scope of Operations Research **SO1.3** Student will demonstrate theprocessofoperations research to problem solving. **SO1.4**Studentwillclassify different models of operations research.	.	**Unit-1 : Introduction to OperationsResearch(OR)** MeaningandDefinitionsof Operations Research. HistoricalDevelopmentof Operations Research. DevelopmentofOperations Research in India. CharacteristicsofOperations Research ScopeofOperations Research. Scope of Operations Researchinmanagement. OperationsResearch Methodology.	i. Quantitative approach to decision making. ii. Quantitative Analysis and Computer-Based Information System

SW-1SuggestedSessionalWork(SW):

a) **Assignments:**
   i. Definitions,HistoricalDevelopment,andCharacteristicsofOR.
   ii. ProcessandModelsofOR.

b) **MiniProject:**
   i. Preparea flowchartofprocessofOR toproblemsolvingina chartpaper.

c) **OtherActivities(Specify):**

HSMC302.2: Thestudent willapplythelinearprogrammingproblemmethodtosolvethevariousbusiness management problems quantitatively.

ApproximateHours

Item	AppxHrs
CI	10
LI	0
SW	2
SL	2
Total	14

SessionOutcomes (SOs)	Laboratory Instruction (LI)	ClassroomInstruction (CI)	SelfLearning (SL)
SO2.1 StudentwillexplainabouttheConcept, Assumptions and Requirements of LPP. **SO2.2**StudentswillformulatetheLPP **SO2.3**StudentwillsolvetheLPPbyGraphical Method **SO2.4**StudentwillSolvetheLPPbySimplex Method. **SO2.5** Student will solve the LPP by Big-M and Two phase methods		**Unit-2:LinearProgramming** Meaning and Requirements of Linear Programming. Assumptions of Linear Programming. Formulation of two variable Maximization type Linear ProgrammingProblem Formulation of two variable Minimization type Linear ProgrammingProblem Formulation of more than two variables Maximization type Linear Programming Problem. Formulation of more than two variables Minimization type Linear Programming Problem	Practice:-SolutionofLPP by Graphical Method Practice:-SolutionofLPP by Simplex Method..

		Formulation of Miscellaneous LPPS Solution of Maximization Type LPP by Graphical Method Solution of Minimization Type LPP by Graphical Method Solution of LPP by Graphical Method: Special Cases- Multiple Optimal Solutions.	

SW-2SuggestedSessionalWork(SW):

a. **Assignments:**
   i. FormulatetheLPP(Problemwill begivenbythesubjectteacher)
   ii. SolvetheLPPbyGraphicalandSimplexMethods(Problemwillbegivenbythesubjectteacher)

b. **MiniProject:**

c. OtherActivities(Specify):

HSMC 302.3: The studentwill use the transportation and assignment techniques to solve the transportation and assignment problems quantitatively.

ApproximateHours

Item	AppxHrs
CI	10
LI	0
SW	2
SL	2
Total	14

SessionOutcomes (SOs)	Laboratory Instruction (LI)	ClassroomInstruction (CI)	SelfLearning (SL)
SO3.1 Studentwillformulatethe transportation problem **SO3.2**Studentwillsolvethe transportation problem	.	**Unit-3:Transportationand Assignment Problem** Concept of Transportation Problem MathematicalFormulationofa Transportation Problem	i) Practice- Solution of transportation Problems

SO3.3 Studentwillformulatethe assignment problem **SO3.4**Studentwillsolvetheassignment problem.		Initial Basic Feasible Solution by NWC Rule and LCM Method. Initial Basic Feasible Solution by Vogel's Approximation Method (VAM) Optimality Test: Minimizationtype problem stepping stone method Optimality Test: Minimizationtype problem by Modified Distribution Method (MODI) Optimality Test: maximizationtype problem stepping stone method Optimality Test: Maximization type problem by Modified Distribution Method (MODI) Transportation Problem: Special Cases (Unbalanced, Multiple Optimal Solution and Prohibited Route Problem) Transportation Problem: Special Cases -Degeneracy Case	ii) Practice-Solution of Assignment Problems.

SW-3SuggestedSessionalWork (SW):

a. Assignments:i. Formulationand solutionofthetransportationproblem
ii.Formulationand solutionoftheassignmentproblem

b. MiniProject: MakeflowchartofthesolutionofaTransportationandAssignment Problems in a chart paper.

c. OtherActivities(Specify):

HSMC302.4: Thestudentwillapplynetworkanalysistechniqueslike PERTandCPMtosolvethe scheduling of activities and resource allocation related problems.

ApproximateHours

Item	AppxHrs
CI	10
LI	0
SW	2
SL	2
Total	14

SessionOutcomes (SOs)	Laboratory Instruction (LI)	ClassroomInstruction (CI)	SelfLearning (SL)
SO4.1 Studentwillbeabletodescribe the network construction rules. **SO4.2** Studentwillbeabletousethe CPM in project management. **SO4.3**Studentwillbeabletousethe PERT in project management. **SO4.4** Student will find out the shortest route and longest routesby dynamic programming. **SO4.5**Studentwillexplainaboutthe simulation and process of simulation.	.	**Unit- 4: PERT and CPM, Dynamic Programming, and Simulation.** Introduction to NetworkAnalysis RulesofNetworkConstruction Redundancy in precedence relationship: Location and removal NetworkConstruction Calculation of Earliest Start and Finish Times and Latest Start and Finish Times Determining thecriticalpath and calculation of project completion time CalculationofFloatTimes Time-CostTrade-off:Crashing ResourceLeveling ResourceAllocation	i. Practice:- Network construction and determination of critical path ii. Practice:- Calculation of Earliest start and Finish Times as well as Latest Startingand Finish time ii.Practice-: PERT-Calculation of Expectedtimeand Variances.

SW-4SuggestedSessionalWork(SW):

a. Assignments:

i) Network Construction,CriticalPathDetermination, CalculationofEarliestandlatest starting and finish times, Calculation of float times. Resource analysis and allocation.
ii) PERT-CalculationofExpectedtimeandVariances

b. **MiniProject:**Constrctuctionofa network anddeterminationofcriticalpathandprojectcompletiontimefor a real project (Project will be detailed by a subject teacher)

c. **OtherActivities(Specify):**

HSMC302.5: Thestudentwillcalculatetheoptimumvalueofgameandoptimumreplacementperiod using game theory and replacement theory respectively.

ApproximateHours

Item	AppxHrs
CI	8
LI	0
SW	2
SL	2
Total	12

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**SelfLearning (SL)**
SO5.1 Student will be able to applythe game theory in the competitive business world as a strategic tool. **SO5.2** Student will be able to determinetheoptimalreplacement time which will help in the formulation of replacement policy **SO5.3** Student will describe the generalstructureofaqueuing system.		Unit 5: **Game Theory, ReplacementTheoryand Queuing Theory.** Meaning of a Two Person Game, N Person Game, Pure Strategy Game, Mixed Strategy Game, Zero Sum Game, Non- Zero Sum Game, Fair Game. Solution of a game whensaddle point exists. Solution of a 2x2 game when saddle point does not exists. Solution of a m x n game with dominance rule Solution of a m x n game with joint (proportional) dominance rule 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 Introduction and Scope of Replacement Theory in Management.	i. Practice:- Formulation and solution of a game. ii. Practice:- Solution of a replacement problem.

SW-5SuggestedSessionalWork(SW):

a. Assignments:

i) FormulationandSolutionofagametheoryproblems

ii) Solutionofreplacementtheoryproblems

b. MiniProject:i)Makeaflowchartofasolutiontoagametheoryproblem.

c. OtherActivities(Specify):

BriefofHourssuggestedfortheCourseOutcome

Course Outcomes	Class Lecture (CI)	Sessional Work (SW)	Self Learning (SI)	Total hour (CI+SW+SI)
HSMC302.1: Thestudentwilldemonstrate the processof problemsolving in Operations Research.	7	1	1	9
HSMC 302.2: The student will apply the linear programming problem method to solve thevariousbusinessmanagementproblems quantitatively.	10	2	2	14
HSMC 302.3: The student will use the transportation and assignment techniques to solvethetransportationandassignment problemsquantitatively.	10	2	2	14
HSMC 302.4: Thestudent willapply network analysis techniques like PERT and CPM to solvetheschedulingofactivitiesandresource allocationrelatedproblems.	10	2	2	14
HSMC 302.5: The student will calculate the optimum value of game and optimum replacementperiodusinggametheoryand replacementtheoryrespectively.	8	2	2	12
TotalHours	45	9	9	63

SuggestionforEndSemesterAssessment

SuggestedSpecificationTable(ForESA)

CO	UnitTitles	MarksDistribution				Total Marks
		Ap	An	Ev	Cr	
CO-1	INTRODUCTION TO OPERATIONS RESEARCH(OR)					
CO-2	LINEAR PROGRAMMING					
CO-3	TRANSPORTATIONANDASSIGNMENT PROBLEM					
CO-4	PERT AND CPM, DYNAMIC PROGRAMMING,ANDSIMULATION.					
CO-5	GAME THEORY, REPLACEMENT THEORY AND QUEUING THEORY.					
Total						50

Legend: **Ap:Apply,** **An:Analyze,** **Ev:Evaluate** **Cr:Create**

Theend ofsemester assessment for OperationsResearchwill beheldwith writtenexamination of50 marks.

Note.DetailedAssessmentrubricneedtobepreparedbythecoursewiseteachersforabovetasks.
Teacherscanalsodesigndifferenttasksasperrequirement,forendsemesterassessment.

SuggestedInstructional/ImplementationStrategies:

1. ImprovedLecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. RolePlay
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog,Facebook,Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

SuggestedLearningResources:

(a)Books:

S. No.	Title	Author	Publisher	Edition& Year
1	Quantitative Techniques in Management	Vohra,N D	TMH,NewDelhi	Latest
2	ProblemsandSolutionsin Operations Research	V.K.Kapoor	SultanChandandSons, New Delhi	Latest
3	PrinciplesofOperations ResearchwithApplication to Managerial Decisions	H.M.Wagner	PHILearning	Latest
4	OperationsResearch	KantiSwarup,PK Gupta and Man Mohan	SultanChand&Sons, New Delhi	Latest
5	OperationsResearch	Heera&Gupta	S. Chand	Latest

CurriculumDevelopmentTeam

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10. Mr.AnuragSinghParihar,TeachingAssociate,Dept.ofBusinessAdministration
11. Ms.KiranChhabariya, AssistantProfessor,Dept.ofBusinessAdministration

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Cos,POsandPSOs Mapping

ProgrammeTitle:B.Tech.Mechanical
CourseCode:HSMC302
CourseTitle:OperationsResearch

CourseOutcomes	ProgramOutcome								ProgramSpecific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
	BusinessEnvironmentand DomainKnowledge	Critical &Analyticalthinking,Business Analysis,ProblemSolvingand Logical Solutions	InternationalExposure andCross-CulturalUnderstanding	SocialResponsivenessand Ethos	EffectiveBusinessCommunication	LeadershipDevelopmentand Synergy	R&DAptitude	Contemporary issues	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
Co1: Thestudent willdemonstratethe processofproblemsolvinginOperations Research.	2	3	-	1	1	1	2	1	1	1	1	-
Co2: The student willapply the linearprogramming problem method tosolvethevariousbusiness managementproblemsquantitatively.	2	3	-	1	1	1	3	1	2	2	1	-
Co3: The student will use thetransportation and assignmenttechniques to solve the transportationand assignment problems quantitatively.	2	3	-	1	1	1	3	1	2	2	1	-
Co4: The student will apply networkanalysis techniques like PERT andCPM to solve the scheduling ofactivitiesandresourceallocation relatedproblems.	2	3	-	1	1	1	3	1	2	2	1	-
Co5: The student will calculate theoptimum value of game and optimumreplacementperiodusinggame theory andreplacementtheoryrespectively.	2	3	-	1	1	1	3	1	2	2	1	-

CourseCurriculumMap:

POs&PSOs No.	COsNo.&Titles	SOs No.	Laboratory Instruction (LI)	ClassroomInstruction(CI)	Self Learning (SL)
PO1,2,3,4,5,6,7,8 PSO1,2,3,4	**Co1:** The student will demonstrate the process of problem solving in Operations Research.	SO1.1 SO1.2 SO1.3 SO1.4		Unit-1:INTRODUCTIONTOOPERATIONS RESEARCH(OR) 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	
PO1,2,3,4,5,6,7,8 PSO1,2,3,4	**Co2:** The student will apply thelinear programming problem method to solve the various business management problems quantitatively.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2LINEAR PROGRAMMING 2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9, 2.10,2.11,2.12,2.13,2.14,2.15,2.16, 2.17,2.18,2.19,2.20	
PO1,2,3,4,5,6,7,8 PSO1,2,3,4	**Co3:** The student will use the transportation and assignment techniques tosolvethetransportation and assignment problems quantitatively.	SO3.1 SO3.2 SO3.3 SO3.4		Unit-3:TRANSPORTATIONAND ASSIGNMENTPROBLEM 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9, 3.10,3.11,3.12,3.13,3.14,3.15,3.16	
PO1,2,3,4,5,6,7,8 PSO1,2,3,4	**Co4:** The student will applynetwork analysis techniques like PERT and CPM to solve the scheduling of activitiesandresourceallocation relatedproblems.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 : PERT AND CPM, DYNAMIC PROGRAMMING,ANDSIMULATION. 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	
PO1,2,3,4,5,6,7,8 PSO1,2,3,4	**Co5:** The student will calculate the optimum value of game andoptimum replacement period using gametheoryandreplacementtheory respectively.	SO5.1 SO5.2 SO5.3		Unit5:GAME THEORY, REPLACEMENT THEORY ANDQUEUING THEORY. 5.1,5.2,5.3,5.4,5.5, 5.6,5.7,5.8, 5.9, 5.10,5.11,5.12,5.13	

Semester-VI

Course Code: PEC-ME06

Course Title : Additive Manufacturing

Pre- requisite: A fundamental understanding of materials science, engineering graphics, and basic manufacturing processes is essential. Proficiency in CAD (Computer-Aided Design) software and familiarity with 3D printing concepts are recommended. Students should possess critical thinking skills to analyze and optimize designs for additive manufacturing technologies.

Rationale: Additive manufacturing curriculum cultivates expertise in cutting-edge 3D printing technologies. It equips students with skills essential for industry demands, fostering innovation and sustainability. This hands-on approach ensures graduates are adept in designing, prototyping, and optimizing production processes, meeting the evolving needs of diverse sectors.

Course Outcomes:

PEC-ME06.1: Students will comprehend the evolution, advantages, and classification of AM processes, distinguishing them from subtractive and forming techniques.

PEC-ME06.2: Gain proficiency in Liquid State-based AM processes, focusing on Stereo lithography, Solid Ground Curing, and their applications in diverse industries.

PEC-ME06.3: Acquire in-depth knowledge of Solid State-based AM processes, specifically Fused Deposition Modeling, Laminated Object Manufacturing, and other techniques, along with practical demonstrations.

PEC-ME06.4: Develop expertise in Powder Bed Fusion Processes, understanding powder fusion mechanisms, and comparing various processes like Selective Laser Sintering and Electron Beam Melting.

PEC-ME06.5: Apply AM techniques to product development lifecycle phases, exploring applications in rapid prototyping, tooling, aerospace, medical, and other sectors, emphasizing real-world scenarios and case studies.

Scheme of Studies:

Board of Study	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)	PEC-ME06	Additive Manufacturing	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

Board of Study	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	PEC-ME06	Additive Manufacturing	15	20	5	5	5	50	50	100

AKS University

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.

PEC-ME06.1: Students will comprehend the evolution, advantages, and classification of AM processes, distinguishing them from subtractive and forming techniques.

Approximate Hours

Item	AppX Hrs
Cl	09
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	LaboratoryInstruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Grasp the historical evolution of Additive Manufacturing (AM) and 3D printing, understanding key milestones that have shaped its development. **SO1.2** analyzes and compares AM with subtractive and forming processes, elucidating the advantages of AM in terms of efficiency, design flexibility, and material utilization. They will also gain insights into the classification of AM processes and the fundamental steps involved in AM workflows.		**Unit-1.0 Introduction to Additive Manufacturing (AM):** 1.1 Introduction to manufacturing. 1.2 Introduction to additive manufacturing. 1.3 Evolution of AM/3D printing. 1.4 Comparison with subtractive. 1.5 Comparison with forming process. 1.6 Advantages of AM. 1.7 Classification of AM processes. 1.8 Key steps in AM. 1.9 Application of AM.	1. Comparison of additive manufacturing process with subtractive and forming processes. 2. Key Features of AM process.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

Explain additive manufacturing process. Classify different method of additive manufacturing process.

PEC-ME06.2: Gain proficiency in Liquid State-based AM processes, focusing on Stereo lithography, Solid Ground Curing, and their applications in diverse industries.

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)
SO2.1 Understand Stereo Lithography's process, working principles, and applications. Explore equipment specifications, advantages, disadvantages, and real-world examples. SO2.2 Achieve proficiency in Solid Ground Curing, comprehending its process, working principles, and applications. Engage with equipment specifications and analyze advantages, disadvantages, and practical examples..		**Unit-2 Liquid State-based AM Processes:** 2.1Stereo lithography Process and working principle. 2.2 Photopolymers. 2.3Photo polymerization, layering technology. 2.4 Laser and Laser scanning. 2.5 Micro stereo lithography; Equipment and specifications. 2.6 Micro stereo lithography Applications, advantages, disadvantages, examples. 2.7 Solid ground curing: Process, Working principle. 2.8 Solid ground curing Equipment and specifications. 2.9 Solid ground curing Applications, advantages, disadvantages, examples.	i. Micro stereo lithography; Equipment and specifications; Applications, advantages, disadvantages, examples.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Explain solid ground curing process with advantages and disadvantages.

PEC-ME06.3: Acquire in-depth knowledge of Solid State-based AM processes, specifically Fused Deposition Modeling, Laminated Object Manufacturing, and other techniques, along with practical demonstrations.

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)
SO3.1 Gain a comprehensive understanding of FDM, including its process, working principles, and compatible materials. Explore equipment specifications, applications, advantages, disadvantages, and real-world examples. **SO3.2** Develop proficiency in LOM by delving into its process, working principles, and equipment specifications. **SO3.3** Explore alternative solid-state processes like Ultrasonic Consolidation, Gluing, and Thermal Bonding. Witness demonstrations of equipment, understanding their unique applications, advantages, disadvantages, and relevance in additive manufacturing		**Unit-3 : Solid State-based AM Processes:** 3.1 Fused Deposition Modeling – Process, working principle. 3.2 Fused Deposition Modeling materials, equipment and specifications. 3.3 Laminated object manufacturing – Process and working principle. 3.4 Laminated object manufacturing equipment and specifications. 3.5 Laminated object manufacturing applications, advantages, disadvantages, examples. 3.6 Other solid-state processes. 3.7 Ultrasonic consolidation. 3.8 Gluing, Thermal bonding. 3.9 Demonstration of equipment.	i. Equipment used in Fused Deposition Modeling. ii. Working principle of Laminated object manufacturing.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Define working principle of laminated object manufacturing process.
ii. Explain equipment used in laminated object manufacturing process.
iii. Explain Ultrasonic consolidation process.

PEC-ME06.4: Develop expertise in Powder Bed Fusion Processes, understanding powder fusion mechanisms and comparing various processes like Selective Laser Sintering and Electron Beam Melting.

Approximate Hours

Item	AppX Hrs
Cl	09
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Understand Powder Bed Fusion, materials, and handling, forging expertise in Laser-Based Fusion processes with real-world applications and examples. **SO4.2** Analyze LBF processes intricately, identifying materials, applications, and limitations, optimizing choices based on material-process relationships for superior outcomes.		**Unit-4 : Powder Based AM Processes:** 4.1 Powder Bed Fusion Processes – Working principle and materials. 4.2 Powder fusion mechanism and powder handling 4.3 Various LBF processes (principle, materials, applications and examples). 4.4 Selective laser Sintering. 4.5 Electron Beam Melting. 4.6 Laser Engineered Net Shaping. 4.7 Binder Jetting and Direct Metal Deposition. 4.8 Comparison between LBF processes; Materials-process-structure-property relationships. 4.9 Relative advantages and limitations.	i. Comparison between LBF processes; Materials-process-structure-property relationships; relative advantages and limitations.

PEC-ME06.2: Gain proficiency in Liquid State-based AM processes, focusing on Stereo lithography, Solid Ground Curing, and their applications in diverse industries.

Approximate Hours

Item	AppX Hrs
Cl	09
LI	0
SW	1
SL	1
Total	11

Session Outcomes (SOs)	LaboratoryInstruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Master AM applications in prototyping, visual aids, and replacement parts for an efficient product development lifecycle. **SO5.2** Explore AM applications across aerospace, medical, automotive, and more, tailoring solutions for diverse industries with precision.		**Unit 5: Applications of AM:** 5.1 Product development lifecycle applications – Rapid prototyping. 5.2 concept models, visualization aids. 5.3 replacement parts, tooling, jigs and fixtures. 5.4 moulds and casting. 5.5 Application sectors – aerospace. 5.6 Application sectors – automobile, medical. 5.7 Application sectors – jewelry, sports. 5.8 Application sectors – electronics, food 5.9 Application sectors – architecture, construction and others.	1. Details of rapid prototyping process. 2. Applications of additive manufacturing process in different field.

SW-5 Suggested Sessional Work (SW):

Assignments:

i. Explain different application of additive manufacturing process.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
PEC-ME06.1: Students will comprehend the evolution, advantages, and classification of AM processes, distinguishing them from subtractive and forming techniques.	9	1	1	11
PEC-ME06.2: Gain proficiency in Liquid State-based AM processes, focusing on Stereo lithography, Solid Ground Curing, and their applications in diverse industries.	9	1	1	11
PEC-ME06.3: Acquire in-depth knowledge of Solid State-based AM processes, specifically Fused Deposition Modeling, Laminated Object Manufacturing, and other techniques, along with practical demonstrations.	9	1	1	11
PEC-ME06.4: Develop expertise in Powder Bed Fusion Processes, understanding powder fusion mechanisms, and comparing various processes like Selective Laser Sintering and Electron Beam Melting.	9	1	1	11
PEC-ME06.5: Apply AM techniques to product development lifecycle phases, exploring applications in rapid prototyping, tooling, aerospace, medical, and other sectors, emphasizing real-world scenarios and case studies	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	Introduction to Additive Manufacturing.	03	02	-	5
CO-2	Liquid State-based AM Processes.	04	04	02	10
CO-3	Solid State-based AM Processes.	04	04	02	10
CO-4	Powder Based AM Processes.	05	07	03	15
CO-5	Applications of AM.	05	03	02	10
Total		21	20	09	50

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

The end of semester assessment for Additive Manufacturing 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	3D Printing & Design	Sabrie Soloman.	Khanna Book Publishing Company, New Delhi	2020
2	Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping and Direct Digital Manufacturing	Ian Gibson, David W Rosen, Brent Stucker	Springer	2015
3	Additive Manufacturing: Principles, Technologies and Applications	C.P Paul, A.N Junoop	McGrawHill	2021
4	3D Printing and Additive Manufacturing: Principles & Applications	Chua Chee Kai, Leong Kah Fai	World Scientific	2015
5	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna .			

Curriculum Development Team

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Cos,POs and PSOs Mapping

Course Title: B. Tech. Mechanical Engineering

Course Code : PEC-ME06

Course Title: Additive Manufacturing

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
CO1 : Students will comprehend the evolution, advantages, and classification of AM processes, distinguishing them from subtractive and forming techniques.	2	1	2	2	3	2	2	2	2	1	3	2	2	2	1	2
CO 2 : Gain proficiency in Liquid State-based AM processes, focusing on Stereo lithography, Solid Ground Curing, and their applications in diverse industries.	1	1	1	1	3	2	2	2	2	1	2	2	1	2	1	2
CO3 : Acquire in-depth knowledge of Solid State-based AM processes, specifically Fused Deposition Modeling, Laminated Object Manufacturing, and other techniques, along with practical demonstrations.	2	2	1	1	3	1	2	2	2	1	1	2	1	2	1	1
CO 4: Develop expertise in Powder Bed Fusion Processes, understanding powder fusion mechanisms, and comparing various processes like Selective Laser Sintering and Electron Beam Melting.	2	2	2	1	3	2	2	2	2	1	2	2	1	2	1	2
CO 5: Apply AM techniques to product development lifecycle phases, exploring applications in rapid prototyping, tooling, aerospace, medical, and other sectors, emphasizing real-world scenarios and case studies.	2	1	1	1	1	3	2	2	2	1	2	2	1	2	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, 3, 4	CO-1: Students will comprehend the evolution, advantages, and classification of AM processes, distinguishing them from subtractive and forming techniques.	SO1.1 SO1.2		Unit-1.0 Introduction to Additive Manufacturing (AM) 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	As mentioned in page number 2 to 6
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 2 : Gain proficiency in Liquid State-based AM processes, focusing on Stereo lithography, Solid Ground Curing, and their applications in diverse industries.	SO2.1 SO2.2		Unit-2 Liquid State-based AM Processes 2.1, 2.2, 2.3,2.4,2.5,2.6,2.7,2.8,2.9	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO3 : Acquire in-depth knowledge of Solid State-based AM processes, specifically Fused Deposition Modeling, Laminated Object Manufacturing, and other techniques, along with practical demonstrations.	SO3.1 SO3.2 SO3.3		Unit-3 : Solid State-based AM Processes 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 4: Develop expertise in Powder Bed Fusion Processes, understanding powder fusion mechanisms, and comparing various processes like Selective Laser Sintering and Electron Beam Melting.	SO4.1 SO4.2		Unit-4 : Powder Based AM Processes 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, 3, 4	CO 5: Apply AM techniques to product development lifecycle phases, exploring applications in rapid prototyping, tooling, aerospace, medical, and other sectors, emphasizing real-world scenarios and case studies.	SO5.1 SO5.2		Unit 5: Applications of AM 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	

AKS University

Semester-VI

Course Code: **PEC-ME 05**

Course Title: Computational fluid dynamics

Pre- requisite: Student should have basic knowledge of fluid mechanics, differential equation, numerical method and program skill like PYTHON, MATLAB languages.

Rationale: CFD offers a powerful means to simulate and analyze fluid behavior across diverse fields, enabling better design, optimization, understanding of complex systems, and aiding in decision-making processes across various industries and scientific domains

Course Outcomes:

PEC-ME 05.1: . : Understand the classification of PDEs, governing equations
PEC-ME 05.2: . : Understand the basic principles of computational methods.
PEC-ME 05.3: . : Apply finite volume method to solve steady and unsteady diffusion, advection-diffusion problems
PEC-ME 05.4: . : Understand Solution algorithms and various discretization schemes
PEC-ME 05.5: . : Solve engineering problems using CFD software

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Scheme of Studies:

Board of Study	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)	PEC-ME 05	Computational fluid dynamics	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

Board of Study	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	PEC ME05	COMPUTATIONAL FLUID DYNAMICS	15	20	5	5	5	50	50	100

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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.

PEC ME 05.1: . Understand the classification of PDEs, governing equations...

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)
.SO1.1 Apply mathematical concepts like calculus, differential equations, and linear algebra to solve CFD problems. Use CFD software to set up simulations and perform basic analyses. SO1.2 Assess the accuracy and reliability of CFD simulations by comparing results with experimental data or established benchmarks. Critically analyze the limitations and assumptions made in the simulation process. SO1.3 Develop and design CFD simulations for specific fluid flow scenarios. Innovate by proposing improvements or modifications to existing numerical models or simulation techniques. .		**S Unit-1. Introduction to Computational Fluid Dynamics** 1.1 Introduction to CFD . 1.2 Principles of Conservation 1.3 Continuity Equation, 1.4 Continuity Equation numerical problem 1.5 Navier Stokes Equation 1.6 Energy Equation and General Structure of Conservation Equations 1.7 Classification of Partial Differential Equations and Physical Behaviour 1.8 Approximate Solutions of Differential Equations 1.9 Error Minimization Principles	**1. Application of continuity equation**

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Explain Navier stoke equation?
2. Numerical problem

PEC ME 05.2: : Understand the basic principles of computational methods

..

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 . Apply discretization techniques to transform partial differential equations (e.g., Navier-Stokes equations) into discrete forms suitable for numerical solvers. Implement basic discretization schemes for simple flow problems. SO2.2 : Evaluate the impact of discretization errors on simulation results. Assess the sensitivity of solutions to grid refinement and discretization choices. Critically evaluate the appropriateness of chosen discretization schemes for specific flow scenarios. SO2.3 Design and develop discretization strategies for complex fluid flow problems. Innovate by proposing improvements or modifications to existing discretization methods to enhance accuracy or computational efficiency.		**Unit-2.0 . Fundamentals of Discretization.** 2.1 . Concept in Discretization 2.2 Finite Element Method 2.3 Finite Difference method 2.4 Finite Volume Method, 2.5 Consistency 2.6 Stability and Convergence 2.7 1-D Steady State Diffusion Problems 2.8 - Source term linearization 2.9 Implementation of boundary conditions	1. Types of Discretization and its application

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Explain finite volume method?
2. Numerical problem

PEC ME 05.3. Apply finite volume method to solve steady and unsteady diffusion, advection-diffusion problems

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)
SO3.1 Apply mathematical formulations, such as the unsteady-state diffusion equation, to model and solve problems involving the time-dependent diffusion of substances in various medium SO3.2 Analyze the factors influencing unsteady state diffusion, such as concentration gradients, diffusion coefficients, boundary conditions, and material properties SO3.3 Evaluate the significance of unsteady state diffusion in practical scenarios, assessing its implications in fields like chemical engineering, material science, and biological systems. Critically assess the accuracy and limitations of mathematical models used for unsteady state diffusion		**Unit-3.0 Unsteady state diffusion problems** 3.11-D unsteady state diffusion problems 3.2 implicit, fully explicit 3.3 Finite volume discretization of convection-diffusion problem 3.4Central difference scheme, Upwind scheme 3.5Exponential scheme and Hybrid scheme 3.6 Power law scheme 3.7, Generalized convection-diffusion formulation 3.8 Finite volume discretization of two-dimensional convection-diffusion problem 3.9 The concept of false diffusion	1. Differentiate between steady-state and unsteady-state diffusion

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   1. Understand how boundary and initial conditions affect the behavior of the diffusion process.
   2. Numerical problem

PEC ME 05.4. Understand Solution algorithms and various discretization schemes

Approximate Hours

Item	AppX Hrs
CI	09
LI	00
SW	02
SL	01
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO4.1 Apply Finite Volume Discretization techniques to set up the discretized forms of governing equations (e.g., diffusion or advection equations) for 2-D unsteady state problems. Implement numerical schemes (e.g., explicit or implicit) to solve these discretized equations. SO4.2 Assess the impact of different numerical schemes and variations in grid configurations on the accuracy and convergence of solutions for unsteady state problems.		**Unit-4.0 Finite Volume Discretization of 2-D unsteady State** 4.1 Finite Volume Discretization of 2-D unsteady State Diffusion type Problems 4.2 Solution of Systems of Linear Algebraic Equations 4.3 Elimination Methods 4.4, Iterative Methods 4.5 Discretization of Navier Stokes Equations 4.6 primitive variable approach 4.7 SIMPLE Algorithm 4.8 SIMPLER Algorithm 4.9 Unstructured Grid Formulation	1. Comprehend the concept of discretizing the domain into control volumes and the associated fluxes across their faces.

Critically evaluate the performance of the Finite Volume Method in capturing complex flow behaviors in two dimensions SO4.3 Design and construct Finite Volume-based simulations for various 2-D unsteady state scenarios. Innovate by proposing improvements or modifications to existing schemes to handle specific challenges or optimize computational efficiencY			

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   1. **state. the governing equations for unsteady-state problems in two dimensions.**
   2. **Numerical problem**

PEC-ME05.5: Solve engineering problems using CFD software

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 Apply different turbulence models (e.g., k-epsilon, k-omega, large eddy simulation) to simulate turbulent flows in different scenarios. Implement these models within CFD software and understand how to set up simulations using these models. SO5.2 Analyze the performance of turbulence models by comparing simulation results with experimental data or benchmark cases. Evaluate the accuracy and applicability of different turbulence models for specific flow conditions and geometries. SO5.3 Design and develop turbulence modeling strategies for complex flow scenarios. Innovate by proposing modifications or combinations of existing turbulence models to improve accuracy and capture intricate turbulent behaviors.		**Unit-5. .** Turbulence Modeling 5.1 . Introduction to Turbulence Modeling 5.2 Important features of turbulent flow 5.3 numericals-1 5.4 numericals-2 5.5 General Properties of turbulent quantities, 5.6 Reynolds average Navier stokes (RANS) equation 5.7 Closure problem in turbulence 5.8 Necessity of turbulence modeling 5.9 turbulence modeling application	1. Comprehend the concept of Reynolds decomposition and time-averaging to handle turbulence

SW-5 Suggested Sessional Work (SW):

a. Assignments:

1. Explain General Properties of turbulent quantities
2. Write the turbulence modeling application.

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)
PEC-ME 05.1: : Understand the classification of PDEs, governing equations	9	0	2	**1**	12
PEC-ME 05.2: Understand the basic principles of computational methods .	9	0	2	**1**	12
PEC-ME 05.3: : Apply finite volume method to solve steady and unsteady diffusion, advection-diffusion problems	9	0	2	1	12
PEC-ME 05.4: Understand Solution algorithms and various discretization schemes .	9	0	2	1	12
PEC-ME 05.5: Solve engineering problems using CFD software	9	0	2	**1**	12
Total Hours	45	00	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	**Introduction to Computational Fluid Dynamics**	03	01	01	05
CO-2	**Fundamentals of Discretization**	02	06	02	10
CO-3	**Unsteady state diffusion problems** .	03	07	05	15
CO-4	**Finite Volume Discretization of 2-D unsteady State**	-	10	05	15
CO-5	**Turbulence Modeling**	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Computational Fluid Dynamics 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:

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

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Applied computational fluid dynamics	S C Gupta	wiley	2019
2	Computational fluid dynamics and COMSOL multiphysics	Ashish S. Chaurasia	Apple academic pres inc.	2021
3	Computational fluid dynamics an introduction	J Anderson, G. Degrez, J.Degroote	springer	2008
4	An introduction to computational fluid dynamics the finite volume method	H. Versteeg, W. Malalaskra	pearson	2008
5	Training Manual			
6	Training Manual			
7	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna .			

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Cos,POs and PSOs Mapping

Course Title: B. Tech Mechanical Engineering

Course Code : PEC ME 05

Course Title: Computational Fluid Dynamics

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modelling and Simulation.	Product Development
CO1 : Understand the classification of PDEs, governing equations	1	1	2	2	2	2	3	1	2	2	1	2	2	2	1	-
CO 2 . Understand the basic principles of computational methods	1	2	2	2	1	2	2	1	1	1	2	3	2	2	2	1
CO3 : Apply finite volume method to solve steady and unsteady diffusion, advection-diffusion problems	2	2	1	1	2	2	2	1	1	2	1	2	2	1	2	2
CO 4: : Understand Solution algorithms and various discretization schemes	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2
CO 5: . Solve engineering problems using CFD software	1	2	2	-	1	1	3	1	1	1	2	2	3	3	1	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	CO1 : Understand the classification of PDEs, governing equations	SO1.1 SO1.2 SO1.3		Unit-1.0 . Introduction to Computational Fluid Dynamics 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	As mentioned in page number 2 to 6
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2 : Understand the basic principles of computational methods	SO2.1 SO2.2 SO2.3		Unit-2 . Fundamentals of Discretization 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO3 : Apply finite volume method to solve steady and unsteady diffusion, advection-diffusion problems	SO3.1 SO3.2 SO3.3		Unit-3 : **Unsteady state diffusion problems** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: Understand Solution algorithms and various discretization schemes	SO4.1 SO4.2 SO4.3		Unit-4 : **Finite Volume Discretization of 2-D unsteady State** 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, 3, 4, 5	CO 5. Solve engineering problems using CFD software	SO5.1 SO5.2 SO5.3		Unit 5: turbulence modelling 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	

AKS University

Semester-VI

Course Code: **PCC-ME 305**

Course Title: Computer Aided Design and Analysis

Pre- requisite: Student should have Mathematical Skills, Computer Skills and Technical Knowledge of design principles, engineering concepts.

Rationale: Computer-Aided Design and Analysis, enables manufacturers to create and modify product designs quickly and accurately, reducing development time and costs. It allows for easy prototyping, analysis, and optimization, improving product quality and performance.

Course Outcomes:

PCC-ME 305.1: Understanding of computer technology and CAD software
PCC-ME 305.2: To broaden and deepen their capabilities in doing Different types of Transformations in Design
PCC-ME 305.3: To impart knowledge of Curves and Surfaces in modelling
PCC-ME 305.4: Have abilities and capabilities for applying Solid modelling techniques
PCC-ME 305.5: Apply/develop solutions or to do research in the areas of Optimization of Design

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Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week) CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	Total Credits (C)
Program Core (PCC)	PCC-ME 305	computer aided design and analysis	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

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks) — Progressive Assessment (PRA): 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)	End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
PCC	PCC-ME 305	computer aided design and analysis	15	20	5	5	5	50	50	100

AKS University

Practical

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV + AT)		
PCC	PCC-ME 305	computer aided design and 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.

PCC 305.1: Understanding of computer technology and CAD software.

Approximate Hours

Item	AppX Hrs
Cl	13
LI	6
SW	1
SL	2
Total	22

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1 Understanding of basic knowledge CAD. SO1.2 CAD tools enable faster prototyping, iteration, and refinement of designs, accelerating the product development lifecycle. SO1.3 These tools allow for precise modeling and analysis, reducing errors and improving the overall accuracy of designs.	1.1 Introduction to laboratory 1.2 Introduction to CAD and Graphics Hardware 1.3 Study and Application of Computer Graphics in CAD	**Unit-1.0 Introduction** 1.1 Introduction to CAD 1.2 Introduction to computer technology 1.3 Application of computer technology 1.4 Role of computers in design process 1.5 Product cycle 1.6 Computer aided designing 1.7 Design processes 1.8 Computer aided analysis 1.9 Computer aided manufacturing 1.10 Computer integrated manufacturing 1.11 Benefits of CAD 1.12 CAD software 1.13 Popular CAD software used in industry	**1.** Explanation of computer system **2.** Input and output devices in computer system

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Explain design of a mechanical component

PCC 305.2: To broaden and deepen their capabilities in doing Different types of Transformations in Design.

Approximate Hours

Item	AppX Hrs
Cl	13
LI	6
SW	1
SL	2
Total	22

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO2.1 Transformation in CAD has led to more powerful software tools that offer advanced functionalities. This includes 3D modeling, parametric modeling, generative design, and simulation capabilities that empower designers to create more complex and innovative designs. SO2.2 CAD has transformed by integrating with various other technologies such as augmented reality (AR), virtual reality (VR), additive manufacturing (3D printing), and cloud computing. This integration enhances visualization, collaboration, and the manufacturing process.	**2.1 Study of** Geometric Transformations **2.2** Transformation in 2D component 2.3 Transformation in 3D component	**Unit-2.0 Transformations** 2.1 Introduction to Transformations 2.2 Matrix representation of points 2.3 Matrix representation of lines 2.4 Matrix representation of planes 2.5 2D transformations 2.6 translation 2.7 Scaling 2.8 rotation 2.9. reflection 2.10 Homogeneous representation 2.11 concatenation 2.12. Application of 2D transformations 2.13 3D transformations.	1. Explain the Cartesian coordinate system 2. Importance of Transformations

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Problems based on Transformations.

PCC 305.3: To impart knowledge of Curves and Surfaces in modelling

Approximate Hours

Item	AppX Hrs
Cl	11
LI	4
SW	1
SL	1
Total	17

Session Outcomes (SOs)	LaboratoryInstruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Curves and surfaces enable the creation of intricate and complex shapes that are challenging or impossible to achieve with traditional geometric primitives. This capability expands the design possibilities for engineers and designers. SO3.2 CAD tools with robust curve and surface manipulation capabilities allow for the creation of aesthetically pleasing designs, particularly in industries like automotive, product design, and architecture, where sleek and stylish appearances are crucial.	3.1 Study of Mathematical Elements of Curves 3.2 Algorithms Used for Generating 2D Output Primitives	**Unit-3.0 Curves and Surfaces** 3.1Introduction to Curves and Surfaces 3.2 Representation of curves 3.3 Hermite curves and Bezier curves 3.4 B-spline curves and Rational curves 3.5 Surface modelling 3.6 parametric representation 3.7 planar surface, surface of revolution 3.8 Coons and bicubic patches 3.9 Bezier and B-spline surfaces 3.10 Application of surface modelling 3.11 Advantages of surface modelling over wire model	1. Basics of curves and surfaces

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
1. Explain the importance of wire and surface modelling

PCC 305.4: Have abilities and capabilities for applying Solid modelling techniques

Approximate Hours

Item	AppX Hrs
Cl	12
LI	8
SW	1
SL	2
Total	23

Session Outcomes (SOs)	LaboratoryInstruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 CAD models can be used directly in 3D printing or other rapid prototyping methods, speeding up the transition from design to physical prototype. SO4.2 With faster design iterations, fewer physical prototypes needed, and more accurate predictions, products can be brought to market more quickly.	4.1 To study of Geometric Modeling (Part Modeling) 4.2 To study of Geometric Modeling (Assembly Modeling) 4.3 To draw 2D component 4.4 To draw 3D component	Unit-4.0 **Solid Modelling** 4.1 Introduction to Solid Modelling 4.2 Solid modelling techniques 4.3 sweep (linear and curved) 4.4 Boolean (constructive solid geometry) 4.5 Some other techniques 4.6 Solid model representation 4.7 Boundary and Constructive Solid Geometry 4.8 Application of solid modelling 4.9 Advantages of solid modelling 4.10 Medical modelling 4.11 pixels, scans and voxels 4.12 Exchange standards (IGES, DXF, STEP, STL etc.)	1. Model of a component 2. Three dimensional model of a component

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
1. Explain different types modeling.

PCC 305.5: Apply/develop solutions or to do research in the areas of Optimization of Design

Approximate Hours

Item	AppX Hrs
Cl	11
LI	6
SW	1
SL	2
Total	20

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO5.1 Engineers can perform simulations to optimize designs for various parameters such as strength, weight, and cost-effectiveness, leading to better-performing products. SO5.2 CAD tools can assist in ensuring designs meet industry standards and regulatory requirements by performing analysis and simulations related to safety, durability, and other criteria. **SO5.3** CAD provides detailed documentation of designs, aiding in manufacturing, assembly, and maintenance. It also allows for realistic visualizations of products for presentations and marketing purposes.	5.1 To study of design optimization 5.2 Design of Machine Elements 5.3 Case-Study on Applications of CAD	**Unit-5.0 Design Optimization** 5.1 Introduction to Design Optimization 5.2 Purpose of optimum design 5.3 Application of optimum design 5.4 Primary design equations 5.5 Subsidiary design equations 5.6 Limit Equations 5.7 Normal and redundant problems 5.8 Incompatible specifications problems 5.9 Application of design equations 5.10 Computer-aided design optimization 5.11 Benefits of design optimization	1. The concept of optimization 2. The importance of design equations in optimization

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**

1. How does design optimization is important ?

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Lecture (LI)	Sessional Work (SW)	Self Learning (SI)	Total hour (Cl+LI+SW+SI)
PCC 305.1: Understanding of computer technology and CAD software.	13	6	1	**2**	22
PCC 305.2: To broaden and deepen their capabilities in doing Different types of Transformations in Design.	13	6	1	**2**	22
PCC 305.3: To impart knowledge of Curves and Surfaces in modelling	11	4	1	1	17
PCC 305.4: Have abilities and capabilities for applying Solid modelling techniques	12	8	1	2	23
PCC 305.5: Apply/develop solutions or to do research in the areas of Optimization of design	11	6	1	**2**	20
Total Hours	60	30	5	9	104

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction	03	01	01	05
CO-2	Transformations	02	06	02	10
CO-3	Curves and Surfaces	03	07	05	15
CO-4	Solid Modelling	-	10	05	15
CO-5	Design Optimization	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for **Computer Aided Design and Analysis** 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:

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

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Mastering CAD CAM	Ibrahim Zeid	Tata McGra Hill Publishig Co.	2007
2	CAD/CAM Principles	C. McMohan and J. Browne	Pearson Education	2nd Edition 1999
3	Geometric Modeling	Michael E. Mortenson	Tata McGraw Hill	2013
4	Principles of Computer Graphics	W. M. Neumann and R.F. Sproul	Tata McGraw Hill	1989
5	Training Manual			
6	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna .			

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Cos,POs and PSOs Mapping

Course Title: B. Tech Mechanical Engineering

Course Code: PCC-ME 305

Course Title: Computer Aided Design and Analysis

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
CO1 : Understanding of computer technology and CAD software.	1	1	2	2	2	2	3	1	2	2	1	2	2	2	1	-
CO 2 : To broaden and deepen their capabilities in doing Different types of Transformations in Design.	1	2	2	2	1	2	2	1	1	1	2	3	2	2	2	1
CO3 : To impart knowledge of Curves and Surfaces in modelling	2	2	1	1	2	2	2	1	1	2	1	2	2	1	2	2
CO 4: Have abilities and capabilities for applying Solid modelling techniques	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2
CO 5: Apply/develop solutions or to do research in the areas of Optimization of design	1	2	2	-	1	1	3	1	1	1	2	2	3	3	1	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	CO1 : Understanding of computer technology and CAD software.	SO1.1 SO1.2 SO1.3	UNIT – 1 1.1 1.2 1.3	Unit-1.0 Introduction 1.1,1.2,1.3,1.4,1.5,1.6,1.71.8,1.9,1.10, 1.11,1.12,1.13	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2 : To broaden and deepen their capabilities in doing Different types of Transformations in Design.	SO2.1 SO2.2	UNIT – 2 2.1 2.2 2.3	Unit-2 Transformations 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	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO3 : To impart knowledge of Curves and Surfaces in modelling	SO3.1 SO3.2	UNIT – 3 3.1 3.2 3.3	Unit-3 : Curves and Surfaces 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8, 3.9,3.10,3.11	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: Have abilities and capabilities for applying Solid modelling techniques	SO4.1 SO4.2	UNIT – 4 4.1 4.2 4.3	Unit-4 : Solid Modelling 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10, 4.11,4.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 5: Apply/develop solutions or to do research in the areas of Optimization of design	SO5.1 SO5.2 SO5.3	UNIT – 5 5.1 5.2 5.3	Unit 5: Design Optimization 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10, 5.11	

Semester-VI

Course Code: **PROJ-ME 301**

Course Title : **Engineering Project-1(Literature Review)**

Pre-requisite: Students should have basic knowledge for design, development and analysis of project.

Rationale: Students should be well-versed in the Mechanical manufacturing process and concrete production. Keeping abreast of the latest technological trends is crucial for identifying contemporary R&D topics. A fundamental understanding of the physical and chemical properties of Material is essential. Additionally, students must be proficient in statistical methods for effective data analysis and interpretation. Competence in Microsoft Word and Excel is necessary for report writing and documentation. By combining technical knowledge with analytical and software skills, students will be well-prepared to tackle challenges in the field and contribute meaningfully to research and development efforts.

Course Outcomes:

PROJ-ME 301.1:Methodology for projectdesign and project scheduling

PROJ-ME 301.2: Methods of Data collection and data compiliation

PROJ-ME 301.3:Product development

PROJ-ME 301.4: Data analysis and data interpretation

PROJ-ME 301.5: Concluding remark and future work

SchemeofStudies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Hours (CI+LI+SW+SL)	
PROJ	PROJ-ME 301	Engineering Project-1(Literature Review)	2		1	1	4	2

Legend:

CI: ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)andothers),
LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop, field or other locations using different instructional strategies)
SW: Sessional Work(includesassignment, seminar, miniprojectetc.),

SL: SelfLearning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback ofteacherto ensureoutcomeofLearning.

Scheme of Assessment:

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)									
			Progressive Assessment (PRA)						End Semester Assessment			Total Marks (PRA+ESA)
			Project Scheduling	Data collection and sampling	Product design	Product analysis and data interporetaion	Report writing and concluding remark	Total Mark	Seminar	Project Viva	Total Marks	
PROJ	PROJ-ME 301	Engineering Project-1(Literature Review)	05	05	05	25	10	50	15	35	50	100

Course-CurriculumDetailing:

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 Lab Work Assignment (LA) Best of 5 of the total, Viva-Voice on Lab Work (VV), and Lab Attendance (LA). 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.

Course Outcome	Activities	Time Schedule (in hours)	
		Class Activity Per week (5 Credit)	Self Learning /Home activity Per week
PROJ-ME 301:	**1. Literature review and identification of Cement and concrete related projects and project**	5	10

CO.1: Methodology for design and project scheduling	**scheduling** Examining recent literature on Materials projects unveils advancements, methodologies, and applications. This review identifies emerging trends, innovative materials, and sustainable practices, significantly impacting construction, durability, and environmental outcomes. Noteworthy projects illustrate novel approaches, enriching insights and guiding future developments in Material technology. **Project scheduling** : Project scheduling involves planning and organizing tasks to ensure timely completion. It includes defining activities, setting deadlines, and allocating resources efficiently. Effective scheduling helps manage time, costs, and personnel, enhancing productivity and project success. It's crucial for meeting goals, coordinating efforts, and maintaining project momentum		
PROJ-ME 301: CO.2: Methods of Data collection and data compiliation	2**. Design and formulation projects** i. Methods of data collection and data compiletion ii. Design and formulation projects concentrate on innovating products through meticulous recipe development and methodological refinement. These initiatives prioritize material optimization, functional enhancement, and quality assurance. By blending creativity with technical prowess, they propel advancements across industries, fostering the creation of distinctive, efficient, and commercially viable solutions.	8	15
PROJ-ME 301: CO.3: Product development	**3. Sample analysis and product development** Testing samples determines their suitability by assessing quality, performance, and compliance with standards. It involves rigorous analysis and evaluation to ensure materials meet project requirements. This process identifies strengths and weaknesses, guiding decision-making and ensuring the reliability and effectiveness of the chosen	10	25

	samples for intended applications. Product design and analysis in R&D involve creating and refining products to meet market needs. This process includes conceptualizing, prototyping, and testing to optimize functionality and performance. Analyzing results helps improve designs, ensuring products are innovative, efficient, and ready for successful market introduction.		
PROJ-ME 301. CO.4: Data analysis and data interpretation	**i. Product Dataanalysis &compilation** Project data compilation involves collecting and organizing all relevant information for analysis and reporting. This process ensures data accuracy and completeness, facilitating informed decision-making and efficient project management. It helps track progress, identify trends, and generate insights, supporting successful project outcomes and future planning. ii. **Statistical data analysis and data interpretation** Statistical data analysis involves examining and processing data to uncover patterns and trends. Data interpretation translates these findings into meaningful insights, aiding decision-making and strategy development. This process enhances understanding, supports evidence-based conclusions,	40	15
PROJ-ME 301. CO.5: Concluding remark and future work	**5. Report Writing, Conclusion, Recommendations and Future work in Research work** **Report Writing** : Comprehensive project report writing **Conclusion:** The study successfully demonstrated key findings. It underscores implications, validating hypothesis/objectives. This contributes field significance, laying groundwork for applications. **Recommendation**: Future research should explore expansion areas, emphasizing methodological improvements. Collaboration partners/stakeholders	12	25

	would enrich knowledge transfer. **Future Work:** Innovations in technology/techniques could advance potential benefits. Addressing challenges would refine outcomes, fostering industry/government support.		
Total		75	90

Suggestion for End Semester Assessment

SuggestedSpecificationTable(ForESA)

Course Outcome	UnitTitles	MarksDistribution			Total Marks
		R	U	A	
PROJ-ME 301: CO.1: Methodology for design and project scheduling	1. Literature review and identification of Material related projects and project scheduling	02	03	-	5
PROJ-ME 301: CO.2: Methods of Data collection and data compiliation	2. Design and formulation projects	-	05	03	8
PROJ-ME 301: CO.3: Product development	3. Sample analysis and product development	-	08	04	12
PROJ-ME 301. CO.4: Data analysis and data interpretation	4. Product Data analysis, data interpretation and findings	-	08	12	20
PROJ-ME 301. CO.5: Concluding remark and future work	5. Report writing, concluding remark and future work		03	02	5
Total		02	27	21	50

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

TheendofsemesterassessmentforEngineering Project-1 (Literature Review) willbeheld with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wiseteachers for above tasks. Teachers can also design different tasks as per requirement, for endsemesterassessment.

SuggestedInstructional/ImplementationStrategies:

1. ImprovedLecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. RolePlay
6. Visit to cement plant
7. Demonstration
8. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp, Mobile,Onlinesources)
9. Brainstorming

SuggestedLearningResources:

(a) Books:

S.No.	Title	Author	Publisher	Edition &Year
1	The literature review : six steps to success	Lawrence A. Machi, Brenda T. McEvoy.	Corwin Press, Inc	2022
2	Lee			
3	Tylor			
4	Manufacturing Processes			
5				

Curriculum Development Team

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COs, POsandPSOs Mapping

ProgramTitle:B.Tech Mechanical Engineering

Course Code:PROJ-ME 301; **CourseTitle:** Engineering Project-1(Literature Review)

CourseOutcomes	Program Outcomes												ProgramSpecificOutcome			
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
PROJ-ME 301: CO.1: Methodology for design and project scheduling	2	1	1	1	1	3	3	1	1	1	1	2	3	3	3	3
PROJ-ME 301: CO.2: Methods of Data collection and data compiliation	3	1	2	2	2	3	3	1	1	1	1	2	3	3	3	3
PROJ-ME 301: CO.3: Product development	2	1	1	1	1	3	3	1	1	1	1	2	3	3	3	3
PROJ-ME 301. CO.4: Data analysis and data interpretation	3	1	2	2	2	3	3	1	1	1	1	2	3	3	3	3
PROJ-ME 301. CO.5: Concluding remark and future work	2	1	1	1	1	3	3	1	1	1	1	2	3	3	3	3

Legend:1–Low,2–Medium,3–High

CourseCurriculumMap: Engineering Project-1(Literature Review)

POs&PSOsNo.	COsNo.&Titles	SOsNo.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning(SL)
	PROJ-ME 301: CO.1: Methodology for design and project scheduling				
	PROJ-ME 301: CO.2: Methods of Data collection and data compiliation				
	PROJ-ME 301: CO.3: Product development				
	PROJ-ME 301. CO.4: Data analysis and data interpretation				
	PROJ-ME 301. CO.5: Concluding remark and future work				

AKS University

Semester-VI

Course Code: **PCC-ME 306**

Course Title: **Manufacturing Automation**

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 theory helps engineers understand how different types of machines operate, from simple mechanisms to complex systems. It provides the foundational principles for designing machines that are efficient, safe, and reliable.It provides a framework for solving engineering problems related to the design and operation of machines.

Course Outcomes:

PCC-ME-306 .1: Students should gain a comprehensive understanding of the concepts, principles, and technologies involved in manufacturing automation, including robotics, programmable logic controllers (PLCs), sensors, actuators, and human-machine interfaces. .

PCC-ME-306 .2: Students should be able to describe and analyze different types of automation systems used in manufacturing processes, such as fixed automation, programmable automation, and flexible automation..

PCC-ME-306 .3: Students should develop programming skills necessary for configuring and controlling automated systems, including programming languages such as ladder logic, Structured Text, Function Block Diagrams, or other relevant languages used in PLC programming.

PCC-ME-306.4: Students should learn how to troubleshoot common issues with automation systems and perform routine maintenance tasks to ensure optimal performance and uptime.

PCC-ME-306 .5: Awareness of emerging trends and technologies in manufacturing automation, such as Industrial Internet of Things (IIoT), Artificial Intelligence (AI), Machine Learning (ML), and advanced robotics, and their potential applications in improving manufacturing processes..

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Scheme of Studies:

Board of Study	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)	PCC-ME-306	Manufacturing Automation	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(includesassignment,seminar,miniprojectetc.),
SL: Self Learning,
C: Credits.

Note:
SW&SLhastobeplannedandperformedunderthecontinuousguidanceandfeedbackofteachertoe nsureoutcomeof Learning.

Scheme of Assessment:

Theory

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment(PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment 5number 3 marks each (CA)	Class Test2 (2bestout of3) 10 marksea ch(CT)	Semina r one (SA)	Class Activity anyone (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
PCC	PCC-ME-306	Manufacturing Automation	15	20	5	5	5	50	50	100

Practical

AKS University

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)					
			Progressive Assessment (PRA)				**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 7 marks each (CA)	VIVA	Class Attendance (AT)	Total Marks (CA+VV + AT)		
PCC	PCC-ME-306	Manufacturing Automation	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 thecourseprogresses,students shouldshowcasetheirmasteryofSessionOutcomes(SOs),culminatingintheoverallachievementofCourseOutcomes(COs)uponthecourse'sconclusion.

PCC-ME-306 .1: Students should gain a comprehensive understanding of the concepts, principles, and technologies involved in manufacturing automation, including robotics, programmable logic controllers (PLCs), sensors, actuators, and human-machine interfaces.

Approximate Hours

Item	AppXHrs
Cl	12
LI	06
SW	02
SL	02
Total	22

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 - Gain knowledge of the various technologies used in machine and process automation, including sensors, actuators, controllers, and communication protocols. SO5.2 - Develop the ability to identify opportunities for automation within manufacturing processes, considering factors such as repetitive tasks, safety requirements, and efficiency improvements. SO5.3 - Understand the process of integrating automation systems with existing machinery and processes, including interfacing with legacy systems and implementing communication protocols for data exchange.	**Unit-1.0 Introduction and Process Automation** 1.1. introduction of Automation lab 1.2. To study the fundamentals of automation and its types. 1.3 Tools introduction	**Unit-1.0 Introduction and Process Automation** 1.1 Definition; Reasons for automating; Strategies 1.2 Types of automation; Numerical control (NC, CNC, DNC) 1.3 Introduction to CNC programming and computer-aided process planning 1.4 Machine and Process Automation 1.5 CNC machines, Automated flow lines (types, selection); 1.6 Work part transport and transfer mechanisms 1.7 Feedback systems and control 1.8 Modular and reconfigurable machines 1.9 adaptive machine controls. 1.10 Tutorial I 1.11 Tutorial II 1.12 Tutorial III	1.1Analysis of CNC programming and computer-aided process planning 1.2 study of feedback system

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. how would you recommend implementing process automation to achieve these goals.
2. Provide specific examples of tasks or processes that could be automated and explain the potential benefits for the company.

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PCC-ME-306 .2: Students should be able to describe and analyze different types of automation systems used in manufacturing processes, such as fixed automation, programmable automation, and flexible automation

Item	Appx Hrs
CI	12
LI	06
SW	02
SL	02
Total	22

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Learn about different types of automated assembly systems, such as fixed sequence, flexible, and modular systems, and understand their respective applications and benefits. SO2.2 Understand the key design considerations for automated assembly systems, including layout optimization, workstation design, part feeding mechanisms, and ergonomic considerations SO2.3 Understand the key design considerations for automated assembly systems, including layout optimization, workstation design, part feeding mechanisms, and ergonomic considerations.	**Unit-2.0 Automated assembly systems and factory automation** 1. Study and report on Pneumatic and Hydraulic Automation system 2. Study and report on micro controller and its application. 3. Instructions for using machine in the correct way	**Unit-2.0 Automated assembly systems and factory automation** 2.1 Historical developments; Choice of assembly methods 2.2 Design for automated assembly 2.3 Transfer systems; 2.4 ; Vibratory and non-vibratory feeders 2.5 Feed tracks, part orienting and placing mechanisms 2.6 Factory Automation: Lean manufacturing 2.7 Automation scalability (fixed, programmable, flexible and reconfigurable); 2.8 Design and analysis of automated flow lines 2.9 ; Average production time, production rate 2.10 line efficiency. 2.11 Tutorial I 2.12 Tutorial II	2.1 Analysis of transfer lines without storage; 2.2 Partial and full automation

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Explain the following -
   i. Production Requirements
   ii. Cost-Benefit Analysis:
2. Write short note on -
   i. Scalability and Flexibility:
   ii. Environmental Impact:

PCC-ME-306 .3: Students should develop programming skills necessary for configuring and controlling automated systems, including programming languages such as ladder logic, Structured Text, Function Block Diagrams, or other relevant languages used in PLC programming.

Approximate Hours

Item	Appx Hrs
CI	12
LI	06
SW	02
SL	02
Total	22

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Participants will grasp the fundamentals of automated assembly systems, including their components, functionalities, and applications across various industries. SO2.2 Identify and analyze the key components and technologies utilized in automated assembly systems and factory automation, such as robotics, conveyors, sensors, PLCs, and human-machine interfaces SO3.3 Develop basic proficiency in programming and controlling automated assembly systems using relevant software tools and programming languages, with a focus on PLC programming and robot programming various.	**Unit-3.0 Automation Tools and Techniques.** 3.1 Study and report on flexible manufacturing system. 3.2 Study and report on Industrial Robotics: Sensors and Actuators 3.3 Instructions for using machine in the correct way	**Unit-3.0 Automation Tools and Techniques** 3.1 Mechanical, electro-mechanical 3.2 pneumatic and hydraulic systems 3.3 Sensors integration; Process monitoring 3.4 data analysis and control using actuators 3.5 Robots (pick, place, assembly, welding, painting, etc.) 3.6 Automatic Guided Vehicles 3.7 Automated inspection and measurement (CMM and 3D Scanning) 3.8 Machine vision 3.9 AI and machine learning. 3.10 Tutorial I 3.11 Tutorial II 3.12 Tutorial III	3.1. Human machine interfaces 3.2. Examples and case studies

SW-3Suggested Sessional Work (SW):

a. **Assignments:**
   1. Define Feasibility Assessment**:**
   2. What do you understand by Integration and Compatibility

PCC-ME-306.4: Students should learn how to troubleshoot common issues with automation systems and perform routine maintenance tasks to ensure optimal performance and uptime

Approximate Hours

Item	Appx Hrs
Cl	12
LI	06
SW	02
SL	02
Total	22

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO4.1 Participants may have gained insights into the latest advancements in automation technologies, including artificial intelligence (AI), machine learning (ML), robotic process automation (RPA), Internet of Things (IoT), and autonomous systems. SO4.2 The session may have included discussions on how advanced automation is being applied across various industries such as manufacturing, healthcare, finance, transportation, and agriculture. Case studies may have been presented to illustrate successful implementations and their impact SO4.3 S There might have been discussions on the skills and education needed to thrive in an increasingly automated world, including the importance of lifelong learning, up skilling, and deskilling.	**Unit-4.0 Advanced Automation Trends** 4.1 Study and report on Different Automated Machinery 4.2 Study and report on Modular Automation System: Casting shop, Machine shop, Press Shop 4.3 Instructions for using machine in the correct way and safety aspect.	**Unit-4.0 Advanced Automation Trends** 4.1 Digital, inclusive 4.2 smart manufacturing 4.3 distributed manufacturing 4.4 Industry 4.0 4.5 Digital transformations in shop-floors 4.6 CIM to Smart factory; 4.7 Intelligent machines to Smart Machines 4.8 Factory automation to Distributed automation 4.9 Human sense to system sensed). 4.10 Tutorial I 4.11 Tutorial II 4.12 Tutorial III	1.Analysis of distributed manufacturing 2.study of Intelligent machines to Smart Machines

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   1. What do you understand by Technological Advancements
   2. Explain Collaboration and Innovation

PCC-ME-306 .5: Awareness of emerging trends and technologies in manufacturing automation, such as Industrial Internet of Things (IIoT), Artificial Intelligence (AI), Machine Learning (ML), and advanced robotics, and their potential applications in improving manufacturing processes

Approximate Hours

Item	Appx Hrs
Cl	12
LI	06
SW	02
SL	02
Total	22

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO5.1 - Participants explore how IoT sensors can provide real-time insights into supply chain operations, enabling proactive decision-making SO5.2 - Logistics Company Z deployed IoT sensors across its supply chain to track the location, temperature, and condition of goods in transit SO5.3 - Participants learn how computer vision technologies can automate visual inspections and quality control processes	**Unit-5.0 Examples and Case Studies** **5.1** Study and report on Economic analysis of Automation. 5.2 Study of Orientation of parts: in-bowl and out-of-bowl tooling's 5.3 Instructions for using machine in the correct way and safety aspect.	**Unit-5.0 Examples and Case Studies** 5.1 Pick and place robots 5.2 testing and sorting based systems 5.3 Orientation of parts: in-bowl and out-of-bowl tooling's 5.4 Manufacturing equipment embedded with digital data 5.5 driven by adoptive controls; 5.6 Manufacturing automation 5.7 autonomous decisions taken by computers based on the realistic process/machines 5.8 production conditions 5.9 Tutorial I 5.10 Tutorial II 5.11 Tutorial III 5.12 Tutorial IV	5.1 data acquired from the resources 5.2 Analysis of manufacturing automation

SW-5 Suggested Sessional Work (SW):

a. Assignments:

1. What specific challenges or inefficiencies did the organization face before implementing the solution
2. How did the organization overcome these challenges, and what strategies were employed to mitigate potential risks?

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)
PCC-ME-306 .1: Students should gain a comprehensive understanding of the concepts, principles, and technologies involved in manufacturing automation, including robotics, programmable logic controllers (PLCs), sensors, actuators, and human-machine interfaces.	12	06	02	02	22
PCC-ME-306 .2: Students should be able to describe and analyze different types of automation systems used in manufacturing processes, such as fixed automation, programmable automation, and flexible automation..	12	06	02	02	22
PCC-ME-306 .3: Students should develop programming skills necessary for configuring and controlling automated systems, including programming languages such as ladder logic, Structured Text, Function Block Diagrams, or other relevant languages used in PLC programming.	12	06	02	02	22
PCC-ME-306.4: Students should learn how to troubleshoot common issues with automation systems and perform routine maintenance tasks to ensure optimal performance and uptime.	12	06	02	02	22
PCC-ME-306 .5: Awareness of emerging trends and technologies in manufacturing automation, such as Industrial Internet of Things (IIoT), Artificial Intelligence (AI), Machine Learning (ML), and advanced robotics, and their potential applications in improving manufacturing processes	12	06	02	02	22
Total Hours	60	30	10	10	110

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Introduction and Process Automation**	03	01	01	05
CO-2	**Automated assembly systems and factory automation**	02	06	02	10
CO-3	**Automation Tools and Techniques**	03	07	05	15
CO-4	**Advanced Automation Trends**	-	10	05	15
CO-5	**Examples and Case Studies**	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for **Manufacturing Automation** will be held with written examination of 50 marks

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

Suggested Instructional/ Implementation Strategies:

2. Improved Lecture
3. Tutorial
4. Case Method
5. Group Discussion
6. Role Play
7. Visit to cement plant
8. Demonstration
9. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
10. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition& Year
1	Automation, Production Systems and Computer-integrated Manufacturing	M. P. Groover	Prentice Hall	2018
2	Manufacturing Engineering and Technology	S. Kalpakjian and S. R. Schmid,	McGraw Hill	2006
3	Computer Control of Manufacturing Systems,	Yoram Koren,	McGraw Hill	2005
4	CAD/CAM Principles and Applications,	P.N. Rao	McGraw Hill	2010
5	TrainingManual			
6	Training Manual			
7	Lecture note provided by Dept.ofMechanical Engineering,AKSUniversity,Satna.			

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Cos,POsandPSOsMapping

CourseTitle: B.Tech Mechanical Engineering

CourseCode: PCC-ME-306

CourseTitle: Manufacturing Automation

CourseOutcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineeringknowledge	Problemanalysis	Design/developmentofsolutions	Conductinvestigationsofcomplexproblems	Modentoolusage	Theengineerandsociety	Environmentandsustainability:	Ethics	Individualandteamwork:	Communication:	Projectmanagementandfinance:	Life-longlearning	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
PCC-ME-306 .1: Students should gain a comprehensive understanding of the concepts, principles, and technologies involved in manufacturing automation, including robotics, programmable logic controllers (PLCs), sensors, actuators, and human-machine interfaces.	1	1	2	2	2	2	3	1	2	2	1	2	2	2	1	-
PCC-ME-306 .2: Students should be able to describe and analyze different types of automation systems used in manufacturing processes, such as fixed automation, programmable automation, and flexible automation..	1	2	2	2	1	2	2	1	1	1	2	3	2	2	2	1
PCC-ME-306 .3: Students should develop programming skills necessary for configuring and controlling automated systems, including programming languages such as ladder logic, Structured Text, Function	2	2	1	1	2	2	2	1	1	2	1	2	2	1	2	2

Block Diagrams, or other relevant languages used in PLC programming.																
PCC-ME-306.4: Students should learn how to troubleshoot common issues with automation systems and perform routine maintenance tasks to ensure optimal performance and uptime.	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2
PCC-ME-306 .5: Awareness of emerging trends and technologies in manufacturing automation, such as Industrial Internet of Things (IIoT), Artificial Intelligence (AI), Machine Learning (ML), and advanced robotics, and their potential applications in improving manufacturing processes	1	2	2	-	1	1	3	1	1	1	2	2	3	3	1	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 PSO1,2,3,4,5	**CO-1 PCC-ME-306 .**1: Students should gain a comprehensive understanding of the concepts, principles, and technologies involved in manufacturing automation, including robotics, programmable logic controllers (PLCs), sensors, actuators, and human-machine interfaces.	SO1.1 SO1.2 SO1.3	UNIT -1 1.1 1.2 1.3	**Unit-1.0 Introduction and Process Automation** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10, 1.11,1.12	As mentioned in Page number 2to6
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	**CO-2 PCC-ME-306 .**2: Students should be able to describe and analyze different types of automation systems used in manufacturing processes, such as fixed automation, programmable automation, and flexible automation..	SO2.1 SO2.2 SO2.3	UNIT -2 2.1 2.2 2.3	**Unit-2.0 Automated assembly systems and factory automation** 2.1,2.2,2.3,2.4,2.5,2.6,2.7, 2.8,2.9,2.10,2.11,2.12	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	**CO-3 PCC-ME-306 .**3: Students should develop programming skills necessary for configuring and controlling automated systems, including programming languages such as ladder logic, Structured Text, Function Block Diagrams, or other relevant languages used in PLC programming.	SO3.1 SO3.2 SO3.3	UNIT -3 3.1 3.2 3.3	**Unit-3.0 Automation Tools and Techniques** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9, 3.10,3.11,3.12	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	**CO-4 PCC-ME-306.**4: Students should learn how to troubleshoot common issues with automation systems and perform routine maintenance tasks to ensure optimal performance and uptime.	SO4.1 SO4.2 SO4.3	UNIT -4 4.1 4.2 4.3	**unit-4.0 Advanced Automation Trends** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9 4.10,4.11,4.12	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	**CO-5 PCC-ME-306 .**5: Awareness of emerging trends and technologies in manufacturing automation, such as Industrial Internet of Things (IIoT), Artificial Intelligence (AI), Machine Learning (ML), and advanced robotics, and their potential applications in improving manufacturing processesdesign	SO5.1 SO5.2 SO5.3	UNIT -5 5.1 5.2 5.3	**Unit-5.0 Examples and Case Studies** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9, 5.10,5.11,5.12	

Semester-VI

Course Code:	PCC- ME 308
Course Title :	Product Innovation & Entrepreneurship
Pre- requisite:	Student should have basic knowledge of Entrepreneurship and also delineate the evolution and development of the concept of the term entrepreneur.
Rationale:	'It's all about the Start-up and New enterprise!' The students studying Entrepreneurship development under the Computer science engineering should possess to develop the knowledge and skills to manage the enterprise affairs of individuals, communities, and businesses based on IT . Students will develop the knowledge and skills necessary to establish and maintain Enterprise, based on internet and technology, Manage financial affairs, Act with integrity and Contribute to the wider community. Entrepreneurship development gives students the tools to make real life business decisions in a constantly changing and uncertain world and enhances business literacy.

Course Outcomes:

CO.1: Acquire the knowledge of Entrepreneurship and different theories of Entrepreneurship,challenges and process of Entrepreneurship.

CO.2: Acquire the basic concept of Entrepreneurial mindset and creativity with innovative ideasrelated to technology.

CO.3: Exposed to various methods of Opportunity analysis which includes opportunity sighting,opportunity evaluation process and different business models.

CO.4: Familiarize and understand Various techniques of pitching, various sources of funds, Types of investors and understanding of the three financial statements: Profit and loss account,Balance sheet, and cash flow statement.

CO.5: Acquire the concept of Collaboration it's types, Networking and it's types and Intellectual property rights.

AKS University

Faculty of Engineering and technology

Department of Mechanical Engineering
Curriculum of B.Tech. (Mechanical Engineering) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
PCC	PCC-ME 308	Product Innovation & Entrepreneurship	4	0	2	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

Board of Study	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	PCC-ME 308	Product Innovation & Entrepreneurship	15	20	5	5	5	50	50	100

CO.1: Acquire the knowledge of Entrepreneurship and different theories of Entrepreneurship,challenges and process of Entrepreneurship.

Approximate Hours

Item	Appx Hrs.
CI	12
LI	0
SW	2
SL	3
Total	17

Session Outcomes (SOs)	(LI)	Class room Instruction (CI)	(SL)
SO1.1 Understand the Concept and nature of Entrepreneurship **SO1.2** Understand Various Entrepreneurship theories **SO1.3** Understand Challenges and Process of Entrepreneurship **SO1.4** Understand Start-up and internet based start-up **SO1.5** Understand Myths related to entreprenneurship and those forces which affects it		**Unit-1 Introduction of Entrepreneurship** 1.1 Concept of Entrepreneurship 1.2 Evolution of Entrepreneurship theories 1.3 Theory of Achievement motivation 1.4 Theory of Entrepreneur as a risk taker 1.5 Theory of Creative Destruction 1.6 Entrepreneurship categories: by Chance, Need, Choice,Force,and Myths 1.7 Challenges and Process of Entrepreneurship 1.8 Start-up and it's types 1.9 Internet based start-up 1.10 Tutorial I 1.11 Tutorial II 1.12 Tutorial III	1. Identify features and functions of Entrepreneurship 2. Comperative study between old and new start-up

SW-1 Suggested Sessional Work (SW):

a. Assignments: Different between entrepreneur and intrapreneur

b. Mini Project: Identification of function performed by an entrepreneur

c. Other Activities (Specify): Distinguish with examples between an entrepreneur and manager

CO.2: Acquire the basic concept of Entrepreneurial mindset and creativity with innovative ideasrelated to technology.

Approximate Hours

Item	Appx Hr.
CI	12
LI	0
SW	2
SL	3
Total	17

Session Outcomes (SOs)	(LI)	Class room Instruction (CI)	(SL)
SO2.1 Concept Meaning& terminology of creativity **SO2.2** Understanding about the character of creative climate **O2.3** Preparation of Entrepreneurial mindset and it's enablers **SO2.4** Understanding the Difference Between scientist, Entrepreneur and manager	.	**Unit 2 Creativity and innovatin** 2.1 Concept of creativity and innovation 2.2 Difference between Scientist, Entrepreneur, and Manager 2.3Characteristics of Entrepreneur 2.4 Entrepreneurial Mindset and its enablers, 2.5 difference between idea and opportunity, 2.6 Link between creativity and innovation, 2.7 character of creative climate with cases of world most creative companies, 2.8 types of innovation, 2.9 link between technology and innovation. 2.10 Tutorial I 2.11 Tutorial II 2.12 Tutorial III	1. Terminology of Entrepreneurial mindset and it's enablers 2. How creativity an innovation link

SW-2 Suggested Sessional Work (SW):

a. **Assignments:** Differentiation between creativity and innovation

b. **Mini Project:** write new innovation in the feald of IT sector

c. **Other Activities (Specify):** Visit any successful entrepreneur innovative idea

CO.3: Exposed to various methods of Opportunity analysis which includes opportunity sighting,opportunity evaluation process and different business models.

Approximate Hours

Item	Appx Hours
CI	12
LI	0
SW	2
SL	3
Total	17

Session Outcomes (SOs)	(LI)	Class room Instruction (CI)	(SL)
SO3.1 Meaning and concept of Opportunity sightings (Market and people driven) **SO3.2** Practical problem related	.	**Unit 3: Opportunity Analysis** 3.1 Opportunity sighting: 3.2 Market Driven, People Driven;	1.How to get idea and after that how to utilise opportunity

to Opportunity analysis **SO3.3** Understanding the Opportunity Evaluation process **SO3.4** Understanding about Ideation and ideation techniques **SO3.5** Preparation of Opportunity mapping and business models		3.3 Opportunity Evaluation Process, 3.4 Approaches to ideation, 3.5 Ideation techniques, 3.6 Idea to Opportunity Mapping. 3.7 Business Model 3.8 Functions of business models 3.9 Factors of Business Model 3.10 Tutorial I 3.11 Tutorial II 3.12 Tutorial III	2. Concept of Ideation and it's techniques

SW-3 Suggested Sessional Work (SW):

a. **Assignments:** Justify the Need for and significance of opportunity identification and selection

b. **Mini Project:** Understand by project identification with examples

c. **Other Activities (Specify):** visit to any Entrepreneur.

CO.4: Familiarize and understand various techniques of pitching, various sources of funds, Types of investors and understanding of the three financial statements: Profit and loss account, Balance sheet, and cash flow statement.

Approximate Hours

Item	Appx Hours
CI	12
LI	0
SW	2
SL	3
Total	17

Session Outcomes (SOs)	(LI)	Class room Instruction (CI)	(SL)
SO4.1 Understanding about the concept and types of pitching **SO4.2** Preparation of Financial statements **SO4.3** Understanding about the Types of capital and break even analysis **SO4.4** Understanding about the Source of funds and types of investors **SO4.5** Preparation of business plan it's types and different sections		**Unit4:** **Sources of funds and types of Financial statements** 4.1 Introduction to Pitching, types of pitch, 4.2 Aspects of funds, types of capital, 4.3 concept of break- even, 4.4 sources of funds, 4.5 Types and nature of investors, 4.6 Understanding of the three financial statements: profit and loss account, 4.7 Balance sheet, cash flow statement, 4.8 Introduction to Business Plan 4.9 Types and different sections of business plan. 4.10 Tutorial I 4.11 Tutorial II 4.12 Tutorial III	1.System of Pitching and it's techniques 2.Inter into a bank and ask about the process how to get funds

SW-4 Suggested Sessional Work (SW):

a. Assignments: Write different sources of funds near you.

b. Mini Project: Collect the list of those sources which are easily available and those which are difficult.

c. Other Activities (Specify): Bank loan procedure.

CO.5: Acquire the concept of Collaboration it's types, Networking and it's types and Intellectualproperty rights.

Item	Appx Hours
Cl	12
LI	0
SW	2
SL	3
Total	17

Session Outcomes (SOs)	(LI)	Class room Instruction (CI)	(SL)
SO5.1 Understand about the concept of collaboration and it's types with approaches **SO5.2** Understand about Networking and it's stages **SO5.3** Understand about Intellectual property rights and it's types **SO5.4** Understanding the Different between data, information and intelligence **SO5.5** Understanding how collaboration affects an organisation		**Unit 5: Collaboration** 5.1 Introduction of Collaboration, 5.2 Types and approaches of collaboration; 5.3 Networking: Why Network: 5.4 Places of networking, 5.5 stages of networking, 5.6 Good networking practices; 5.7 Distinction between data, information, intelligence and knowledge, 5.8 Components of Knowledge; 5.9 Intellectual Property: Its life cycle, its types and IP Rights 5.10 Tutorial I 5.11 Tutorial II 5.12 Tutorial III	**1.**Comparision between data information and intelligence **2.** How to collaborate one Organisation with another

SW-5 Suggested Sessional Work (SW):

a. **Assignments:** Collaboration and it's importance in an organisation
b. **Mini Project:** Prepare a report on the business or companies Collaboration
c. **Other Activities (Specify):** Power Point Presentation of Networking

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
CO.1: Acquire the knowledge of Entrepreneurship and different theories of Entrepreneurship, challenges and process of Entrepreneurship	12	2	3	17
CO.2: Acquire the basic concept of Entrepreneurial mindset and creativity with innovative ideas related to technology.	12	2	3	17
CO.3: Exposed to various methods of Opportunity analysis which includes opportunity sighting, opportunity evaluation process and different business models.	12	2	3	17
CO.4: Familiarize and understand Various techniques of pitching, various sources of funds, Types of investors and understanding of the three financial statements: Profit and loss account, Balance sheet, and cash flow statement.	12	2	3	17
CO.5: Acquire the concept of Collaboration it's types, Networking and it's types and Intellectual property rights.	12	2	3	17
Total Hours	60	10	15	85

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	**Unit Titles**	**Marks Distribution**			**Total Marks**
		R	**U**	**A**	
CO-1	**Introduction of Entrepreneurship**	01	01	03	05
CO-2	**Creativity and innovation**	01	01	03	05
CO-3	**Opportunity Analysis**	-	03	10	13

CO-4	**Sources of funds and types of Financial statements**	-	03	10	13
CO-5	**Collaboration**	01	03	10	14
Total		03	12	36	50

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

The end of semester assessment for Product Innovation & Entrepreneurship will be held with written examinationof 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:

S. No.	Title	Author	Publisher	Edition & Year
1	Entrepreneurship development	Dr. S.S. khanka	*S. Chand*	
2	Entrepreneurship of small scaler industries	Deshpande, M.U.	Deep and Deep	

3	Entrepreneurship theory and practice	Raj Shankar		
4	Lecture note provided by Dept. of Commerce AKS University, Satna .			

(a) Books :

COs, Pos and PSOs Mapping

ProgramTitle:B.Tech Mechanical Engineering

Course Code: PCC ME 308; **CourseTitle: Product Innovation & Entrepreneurship**

CourseOutcomes	Program Outcomes												ProgramSpecificOutcome			
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
PROJ-ME 301: CO.1: Methodology for design and project scheduling	2	1	1	1	1	3	3	1	1	1	1	2	3	3	3	3
PROJ-ME 301: CO.2: Methods of Data collection and data compiliation	3	1	2	2	2	3	3	1	1	1	1	2	3	3	3	3
PROJ-ME 301: CO.3: Product development	2	1	1	1	1	3	3	1	1	1	1	2	3	3	3	3
PROJ-ME 301. CO.4: Data analysis and data interpretation	3	1	2	2	2	3	3	1	1	1	1	2	3	3	3	3
PROJ-ME 301. CO.5: Concluding remark and future work	2	1	1	1	1	3	3	1	1	1	1	2	3	3	3	3

Legend:1–Low,2–Medium,3–High

Course Curriculum Map: Product Innovation & Entrepreneurship

POs & PSOs No.	COs No.& Titles	SOs No.	Class room
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4,	CO-1: Acquire the knowledge of Entrepreneurship and different theories of Entrepreneurship, challenges and process ofEntrepreneurship	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	Unit1 **Introduction of Entrepreneurship** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8 1.9,1.10,1.11,1.12
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4,	CO 2 : Acquire the basic concept of Entrepreneurial mindset and creativity with innovative ideas relatedto technology.	SO2.1 SO2.2 SO2.3 SO2.4	Unit-2 **Creativity and innovation** 2.1, 2.2,2.3,2.4,2.5,2.6,2.72.8, 2.9,2.10,2.11,2.12
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4,	**CO.3:**Exposed to various methods of Opportunity analysis which includes opportunity sighting, opportunity evaluation process and different businessmodels.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	Unit-3 : **Opportunity 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
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4,	**CO.4:** Familiarize and understand Various techniques of pitching, various sources of funds, Types of investors and understanding of the three financial statements: Profit and loss account, Balance sheet, and cash flow statement.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	Unit-4 : **Sources of funds and types of Financial statements** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8 4.9,4.10,4.11,4.12
PO 1,2,3,4,5,6 7,8,9,10,11, 12 PSO 1,2, 3, 4,	**CO.5:** Acquire the concept of Collaboration it's types, Networking and it's types and Intellectual property rights.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	Unit 5: **Collaboration** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8 5.9,5.10,5.11,5.12

Semester-VI

Course Code: PCC-ME307

Course Title: Production & Operation Management

Pre-requisite: Understanding of basic engineering principles and fundamental manufacturing processes.

Rationale: Production and Operation Management is essential in the B. Tech. Mechanical Engineering curriculum to equip students with the knowledge and skills required for effective planning, organizing, and controlling manufacturing processes. This subject provides a comprehensive understanding of optimizing resources, improving efficiency, and ensuring quality in industrial production, preparing students for key roles in the field of manufacturing and operations.

Course Outcomes:

PCC-ME307.1: Understanding of the intricacies of production systems and resources, the classification of production types and the pivotal roles played by line supervisors and production managers.

PCC-ME307.2: Students will be able to effectively manage the entire project life cycle, from concept phase to execution and completion, while ensuring quality, handling risks, and achieving project objectives.

PCC-ME307.3: Students will be able to effectively plan, control, and manage production and supply chain operations to achieve optimal efficiency and cost-effectiveness.

PCC-ME307.4: Understand the principles of factory management and their application in modern manufacturing systems. Apply the concepts of factory management to improve productivity, quality, and sustainability.

PCC-ME307.5: Students will be able to apply mathematical and problem-solving techniques to optimize resource allocation and decision-making in various operational and logistical systems.

Scheme of Studies:

Board of Study	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)	PCC-ME307	Production & Operation Management	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

Board of Study	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 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)	(ESA)	(PRA+ ESA)
PCC	**PCC-ME307**	Production & Operation 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 showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

PCC-ME307.1: Understanding of the intricacies of production systems and resources, the classification of production types and the pivotal roles played by line supervisors and production managers.

Approximate Hours

Item	AppX Hrs
Cl	7
LI	0
SW	2
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO1.1 Define and classify production resources **SO1.2** Analyze the components of a production system. **SO1.3** Differentiate between batch, flow, and unit production systems. **SO1.4** Describe the roles and responsibilities of line supervisors. **SO1.**5 Identify the key responsibilities of production managers..	.	**Unit-1.0 Introduction** 1.1 Introduction of the subject 1.2 Scope of production management. 1.3 Production system and resources (machines, tooling, etc.) 1.4 Types of production (batch, flow and unit) 1.5 Roles of line supervisors 1.6 Roles of production managers. 1.7 Tutorial-1	1. Historical development and evolution of production management.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Analyze real-world examples of successful production management strategies.

b. Other Activities(Role play):

A role play where students take on the roles of line supervisors and production managers, making strategic decisions in a simulated production environment.

PCC-ME307.2: Students will be able to effectively manage the entire project life cycle, from concept phase to execution and completion, while ensuring quality, handling risks, and achieving project objectives.

Approximate Hours

Item	AppX Hrs
Cl	13
LI	0
SW	2
SL	2
Total	17

Session Outcomes (SOs)	(LI)	Classroom Instruction (CI)	Self Learning (SL)
SO2.1 Analyze and prepare quotations and proposals. **SO2.2** Demonstrate to prepare a Detailed Project Report (DPR). **SO2.3** Understand the process of acquiring financing for projects. **SO2.4** Identify potential risks in project management. **SO2.5** Develop project schedules and timelines.	.	Unit-2 Project life cycle 2.1 Concept phase (RFQ, Quotations, Proposals), 2.2 Project initiations, 2.3 DPR preparation (project value) 2.4 Business case development 2.5 Feasibility study 2.6 Project planning 2.7 Project team, producing quality outputs, 2.8 Handling risk 2.9 Acceptance criteria 2.10 Project execution : allocation of resources 2.11 Project execution : scheduling 2.12 Tutorial-1 2.13 Tutorial-2	i. Study various methods of cost estimation in project management. ii. Analyze case studies related to feasibility in projects.

SW-2 Suggested Sessional Work(SW):

a. **Assignments:**

i. Analyze real-world case studies highlighting challenges and solutions in production management.

ii. Simulate the process of acquiring resources for a hypothetical project.

PCC-ME307.3: Students will be able to effectively plan, control, and manage production and supply chain operations to achieve optimal efficiency and cost-effectiveness.

Approximate Hours

Item	AppX Hrs
Cl	16
LI	0
SW	2
SL	2
Total	20

Session Outcomes (SOs)	(LI)	Classroom Instruction (CI)	Self Learning (SL)
SO3.1 Understand the importance of production planning and control in manufacturing processes. **SO3.2** Ability to formulate production plans based on demand forecasting. **SO3.3** Apply aggregate production planning techniques to balance demand and capacity. **SO3.4** Calculate Economic Order Quantity (EOQ) and apply it in inventory management. **SO3.5** Analyze JIT and supply chain management.	.	**Unit-3:** Production Planning and Control 3.1 Ordinary Production planning 3.2 Process planning 3.3 Resource planning 3.4 Introduction of Forecasting methods 3.5 Types of Forecasting methods 3.6 Numerical analysis on various forecasting methods 3.7 Aggregate production planning 3.8 Materials requirement planning 3.9 Inventory Management 3.10 Economic order Quantity 3.11 Discount models, 3.12 Stochastic inventory models, 3.13 JIT 3.14 Supply chain management. 3.15 Tutorial-1 3.16 Tutorial-1	i. Identification and assessment of supply chain risks ii. Strategies for mitigating supply chain disruptions

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Analyze real-world cases of successful production planning and control implementation.

ii. Evaluate challenges faced and solutions implemented.

b. Project:

I. Develop a comprehensive production plan for a hypothetical manufacturing unit.

PCC-ME307.4: Understand the principles of factory management and their application in modern manufacturing systems. Apply the concepts of factory management to improve productivity, quality, and sustainability.

Approximate Hours

Item	AppXHrs
Cl	14
LI	0
SW	2
SL	2
Total	18

Session Outcomes (SOs)	(LI)	Classroom Instruction (CI)	Self Learning (SL)
SO4.1 Understand the key principles of effective factory management. **SO4.2** Understand the principles of lean manufacturing and its application in the industry. **SO4.3** Analyze the importance of training in enhancing workforce skills. **SO4.4** Gain knowledge of block chain technology and its applications in the manufacturing industry. **SO4.5** Analyze process capability in manufacturing and its impact on quality.	.	**Unit-4 : Factory Management** 4.1 Factory layout 4.2 line balancing 4.3 material flow and handling 4.4 Lean and green manufacturing 4.5 Human resource management 4.6 Advantage and opportunities for Digitalization 4.7 TQM; Important acts, regularities and safety norms 4.8 Reliability assessment of processes 4.9 Block chain 4.10 Energy management, Efficiency & throughput 4.11 Overall equipment effectiveness 4.12 Process capability 4.13 Tutorial-1 4.14 Tutorial-2	i. Importance and Types of Factory Layouts. ii. Opportunities and Challenges of Digitalization in Manufacturing

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Analyze the layout of a local manufacturing facility and suggest improvements.
   ii. Evaluate the environmental impact of a manufacturing facility and suggest green improvements.

PCC-ME307.5: students will be able to apply mathematical and problem-solving techniques to optimize resource allocation and decision-making in various operational and logistical systems.

Approximate Hours

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

Session Outcomes (SOs)	(LI)	Classroom Instruction (CI)	Self Learning (SL)
SO5.1 Define LP and its applications in production and operation management. **SO5.2** Identify feasible and optimal solutions using graphical methods. **SO5.3** Apply algorithms to solve LP problems and optimize solutions. **SO5.4** Formulate transportation and assignment problems. **SO5.5** Apply queuing models to analyze and optimize system performance.		**Unit5: Operation Management** 5.1 Linear programming 5.2 Objective function 5.3 Constraints 5.4 Graphical method 5.5 Simplex method 5.6 Duplex algorithms 5.7 Transportation 5.8 Assignment 5.9 Simple queuing theory models 5.10 Tutorial-1	1. Application of simplex and duplex methods in solving LP problems.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Formulate a real-world problem as an LP model.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
PCC-ME307.1: Understanding of the intricacies of production systems and resources, the classification of production types and the pivotal roles played by line supervisors and production managers.	7	2	1	**10**
PCC-ME307.2: students will be able to effectively manage the entire project life cycle, from concept phase to execution and completion, while ensuring quality, handling risks, and achieving project objectives.	13	2	2	**17**
PCC-ME307.3: Students will be able to effectively plan, control, and manage production and supply chain operations to achieve optimal efficiency and cost-effectiveness.	16	2	2	**20**
PCC-ME307.4: Understand the principles of factory management and their application in modern manufacturing systems. Apply the concepts of factory management to improve productivity, quality, and sustainability.	14	2	2	18
PCC-ME307.5: students will be able to apply mathematical and problem-solving techniques to optimize resource allocation and decision-making in various operational and logistical systems.	10	1	1	**12**
Total Hours	**60**	09	08	**77**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction	01	02	03	06
CO-2	Project Management	01	03	07	11
CO-3	Production Planning and Control	01	07	04	12
CO-4	Factory Management	01	06	04	11
CO-5	Operation Management	01	06	03	10
Total		5	24	21	50

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

The end of semester assessment for **Production and Operation 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. Visit to industry
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	Operations Management: Strategy and Analysis	L.J. Krajewski and L.P Ritzmen	Pearson	2010
2	Operations Management for Competitive Advantage	R.B. Chase, F.R. Jacobs and N.J. Aquilano	Tata McGraw Hill	2011
3	Factory Physics: Foundations of Manufacturing Management	W. J. Hopp and M. L. Spearman	McGraw Hill International Edition	2008
4	Operations Management: Theory and Practice	Mahadevan. B.	Pearson	2015
5	Operations Research	Taha H. A.	PHI India	2003
6	Lecture notes provided by Dept. of Mechanical Engineering, AKS University, Satna			

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Cos,Pos and PSOs Mapping

Course Title: B. Tech. Mechanical Engineering

Course Code: PCC-ME307

Course Title: Production and Operation Management

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation	Product Innovation and Development
CO1: Understanding of the intricacies of production systems and resources, the classification of production types and the pivotal roles played by line supervisors and production managers.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO 2 : students will be able to effectively manage the entire project life cycle, from concept phase to execution and completion, while ensuring quality, handling risks, and achieving project objectives.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3: Students will be able to effectively plan, control, and manage production and supply chain operations to achieve optimal efficiency and cost-effectiveness.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO 4: Understand the principles of factory management and their application in modern manufacturing systems. Apply the concepts of factory management to improve productivity, quality, and sustainability.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO5: students will be able to apply mathematical and problem-solving techniques to optimize resource allocation and decision-making in various operational and logistical systems.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	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: Understanding of the intricacies of production systems and resources, the classification of production types and the pivotal roles played by line supervisors and production managers.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Introduction 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7	As mentioned in Page number 2 to 6
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1, 2, 3, 4, 5	CO 2: students will be able to effectively manage the entire project life cycle, from concept phase to execution and completion, while ensuring quality, handling risks, and achieving project objectives.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2 Project Management 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	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1, 2, 3, 4, 5	CO3 : Students will be able to effectively plan, control, and manage production and supply chain operations to achieve optimal efficiency and cost-effectiveness.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 : Production Planning and Control 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, 3.14, 3.15, 3.16	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1, 2, 3, 4, 5	CO 4: Understand the principles of factory management and their application in modern manufacturing systems. Apply the concepts of factory management to improve productivity, quality, and sustainability.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4: Factory Management 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	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1, 2, 3, 4, 5	CO 5: students will be able to apply mathematical and problem-solving techniques to optimize resource allocation and decision-making in various operational and logistical systems.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit-5: Operation Management 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10	

Semester-VII

Course Code: **OEC12**

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

OEC12.1: Understand and apply big data flow to actual projects as well as apply data analytics life cycle to big data projects.
OEC12.2: Apply appropriate techniques and tools to solve big data problems
OEC12.3: Describe big data and use cases from selected business domains
OEC12.4: Explain NoSQL big data management
OEC12.5: Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
OEC	OEC12	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 of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Board of Study	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.

OEC12.1. 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

OEC12.2. 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

OEC12.3. 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.

OEC12.4. 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.

OEC12.5: 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)
OEC12.1. 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
OEC12.2. Apply appropriate techniques and tools to solve big data problems	8	2	2	12

OEC12.3. Describe big data and use cases from selected business domains	6	2	2	10
OEC12.4. Explain NoSQL big data management	6	2	1	9
OEC12.5. 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

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Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: OEC12
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	PSO 3	PSO 4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
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	1	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	2	3
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	1	2
CO4 Explain NoSQL big data management	3	2	2	2	3	1	3	1	2	1	2	2	3	3	2	2
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	2	2

Legend: 1 – Low, 2 – 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, 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

Semester VII

Course Code:	**OEC04**
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:

OEC04.1: Understand the architecture principles that have enabled the orders of magnitude expansion of the Internet

OEC04.2: Understand networked applications and their protocols, their installation, operation, and performance tuning

OEC04.3: Understand layering as a means of tackling complexity, layering applied to the Internet

OEC04.4: Understand protocols as a structured means of reliable communications

OEC04.5: Be familiar with tools for configuring, monitoring and tuning the Internet and hosts

Scheme of Studies:

Board of 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 Course (OEC)	OEC04	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 ofteacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Board of Study	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	OEC04	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.

OEC04.1. 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

OEC04.2. 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.

OEC04.3. 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

OEC04.4. 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

OEC04.5. 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, Superscalarprocessors 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)
OEC04.1. Understand the architecture principles that have enabled the orders of magnitude expansion of the Internet	7	1	1	9
OEC04.2. Understand networked applications and their protocols, their installation, operation, and performance tuning	9	2	2	13
OEC04.3. Understand layering as a means of tackling complexity, layering applied to the Internet	6	2	2	10
OEC04.4. Understand protocols as a structured means of reliable communications	9	1	1	11
OEC04.5. 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

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COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: OEC04
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	PSO 2	PSO 2
	Engineering knowledge	Problem Solving	Design Skills	Labo ratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Lifelong Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
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	3	2
CO2: Understand networkedapplications and their protocols, their installation, operation, and performancetuning	1	3	2	3	2	2	2	2	1	1	1	3	3	3	2	3
CO3 Understand layering asa means of tackling complexity, layering appliedto the Internet	2	2	2	3	3	2	1	2	1	1	1	3	2	3	3	2
CO4 Understand protocolsas a structured means of reliable communications	1	2	3	2	3	2	1	3	1	2	1	3	3	2	3	3
CO5 Be familiar with toolsfor configuring, monitoring and tuning the Internet andhosts	1	2	2	2	3	2	1	3	1	1	1	3	3	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 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 Mechanical Engineering

Curriculum of B.Tech. (Mechanical Engineering) Program

Semester-VII

Course Code: **OEC02**

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:

OEC02.l: Understanding abstract specification of data-structures and their implementation.

OEC02.2: Understanding time and space complexity of programs and data-structures.

OEC02.3: Knowledge of basic data-structures, their applications and relative merits.

OEC02.4: 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

OEC02.5: Acquire basic knowledge of the graphs.

Scheme of Studies:

Board of 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 Course (OEC)	OEC02	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

Board of Study	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.

OEC02.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. $logn$, n, 2^n: understanding growth ofthese functions, and applications (binary search and extensions to similar problems) 3. $logn$, 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: $O(\quad)$, $\Omega(\quad)$	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.

OEC02.2. 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.

OEC02.3 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.

OEC02.4 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..

OEC02.5 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)
OEC02.1 Understanding abstract specification of data-structures and their implementation	7	2	1	10
OEC02.2. Understanding time and space complexity of programs and data-structures	8	2	1	11
OEC02.3 Knowledge of basic data-structures, their applications and relative merits	7	2	2	11
OEC02.4 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
OEC02.5 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.

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Curriculum Development Team

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Cos, POs and PSOs Mapping

Programming Title: B. Tech. Electrical Engineering
Course Code: OEC02
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	PSO 3	PSO 4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
CO1 Understanding abstract specification of data-structures and their implementation	3	3	2	3	3	2	1	2	3	2	2	3	3	3	2	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	3	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	2	1
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	2	3	1
CO5 Acquire basic knowledge on hashing.	3	3	3	3	2	3	2	3	2	2	2	2	3	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** 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

Semester-VII

Course Code: **OEC01**

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:

OEC01.1: Understanding of the concept of semiconductor materials, pn junction, pn junction diodes and special purpose diodes.

OEC01.2: Understanding of Diode Applications as Rectifiers , filters for rectifiers, voltage regulators.

OEC01.3: Explain the principle, construction and working of Transistor , and different biasing techniques.

OEC01.4: Explain the principle, construction and working of FET's , JFET's, MOSFET's

OEC01.5: Explain the principle, construction and working of feedback .amplifiers, Oscillators and its types

Scheme of Studies:

Board of 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 Course (OEC)	OEC01	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

Board of Study	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.

OEC01.1: 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.

OEC01.2: 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

OEC01.3: 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.

OEC01.4: 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 4.10MOSFET 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.

OEC01.5: 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)
OEC01.1: Understanding of the concept of semiconductor materials, pn junction,pn junction diodes and special purpose diodes.	7	1	1	09
OEC01.2: Understanding of Diode Applications as Rectifiers ,filters for rectifiers, voltage regulators.	9	1	1	11
OEC01.3: Explain the principle, construction and working of Transistor and its different biasing techniques.	9	1	1	11
OEC01.4: Explain the principle, construction and working of FET’s ,JFET’s, MOSFET’s	9	1	1	11
OEC01.5: 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.			

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Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: OEC01
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	PSO 3	PSO 4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
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	2	3
CO.2: Understanding of Diode Applications as Rectifiers ,filtersfor rectifiers, voltage regulators.	3	3	3	3	2	2	1	2	1	2	2	2	2	3	2	1
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	2	1
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	2	3	2
CO 5: Explain the principle, construction and working of feedback . amplifiers, Oscillatorsand its types	3	3	3	3	2	3	2	3	2	2	2	2	3	3	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:** 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

A K S University

Faculty of Engineering and Technology

Department of Mechanical Engineering

Curriculum of B.Tech. (Mechanical Engineering) Program

Semester-
VII

Course Code: **OEC05**

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:

OEC05.1: Identify hardware and software components of an embedded system

OEC05.2: Learn the basics of OS and RTOS

OEC05.3: Illustrate different Inter Process Communication (IPC) mechanisms used by tasks/process/tasks to communicate in multitasking environment

OEC05.4: Design simple embedded system-based applications

OEC05.5: To introduce the typical components of an embedded system & different communication interfaces

Scheme of Studies:

Board of 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)	OEC05	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

Board of Study	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.

OEC05.1: 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.

OEC05.2: 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.

OEC05.3: 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 .

OEC05.4: 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.

OEC05.5: 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)
OEC05.1: Identify hardware and software components of an embedded system	7	1	1	09
OEC05.2: Learn the basics of OS and RTOS	11	1	1	13
OEC05.3: Illustrate different Inter Process Communication (IPC) mechanisms used by tasks/process/tasks to communicate in multitasking environment	8	1	1	10
OEC05.4: Design simple embedded system-based applications	7	1	1	09
OEC05.5: 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	mbedded 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.			

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COs,POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: OEC05
Course Title: Embedded System

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
	Engineering knowledge	Problem Solving	Design Skills	Laboratory Skills	Team work	Communication Skills	Ethical and Professional Behavior	Life long Learning	Global and Societal Impact	Project Management	Adaptability	Professional Development	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
CO1: Identify hardware and softwarecomponents of an embedded system	3	3	2	2	2	1	1	2	2	1	2	2	2	2	3	2
CO 2: Learn the basics of OS and RTOS	3	3	3	3	2	2	1	3	2	2	2	3	3	3	2	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	2	3	1
CO 4: Design simple embedded system-based applications	3	3	2	2	2	1	1	3	2	2	2	2	3	2	3	2
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	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: 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-VII

Course Code: **PROJ-ME 401**

Course Title : **Engineering Project-2 (Design & Analysis)**

Pre-requisite: Students should have basic knowledge for design, development and analysis of project.

Rationale: Students should be well-versed in the Mechanical manufacturing process and concrete production. Keeping abreast of the latest technological trends is crucial for identifying contemporary R&D topics. A fundamental understanding of the physical and chemical properties of Material is essential. Additionally, students must be proficient in statistical methods for effective data analysis and interpretation. Competence in Microsoft Word and Excel is necessary for report writing and documentation. By combining technical knowledge with analytical and software skills, students will be well-prepared to tackle challenges in the field and contribute meaningfully to research and development efforts.

Course Outcomes:

PROJ-ME 401.1:Methodology for projectdesign and project scheduling
PROJ-ME 401.2: Methods of Data collection and data compiliation
PROJ-ME 401.3:Product development
PROJ-ME 401.4: Data analysis and data interpretation
PROJ-ME 401.5: Concluding remark and future work

SchemeofStudies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Hours (CI+LI+SW+SL)	
PROJ	PROJ-ME 401	Engineering Project-2 (Design & Analysis)	2	6	1	1	10	5

Legend:

CI: ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)andothers),
LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop, field or other locations using different instructional strategies)
SW: Sessional Work(includesassignment, seminar, miniprojectetc.),

SL: SelfLearning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback ofteacherto ensureoutcomeofLearning.

Scheme of Assessment:

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)									
			Progressive Assessment (PRA)						End Semester Assessment			Total Marks (PRA+ESA)
			Project Scheduling	Data collection and sampling	Product design	Product analysis and data interporetaion	Report writing and concluding remark	Total Mark	Seminar	Project Viva	Total Marks	
PROJ	PROJ-ME 401	Engineering Project-2 (Design & Analysis)	05	05	05	25	10	50	15	35	50	100

Course-CurriculumDetailing:

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 Lab Work Assignment (LA) Best of 5 of the total, Viva-Voice on Lab Work (VV), and Lab Attendance (LA). 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.

Course Outcome	Activities	Time Schedule (in hours)	
		Class Activity Per week (5 Credit)	Self Learning /Home activity Per week
PROJ-ME 401:	**1. Literature review and identification of Mechanical and Material related projects and**	5	10

CO.1: Methodology for design and project scheduling	**project scheduling** Examining recent literature on Materials projects unveils advanMechanicals, methodologies, and applications. This review identifies emerging trends, innovative materials, and sustainable practices, significantly impacting construction, durability, and environmental outcomes. Noteworthy projects illustrate novel approaches, enriching insights and guiding future developments in Material technology. **Project scheduling** : Project scheduling involves planning and organizing tasks to ensure timely completion. It includes defining activities, setting deadlines, and allocating resources efficiently. Effective scheduling helps manage time, costs, and personnel, enhancing productivity and project success. It's crucial for meeting goals, coordinating efforts, and maintaining project momentum		
PROJ-ME 401: CO.2: Methods of Data collection and data compiliation	2**. Design and formulation projects** i. Methods of data collection and data compiletion ii. Design and formulation projects concentrate on innovating products through meticulous recipe development and methodological refinement. These initiatives prioritize material optimization, functional enhanMechanical, and quality assurance. By blending creativity with technical prowess, they propel advanMechanicals across industries, fostering the creation of distinctive, efficient, and commercially viable solutions.	8	15
PROJ-ME 401: CO.3: Product development	**3. Sample analysis and product development** Testing samples determines their suitability by assessing quality, performance, and compliance with standards. It involves rigorous analysis and evaluation to ensure materials meet project requirements. This process identifies strengths and weaknesses, guiding decision-making and ensuring the reliability and effectiveness of the chosen	10	25

	samples for intended applications. Product design and analysis in R&D involve creating and refining products to meet market needs. This process includes conceptualizing, prototyping, and testing to optimize functionality and performance. Analyzing results helps improve designs, ensuring products are innovative, efficient, and ready for successful market introduction.		
PROJ-ME 401. CO.4: Data analysis and data interpretation	**i. Product Dataanalysis &compilation** Project data compilation involves collecting and organizing all relevant information for analysis and reporting. This process ensures data accuracy and completeness, facilitating informed decision-making and efficient project management. It helps track progress, identify trends, and generate insights, supporting successful project outcomes and future planning. ii. **Statistical data analysis and data interpretation** Statistical data analysis involves examining and processing data to uncover patterns and trends. Data interpretation translates these findings into meaningful insights, aiding decision-making and strategy development. This process enhances understanding, supports evidence-based conclusions,	40	15
PROJ-ME 401. CO.5: Concluding remark and future work	**5. Report Writing, Conclusion, Recommendations and Future work in Research work** **Report Writing** : Comprehensive project report writing **Conclusion:** The study successfully demonstrated key findings. It underscores implications, validating hypothesis/objectives. This contributes field significance, laying groundwork for applications. **Recommendation**: Future research should explore expansion areas, emphasizing methodological improvements. Collaboration partners/stakeholders	12	25

	would enrich knowledge transfer. **Future Work:** Innovations in technology/techniques could advance potential benefits. Addressing challenges would refine outcomes, fostering industry/government support.		
Total		75	90

Suggestion for End Semester Assessment

SuggestedSpecificationTable(ForESA)

Course Outcome	UnitTitles	MarksDistribution			Total Marks
		R	U	A	
PROJ-ME 401: CO.1: Methodology for design and project scheduling	1. Literature review and identification of Material related projects and project scheduling	02	03	-	5
PROJ-ME 401: CO.2: Methods of Data collection and data compiliation	2. Design and formulation projects	-	05	03	8
PROJ-ME 401: CO.3: Product development	3. Sample analysis and product development	-	08	04	12
PROJ-ME 401. CO.4: Data analysis and data interpretation	4. Product Data analysis, data interpretation and findings	-	08	12	20
PROJ-ME 401. CO.5: Concluding remark and future work	5. Report writing, concluding remark and future work		03	02	5
Total		02	27	21	50

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

Theendofsemesterassessmentfor Engineering Project-1 (Literature Review) willbeheld with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wiseteachers for above tasks. Teachers can also design different tasks as per requirement, for endsemesterassessment.

SuggestedInstructional/ImplementationStrategies:

1. ImprovedLecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. RolePlay
6. Visit to Mechanical plant
7. Demonstration
8. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp, Mobile,Onlinesources)
9. Brainstorming

SuggestedLearningResources:

(a) Books:

S.No.	Title	Author	Publisher	Edition &Year
1	The literature review : six steps to success	Lawrence A. Machi, Brenda T. McEvoy.	Corwin Press, Inc	2022
2	Lee			
3	Tylor			
4	Manufacturing Processes			
5				

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COs, POsandPSOs Mapping

ProgramTitle:B.Tech Mechanical Engineering

Course Code:PROJ-ME 401; **CourseTitle: Engineering Project-2 (Design & Analysis)**

CourseOutcomes	Program Outcomes												ProgramSpecificOutcome			
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
PROJ-ME 401: CO.1: Methodology for design and project scheduling	2	1	1	1	1	3	3	1	1	1	1	2	3	3	3	3
PROJ-ME 401: CO.2: Methods of Data collection and data compiliation	3	1	2	2	2	3	3	1	1	1	1	2	3	3	3	3
PROJ-ME 401: CO.3: Product development	2	1	1	1	1	3	3	1	1	1	1	2	3	3	3	3
PROJ-ME 401. CO.4: Data analysis and data interpretation	3	1	2	2	2	3	3	1	1	1	1	2	3	3	3	3
PROJ-ME 401. CO.5: Concluding remark and future work	2	1	1	1	1	3	3	1	1	1	1	2	3	3	3	3

Legend:1–Low,2–Medium,3–High

CourseCurriculumMap: Engineering Project-2 (Design & Analysis)

POs&PSOsNo.	COsNo.&Titles	SOsNo.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning(SL)
	PROJ-ME 401: CO.1: Methodology for design and project scheduling				
	PROJ-ME 401: CO.2: Methods of Data collection and data compiliation				
	PROJ-ME 401: CO.3: Product development				
	PROJ-ME 401. CO.4: Data analysis and data interpretation				
	PROJ-ME 401. CO.5: Concluding remark and future work				

AKS University
Faculty of Engineering & Technology
Department of Mechanical Engineering
Curriculum & Syllabus of B.Tech. Mechanical Engineering program

Semester-VII

Course Code:	**PEC-ME 04**
Course Title :	**Finite Element Analysis**
Pre-requisite:	Student should have basic knowledge of Mathematics such as matrix algebra, differential equation etc. and knowledge of core engineering subjects such as SOM, Mechanical vibrations and HMT etc.
Rationale:	Familiarize with the fundamental concepts of finite element method. Inculcate the formulation of finite element models by selecting a suitable element, developing element matrices & vectors, and incorporating boundary conditions. Familiarize with finite element procedures to solve structural, thermal, and fluid flow problems using commercial finite element packages

Course Outcomes:

PEC-ME 04.1: Understand the fundamental concepts of finite element method to solve engineering problems.

PEC-ME 04.2: Formulate finite element models using appropriate element selection, development of stiffness & force matrices, and application of boundary conditions

PEC-ME 04.3: Solve structural, thermal, and fluid flow problems in one dimensionusing the developed finite element formulations

PEC-ME 04.4: Formulate Two-Dimensional Finite Element models and shape function derivation for triangular and rectangular elements.

PEC-ME 04.5: Solve two dimensional problems for plane stresses-strains and for dynamic systems using the developed finite element formulations.

Scheme of Studies:

Board of Study	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 courses(PEC)	**ME 04**	**Finite Element Analysis**	3	0	1	1	5	3

Legend: **CI:**ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)andothers),
LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop, field or other locations using different instructional strategies)
SW: Sessional Work(includesassignment, seminar, miniprojectetc.),
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

Board of Study	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	**PEC-ME 04**	Finite Element Analysis	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.

PEC-ME 04.1: Explain Introductory Concepts, general FEM procedure and approximate methods to solve differential equations.

Approximate Hours

Item	AppX Hrs
Cl	5
LI	0
SW	2
SL	1
Total	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Ability to understand the FEM procedure. **SO1.2**Ability to Understand various weighted integral methods used to get approximate solutions. **SO1.3**The students will be able to Analyze and solve field problems in engineering practices.	.	**Unit-1: Introductory Concepts:** 1.1 General FEM procedure, Applications of FEM in various fields Advantages and disadvantages of FEM 1.2 Mathematical Modeling of field problems in engineering practices. 1.3 Governing equations, Differential equations in different fields. 1.4 Approximate solution of differential equations using Least square method. 1.5 Approximate solution of differential equations using Galerikin method.	Numerical problems based on Galerik in method.

SW-1 Suggested Sessional Work(SW):

a. **Assignments:** Numerical problem solving on least square method.

b. **Mini Project: Prepare a chart listing down various approximate methods used in FEM.**

PEC-ME 04.2: Analyzing and solving problems using Weighted Residual Methods - Ritz Technique.

Approximate Hours

Item	Approx. 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 The students will be able to understand the FEA Procedure. **SO2.2** The students will be able to understand Global & local boundary conditions. **SO2.3**The students will be able to apply the Rayleigh-Ritz method in design offins.	.	**Unit-2**:**FEA Procedure:** 2.1 Weighted Residual Methods - Ritz Technique. 2.2 Definitions of various terms used in FEM like element, order of the element, internal and external node/s, degree of freedom, primary and secondary variables 2.3 Global & local boundary conditions. 2.4 Minimization of a functional. 2.5 Principle of minimum total potential. 2.6 Piecewise Rayleigh-Ritz method 2.7 Design of fins for maximum heat transfer. 2.8 Formulation of 'stiffness matrix'. 2.9 Transformation and assembly concepts	Numerical problem on heat conduction using Piecewise Rayleigh-Ritz method.

SW-2 Suggested Sessional Work(SW):

a. **Assignments:** Numerical problem on a cantilever beam using Piecewise Rayleigh-Ritz method.
MiniProject: Prepare a mind map explaining the Formulation of 'stiffness matrix'.

PEC-ME 04.3: Analyzing and solving one Dimensional Problem using FEA.

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 The students will be able to understand discretization element types - linear and higher, order elements. **SO3.2** The students will be able to solve problems in one dimensional for structural beams. **SO3.3** The students will be able to solve problems in one dimensional for spring cart.	.	**Unit-3 :One Dimensional Problems:** 3.1 One dimensional second order equations-discretization element types - linear and higher, order elements 3.2 stiffness matrices and force vectors, Assembly of Matrices 3.3 solution of problems in one dimensional for structural beams. 3.4 solution of problems in one dimensional for taper bars. 3.5 solution of problems in one dimensional for Fluid flow network. 3.6 solution of problems in one dimensional for planer truss. 3.7 solution of problems in one dimensional for heat conduction. 3.8 solution of problems in one dimensional for spring cart system.	Revise the discretization and assembly procedure.

SW-3 Suggested Sessional Work(SW):

a. Assignments:

Problem on one dimensional for Fluid flow network.

b. Mini Project:

Problems of designing a taper bar subjected to axial loading.

PEC-ME 04.4: Two-Dimensional Finite Element Formulations.

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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)
SO4.1 To understand serendipity and Lagrange's methods for deriving shape functions **SO4.2**To derives the shape function of three noded triangular elements. **SO4.3**. To analyse and solve the problems on shape function of three and fournoded elements.	.	**Unit-4:Two-Dimensional Finite Element Formulations:** 4.1 serendipity and Lagrange's methods for deriving shape functions. 4.2Derivation of shape function for three noded triangular elements. 4.3Derivation of shape function for four nodedrectangular element. 4.4Derivation of shape function for four node quadrilateral elements. 4.5Derivationof shape function for the eight-node quadrilateral element 4.6Natural coordinates and coordinates transformations 4.7Numerical problems on boiling. 4.8Sub parametric, Isoparametric,	1. Numerical Problem on three noded triangular element. 2.Numerical Problem on three noded triangular element.

		super parametric elements. 4.9Compatibility and Patch test. 4.10Convergence criterion, sources of errors.	

SW-4 **SuggestedSessionalWork(SW):**

a. Assignments:

i. Explain Natural coordinates and coordinates transformations?

ii. Write a short note on sources of errors?

b. Mini Project:

Prepare a mind map for Two-Dimensional Finite Element Formulation method.

PEC-ME 4.5: Two Dimensional Vector Variable Problems and Finite Element Formulation of Dynamic systems.

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	2
SL	2
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 To Understand stress analysis in a plane using FEA. **SO5.2**To Analyze stress of CST element. **SO5.3**To determines transverse deflections of a beam.		**Unit 5: 2-D Vector Variable Problems** and **Finite Element Formulation of Dynamic systems.** 5.1Equations of elasticity - Plane stress, plane strain and ax symmetric problems 5.2 stress analysis of CST element. 5.3 stress analysis of four node Quadratic element. 5.4 free vibration problems of a beam. 5.5 Lumped and consistent mass matrices Solutions techniques to	1. Free vibration problem of a beam. 2. Longitudinal vibration problem of a beam.

		Dynamic problems. 5.6 longitudinal vibration frequencies and mode shapes. 5.7 Fourth order beam equation. 5.8 Numerical problems on radiation shields. 5.9 transverse deflections and natural frequencies of beams.	

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Numerical problems on radiation shields.

ii. Numerical problem on transverse deflections and natural frequencies of beams

Mini Project:

Explain how the frequencies and mode shapes of longitudinal vibration can be determined using FEA?

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
PEC-ME 04.1: Explain Introductory Concepts, general FEM procedure and approximate methods to solve differential equations.	7	2	1	10
PEC-ME 04.2: Analysing and solving problems using Weighted Residual Methods - Ritz Technique	10	2	1	13
PEC-ME 04.3: Analyzing and solving one Dimensional Problems using FEA.	8	2	2	12
PEC-ME 04.4: Explain Two-Dimensional Finite Element Formulation method and shape functions.	10	2	2	14
PEC-ME 04.5: Analyze and solve Two-Dimensional Vector Variable Problems and Finite Element Formulation of Dynamic systems	10	2	2	14
Total Hours	45	10	8	63

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introductory Concepts, general FEM procedure and approximate methods.	02	05	05	12
CO-2	Analyzing and solving problems using Weighted Residual Methods - Ritz Technique.	02	03	03	8
CO-3	Analyzing and solving one Dimensional Problems using FEA.	02	05	05	12
CO-4	Two-Dimensional Finite Element Formulation method and shape functions.	02	04	04	10
CO-5	Two-Dimensional Vector Variable Problems and Finite Element Formulation of Dynamic systems	01	04	03	08
Total		9	21	20	50

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

The end of semester assessment for **Finite Element Analysis** 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. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
9. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Finite Element Method	JNReddy,	McGraw Hill	9th Edition, 2004
2	'Introduction to Finite Elements in Engineering	Chandrupatla and Belegundu	Pearson Education	1998
3	A first course in Finite Element Method	Logan D L, Thomson.	Asia PvtLtd	5th Edition, 2002
4	The Finite Element Method in Engineering	SS, Rao, Butter WorthHeinemann	Wiley Sons	4th Edition, 2018
5	Lecture notes provided by Dept. of Mechanical engineering, AKS University, Satna.			

Cos, Pos and PSOs Mapping

Programme Title: B.Tech Mechanical Engineering

Course Code: PEC-ME 04

Course Title-Finite Element Analysis

CourseOutcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineeringknowledge	Problemanalysis	Design/developmentofsolutions	Conductinvestigationsofcomplex problems	Moderntoolusage	Theengineerandsociety	Environmentandsustainability:	Ethics	Individualandteamwork:	Communication:	Projectmanagementandfinance:	Life-longlearning	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
CO-1: Introductory Concepts, general FEM procedure and approximate methods.	2	1	2	2	3	2	2	2	2	1	3	2	2	2	1	2
CO-2: Analyzing and solving problems using Weighted Residual Methods - Ritz Technique.	1	1	1	1	3	2	2	2	2	1	2	2	1	2	1	2
CO-3: Analyzing and solving one Dimensional Problems using FEA.	2	2	1	1	3	1	2	2	2	1	1	2	1	2	1	1
CO-4:2-D Finite ElementFormulation method and shape functions.	2	2	2	1	3	2	2	2	2	1	2	2	1	2	1	2
CO-5: Two-Dimensional Vector Variable Problems and Finite Element Formulation of Dynamic systems	2	1	1	1	1	3	2	2	2	1	2	2	1	2	1	1

Pos &PSOs No.	Cos No.& Titles	SOs No.	Classroom Instruction (CI)
PO1,2,3,4,5,6	CO-1: Understand the fundamental concepts of finite element method to solve engineering problems.	SO1.1	Unit-1.0: Introductory Concepts, general FEM procedure and approximate methods.
7,8,9,10,11,12		SO1.2	
PSO1,2,3,4			
PO1,2,3,4,5,6	CO -2: Formulate finite element models using appropriate element selection, development of stiffness & force matrices, and application of boundary conditions	SO2.1	Unit-2: Analyzing and solving problems using Weighted Residual Methods - Ritz Technique
7,8,9,10,11,12		SO2.2	
PSO1,2,3,4			
PO1,2,3,4,5,6 7,8,9,10,11,12	CO3: Solve structural, thermal, and fluid flow problems in one dimension using the developed finite element formulations	SO3.1 SO3.2	Unit-3: Analyzing and solving one Dimensional Problems using FEA.
PSO1,2,3,4		SO3.3	3.1,3.2,3.3
PO1,2,3,4,5,6	CO -4: Formulate Two-Dimensional Finite Element models and shape function derivation for triangular and rectangular elements.	SO4.1	Unit-4:2-D Finite Element Formulation method and shape functions. 4.1,4.2,4.3
7,8,9,10,11,12			
PSO1,2,3,4			
PO1,2,3,4,5,6	CO -5: Solve two dimensional problems for plane stresses-strains and for dynamic systems using the developed finite element formulations.	SO5.1	Unit5:Two-Dimensional Vector Variable Problems and Finite Element Formulation of Dynamic systems. 5.1,5.2,5.3
7,8,9,10,11,12		SO5.2	
PSO1,2,3,4			

A K S University

Faculty of Engineering and Technology

Department of Mechanical Engineering

Curriculum of B.Tech. (Mechanical Engineering) Program

Semester-VII

Course Code: **OEC11**

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:

OEC11.1: Learn the basics of databases and data management.

OEC11.2: Understand various theoretical and practical principles involved in the design and use of databases systems with the help of database.

OEC11.3: Learn the Transaction management with grant and revoke.

OEC11.4: Design and implement databases for various scenarios.

OEC11.5: Design a database scenario for handling any organizations centralized data.

Scheme of Studies:

Board of Study	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)	OEC11	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

Board of Study	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 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.

OEC11.1: 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	

OEC11.2: 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.	

OEC11.3: 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	

OEC11.4: 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.	

OEC11.5: 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)
OEC11.1: Acquire the knowledge of IoT concept and its Architecture.	8	0	0	8
OEC11.2: Acquire the basic concept of Softwaredefined networking and Machine-to-Machine (M2M).	4	0	0	4
OEC11.3: Exposed to various web communication Protocols for connected devices & Message communication Protocols for connected devices.	8	0	0	8
OEC11.4: Familiarize and understand the basic Sensor data Communication Protocols.	8	0	0	8
OEC11.5: 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			

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A K S University

Faculty of Engineering and Technology

Department of Mechanical Engineering

Curriculum of B.Tech. (Mechanical Engineering) Program

Curriculum Development Team

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Cos, POs and PSOs Mapping

Programme Title: B. Tech. Electrical Engineering
Course Code: OEC11
Course Title: Internet of Things.

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	Engineer ing knowled ge	Problem Solving	Design Skills	Labor atory Skills	Team work	Comm u nicatio nSkills	Ethical and Professio nal Behavior	Lifelong Learnin g	Global and Societal Impact	Project Manage ment	Adapta b ility	Professio nal Develop ment	Mechanical System Design and Analysis	Manufacturi ng Processes and Automation	Computatio nal Modeling and Simulation.	Product Innovati on and Develop ment
CO1: Acquire the knowledge of IoTconcept and its Architecture.	3	1	2	2	2	2	3	1	2	2	1	2	2	2	2	1
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	1	2	2
CO3: Exposed to various web communicationProtocols for connected devices & Message communication Protocols for connected devices.	2	2	1	1	2	2	2	1	1	2	1	2	2	2	1	2
CO4: Familiarize and understand the basicSensor data Communication Protocols.	3	2	2	2	3	1	3	1	2	1	2	2	3	3	3	2
CO5: Smart City Streetlights control & monitoring.	2	2	2	2	1	1	3	1	1	1	2	2	3	1	3	2

Legend: 1 – Low, 2 – 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, 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: **PEC-ME 02**

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:

PEC-ME 02.1: Discuss various components of steam power plant and the factors influencing the site selection for the plant.
PEC-ME 02.2: Illustrate the working of gas turbine and combined power plant and its components.
PEC-ME 02.3: Explain the components, principles and working of nuclear power plant
PEC-ME 02.4: Explain the working of hydroelectric power plant and renewable power system
PEC-ME02.5: Explain the economics involved in Power Plant and identify the factors related to selection of plant.

Scheme of Studies:

Board of Study	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)	PEC-ME 02	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 of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Board of Study	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	ME02	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.

PEC ME 02.1: Discuss various components of steam power plant and the factors influencing the site selection for the plant.

Approximate Hours

Item	Appx. Hrs
CI	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. • Analyze 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.		**S 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:
1. Explain classification of power plant based on energy sources.
2. Explain working and construction of Rankine cycle?

PEC ME 02-.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. • Utilize software tools to simulate and optimize the		**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. Numerical of brayton cycle

performance of a combined cycle power plant. • **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. • Create a model or presentation outlining the future advancements in gas turbine technology for power generation.			

SW-2 Suggested Sessional Work (SW):

a. Assignments:
1. Drive the expression for efficiency of brayton cycle.
2. Explain working and construction of IGCC system.

PEC ME 02 2.3. : 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)	LaboratoryInstruction (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		**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. Safetys measures in functioning of nuclear power plant 2. Enivironmental impact of nuclear power plant

procedures, emergency response plans, and proposing improvements based on 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.

2. Explain fast breeder reactor.

PEC ME 02-2.4. Explain the working of hydroelectric power plant and renewable power system

Approximate Hours

Item	AppX Hrs
CI	09
LI	00
SW	01
SL	02
Total	12

Session Outcomes (SOs)	LaboratoryInstruction (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. • Analyze case studies of hydroelectric power plants and propose improvements for better performance. **SO4.2 Assess** the sustainability and long-term		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	1. environmental impact of hydroelectric power system

viability of hydroelectric power compared to other renewable energy sources. • **SO4.3** Design a hypothetical hydroelectric power system considering geographical, environmental, and economic factors. • Develop a proposal for optimizing existing hydroelectric power plants for increased efficiency or reduced environmental impact.		4.8 Principles and working of biogas power plant 4.9 Principles and working of fuel cell power systems power plant	

SW-4 Suggested Sessional Work (SW):

a. Assignments:

1. Explain working and construction of tidal power plant.
2. Make layout of hydroelectric power system..

PEC-ME02.5: 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)	LaboratoryInstruction (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:

1. 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)
PEC-ME 02.1: Discuss various components of steam power plant and the factors influencing the site selection for the plant	9	0	1	**2**	12
. PEC-ME 02.2: Illustrate the working of gas turbine and combined power plant and its components .	9	0	2	**1**	12
PEC-ME 02.3: Explain the components, principles and working of nuclear power plant	9	0	2	1	12
PEC-ME 02.4: Explain the working of hydroelectric power plant and renewable power system	9	0	2	1	12
PEC-ME02.5: 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 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:

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

Curriculum Development Team

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Cos,POs and PSOs Mapping

Programme Title: B. Tech Mechanical Engineering

Course Code: PEC ME 02

Course Title: Power plant engineering

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
CO1 : . Discuss various components of steam power plant and the factors influencing the site selection for the plant.	1	1	2	2	2	2	3	1	2	2	1	2	2	2	1	-
CO 2 . Illustrate the working of gas turbine and combined power plant and its components.	1	2	2	2	1	2	2	1	1	1	2	3	2	2	2	1
CO3 Explain the components, principles and working of nuclear power plant	2	2	1	1	2	2	2	1	1	2	1	2	2	1	2	2
CO 4: : Explain the working of hydroelectric power plant and renewable power system	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2
CO 5: . Explain the economics involved in Power Plant and identify the factors related to selection of plant	1	2	2	-	1	1	3	1	1	1	2	2	3	3	1	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	CO1 : . Discuss various components of steam power plant 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	As mentioned in page number 2 to 6
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2 : Illustrate the working of gas turbine and combined power plant and its components .	SO2.1 SO2.2 SO2.3 SO2.4		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	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO3 : . : Explain the components, principles and working of nuclear power plant	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 : **Nuclear Power Plants** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: . Explain the working of hydroelectric power plant and renewable power system	SO4.1 SO4.2 SO4.3		Unit-4 : . **Hydroelectric and Renewable Power System** 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, 3, 4, 5	CO 5: Explain the economics involved in Power Plant and identify the factors related to selection of plant	SO5.1 SO5.2 SO5.3 SO5.4		Unit 5: **Energy Economics and Environment** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	

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Semester-VI

Course Code: PEC-ME 01

Course Title: REFRIGERATION AND AIR CONDITIONING

Pre-requisite: Students should have basic knowledge in thermodynamics, heat transfer, and fluid mechanics, along with familiarity with HVAC concepts, psychometry, and refrigeration cycles."

Rationale: Refrigeration and air conditioning ensure comfort, preserve perishables, and maintain industrial processes by controlling temperature, humidity, and air quality for various applications and environments."

Course Outcomes:

ME 01.1: Grasp refrigeration principles, analyze vapor compression systems, and understand limitations for practical applications.".

ME 01.2: Comprehend multi-stage and multi-evaporator systems, including flash gas removal, intercooling, and diverse configurations with applications, advantages, and limitations."

ME 01.3: Students will grasp gas cycle refrigeration concepts, aircraft applications, and cooling tower types, performance, operation, and energy-saving opportunities

ME 01.4:. Master psychrometry, moist air properties, psychrometric processes, heat transfer rates, and applications including SHF, bypass factor, ADP, and air washers."

ME 01.5: apply design conditions, understand thermal comfort, psychometric calculations, and design various summer air conditioning systems, considering ventilation, bypass factors, and reheat strategies."

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SchemeofStudies:

Course Category	Course Code	CourseTitle	Schemeofstudies(Hours/Week)					TotalCredits (C)
			Cl	LI	SW	SL	TotalStudyHours (CI+LI+SW+SL)	
Professional elective course (PEC)	ME 01	REFRIGERATION AND AIR CONDITIONING	3	0	1	1	5	3

Legend: **CI:** Class room 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.

SchemeofAssessment:

Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment(PRA)						End Semester Assessment	Total Marks
			Class/HomeAssignment5number 3marks each (CA)	ClassTest 2 (2bestout of3) 10marks each(CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
Professional elective course (PEC)	ME 01	REFRIGERATION AND AIR CONDITIONING	15	20	5	5	5	50	50	100

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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.

ME 302.1: Grasp refrigeration principles, analyze vapor compression systems, and understand limitations for practical applications.".

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)**
S01.1 Understand refrigeration principles and the second law of thermodynamics. **S01.2** Evaluate practical limitations of the reversed Carnot cycle in refrigeration. **S01. 3** Analyze standard vapor compression refrigeration system performance under various conditions. **S01.4** Explore modifications and criteria for optimum superheat in refrigeration systems. **S01.5** Assess limitations and challenges of single-stage vapor compression refrigeration systems. .	.	**Unit-1.0 Understanding the Basics of Refrigeration and Second Law of Thermodynamics** 1.1 Introduction to Refrigeration 1.2 Second law of thermodynamics, 1.3 Reversed Carnot Cycle. Its practical limitations 1.4 Standard Vapor compression Refrigeration System its performance analysis. 1.5 Effect of evaporator and condensing temperatures. 1.6 Modifications, its effects, 1.7 Liquid-to-Suction heat exchanger, 1.8 Effect of Superheat and criteria For optimum	1. Investigate and list the practical limitations of implementing the reversed Carnot cycle in real-world refrigeration systems. 2. Research the con a liquid-to-suctio exchanger and ex how it enhances t efficiency of a refrigeration syst

		1.9	superheat, Actual vapor compression refrigeration systems, Limitations of single stage.	

SW-1 Suggested Sessional Work(SW):

a. Assignments:

1. Describe the Reversed Carnot Cycle and its significance in refrigeration systems. Explain its practical limitations and why it cannot be achieved in real-world applications.

ME 302.2: Comprehend multi-stage and multi-evaporator systems, including flash gas removal, intercooling, and diverse configurations with applications, advantages, and limitations."

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)
S02.1 Understand concepts of flash gas removal, intercooling, and flash tanks. **S02.2** Evaluate applications, advantages, and compare single and multi-evaporator systems. **S02.3** Analyze systems with single compressors, multiple expansion valves, and cascade configurations. **S02.4** Explore the use of flash tanks for gas removal and intercooling. **S02.5** Assess limitations inherent in multi-stage refrigeration and evaporator systems.	.	**UNT 2.0- Multi-Stage Systems And Multi–Evaporator Systems:** 2.1 Introduction to Multi-Stage Systems 2.2**:** Concept of flash gas removal using flash tank in multi stage system, inter cooling in multi stage system 2.3 Flash gas removal and inter cooling 2.4 Limitations of multi-stage systems. 2.5 Introduction to Multi-Evaporator Systems, Application, comparison Advantages 2.6 Systems using single compressor and a pressure reducing valve with Individual expansion valves 2.7 Systems using single compressor and a pressure reducing valve with multiple expansion valves 2.8 Systems with multi compression, inter cooling and flash gas removal, with individual compressors 2.9 Systems with multi compression, inter cooling and flash gas removal, with individual compressors, Cascade systems	1. Simple nVapour Absorption Refrigeration System. 2. Practical vapour absorption system.

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SW-2 Suggested Sessional Work (SW):

a. **Assignments:** Discuss advanced multi-compression systems with intercooling and flash gas removal. Analyze the benefits of using multiple compressors and expansion valves in improving system efficiency and capacity modulation.

ME 302.3: Students will grasp gas cycle refrigeration concepts, aircraft applications, and cooling tower types, performance, operation, and energy-saving opportunities

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 Examine limitations of Carnot and reversed Carnot cycles in refrigeration. **SO3.2** Explore modified cycles, reversed Bell-Colemann, and actual Bell-Colemann cycles. **SO3.3** Apply gas cycle refrigeration principles to the unique context of aircraft. **SO3.4** Compare diverse air cooling methods, including simple, evaporative, and regenerative. **SO3.5** Evaluate types, performance, flow control, and energy-saving opportunities in cooling towers.	.	**UNIT-3.0 Gas Cycle Refrigeration And Cooling Tower** 3.1 Limitation of Carnot and reversed Carnot Cycle 3.2 Modified Cycle 3.3 Reversed Bell- Colemann cycle 3.4 Actual Bell-Colemann Cycle 3.5 Application of Aircraft RefrigerationL, Overview of simple air cooling, 3.6 Evaporative Air cooling, boot Strap, Boot Strap with evaporative, Reduced ambient, 3.7 Regenerative and comparison of different air cooling system in Air Craft. 3.8 Cooling Tower: Types and perormance evaluation, efficient system operation, 3.9 Flow control strategies and energy saving opportunities, Assessment of cooling towers.	1. Develop a comprehensive assessment plan for cooling towers. 2. Compare regenerative air cooling systems with other air cooling systems used in aircraft.

SW-3Suggested Sessional Work (SW):

a. **Assignments:**

i. Conduct an assessment of cooling towers used in aircraft applications, considering factors such as thermal efficiency, water consumption, environmental impact, and cost-effectiveness.

ME 302.4: Master psychrometry, moist air properties, psychrometric processes, heat transfer rates, and applications including SHF, bypass factor, ADP, and air washers."

Approximate Hours

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

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Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO4. 1 Understand psychrometry, estimating moist air properties, and utilizing psychrometric charts. **SO4. 2** Analyze adiabatic saturation and thermodynamic wet bulb temperature in psychrometry. **SO4. 3** Explore psychrometer use, precautions, and instrument-related considerations in psychrometric measurements. **SO4. 4** Apply equations for heat and mass transfer rates in psychrometric processes. **SO4. 5** Comprehend concepts of SHF, bypass factor, ADP, and air washers for system optimization.		**UNIT-4.0 Psychrometry** 4.1 Psychrometry, Estimating properties of moist air 4.2 psychrometry chart, 4.3 Straight line law, 4.4 Adiabatic saturation and thermodynamic wet bulb temperature, 4.5 Psychrometer and the precautions, 4.6 psychrometric prcesses and their representation, 4.7 equations for heat and mass transfer rates, 4.8 Concept of SHF, By pass factor and ADP, 4.9 Air washer and its use.	1. Psychrometric principles in creating healthier living and working environments 2. Impact of psychrometry on agriculture or industrial processes beyond HVAC

SW-4Suggested Sessional Work (SW):

a. **Assignments:**

i. Describe the construction and use of a psychrometric chart for analyzing the properties of moist air. Explain how to read and interpret a psychrometric chart, including the representation of psychrometric processes and the calculation of various psychrometric properties.

ME 01.5: Apply design conditions, understand thermal comfort, psychometric calculations, and design various summer air conditioning systems, considering ventilation, bypass factors, and reheat strategies."

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

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Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO5.1 Grasp criteria for suitable indoor/outdoor conditions and factors affecting thermal comfort. **SO5.2** Analyze heat balance equations, thermal indices, and the ASHRAE comfort chart. **SO5.3** Evaluate criteria for outdoor conditions, considering typical summer design conditions. **SO5.4** Apply psychometric calculations to a simple air conditioning system with re-circulated air. **SO5.5** Design various summer air conditioning systems with ventilation, considering reheat and bypass factors.		**UNIT-5.0 ENVIRONMENTAL COMFORT AND HVAC SYSTEMS DESIGN** 5.1Introduction to indoor and outdoor design conditions. 5.2 Fixing suitable indoor and outdoor design conditions, thermal comfort, metabolic rate, heat balance equation, equations for all modes of heat losses from the skin, thermoregulatory mechanism. 5.3Factors affecting thermal comfort, thermal indices, presents ASHRE comfort chart 5.4 Concept of Predicted Mean Vote (PMV) and percent of people Dissatisfied(PPD) 5.5 criteria used for selecting outside design conditions and present typical summer design conditions. 5.6 Psychometric calculations 5.7 Simple summer air conditioning system with 100% re-circulated air 5.8 , various Summer air conditioning systems with ventilation and with zero and non zero by pass factor, 5.9 with re-heat for high latent cooling load applications	1. Selection guidelines for supply air conditions. 2. impact of ventilation

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SW-5Suggested Sessional Work (SW):

a. **Assignments:**

i) Explore the heat balance equation and its application in assessing thermal comfort. Discuss the components of the heat balance equation, including metabolic heat production, sensible heat exchange, and latent heat exchange.

i.

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: Grasp refrigeration principles, analyze vapor compression systems, and understand limitations for practical applications.".	9	1	1	11
CO2: Comprehend multistage and multi-evaporator systems, including flash gas removal, intercooling, and diverse configurations with applications, advantages, and limitations."	9	1	1	11
CO:3 Students will grasp gas cycle refrigeration concepts, aircraft applications, and cooling tower types, performance, operation, and energy-saving opportunities	9	1	1	11
CO:4 Master psychrometry, moist air properties, psychrometric processes, heat transfer rates, and applications including SHF, bypass factor, ADP, and air washers."	9	1	1	11
CO5: Apply design conditions, understand thermal comfort, psychometric calculations, and design various summer air conditioning systems, considering ventilation, bypass factors, and reheat strategies."	9	1	1	11
Total Hours	45	5	5	55

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Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Understanding the Basics of Refrigeration and Second Law of Thermodynamics	03	01	01	05
CO-2	Multi-Stage Systems And Multi–Evaporator Systems:	02	06	02	10
CO-3	Gas Cycle Refrigeration And Cooling Tower	03	07	05	15
CO-4	Psychrometry	-	10	05	15
CO-5	Environmental Comfort and HVAC Systems Design	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for REFRIGERATION AND AIR CONDITIONING 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, Whats-app, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher
1	Refrigeration And Air Conditioning	C.P. Arora	Tata McGraw-Hill
2	Refrigeration And Air Conditioning	R.K. Rajput	Katson Publication
3	Refrigeration And Air Conditioning	Arora & Domkundwar	Dhanpat raj Sons
4	Refrigeration And Air Conditioning	W.F. STOECKER & J.W JONES	Tata McGraw-Hill
5	Refrigeration And Air Conditioning	Ahmadaul Ameen	PHI publication
6	Handbook of Refrigeration And Air Conditioning	Shan K.Wang	Tata McGraw-Hill

Curriculum Development Team

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****

Cos, Pos and PSOs Mapping

Programme Title: **B. Tech Mechanical Engineering**

Course Code : ME 01

Course Title: REFRIGERATION AND AIR CONDITIONING

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	Problemanalysis	Design/developmentofsolutions	Conductinvestigationsofcomplexproblems	Modern toolusage	Theengineerandsociety	Environment and sustainability:	Ethics	Individualandteamwork:	Communication:	Project management and finance:	Life-longlearning	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
CO1: Grasp refrigeration principles, analyze vapor compression systems, and understand limitations for practical applications.".	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO2: Comprehend multistage and multi-evaporator systems, including flash gas removal, intercooling, and diverse configurations with applications, advantages, and limitations."	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO:3 Students will grasp gas cycle refrigeration concepts, aircraft applications, and cooling tower types, performance, operation, and energy-saving opportunities	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO:4 Master psychrometry, moist air properties, psychrometric processes, heat transfer rates, and applications including SHF, bypass factor, ADP, and air washers."	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO5: Apply design conditions, understand thermal comfort, psychometric calculations, and design various summer air conditioning systems, considering ventilation, bypass factors, and reheat strategies."	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	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 PSO1,2,3,4,5	CO1: Grasp refrigeration principles, analyze vapor compression systems, and understand limitations for practical applications.".	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**Unit-1.0 Understanding the Basics of Refrigeration and Second Law of Thermodynamics** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	As mentioned in Page number 2 to 6
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO2: Comprehend multistage and multi-evaporator systems, including flash gas removal, intercooling, and diverse configurations with applications, advantages, and limitations."	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		**UNT 2.0- Multi-Stage Systems And Multi–Evaporator Systems:** 2.1,2.2,2.3,2.4,2.5,2.6,2.7, 2.8,2.9,	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO:3 Students will grasp gas cycle refrigeration concepts, aircraft applications, and cooling tower types, performance, operation, and energy-saving opportunities	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		**UNIT-3.0 Gas Cycle Refrigeration And Cooling Tower** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO:4 Master psychrometry, moist air properties, psychrometric processes, heat transfer rates, and applications including SHF, bypass factor, ADP, and air washers."	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		**UNIT-4.0 Psychrometry** 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 PSO1,2,3,4,5	CO5: Apply design conditions, understand thermal comfort, psychometric calculations, and design various summer air conditioning systems, considering ventilation, bypass factors, and reheat strategies.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		**UNIT-5.0 ENVIRONMENTAL COMFORT AND HVAC SYSTEMS DESIGN** 5.1, 5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	

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Course Code: PEC -ME 03

Course Title : Renewable Energy Engineering

Pre- requisite: Knowledge of thermodynamics, heat transfer, energy engineering, applied thermodynamics and heat cycles

Rationale: The combustion of fossil fuels releases greenhouse gases, such as carbon dioxide, contributing to climate change. Renewable energy sources like solar, wind, and hydropower produce electricity with significantly lower or zero emissions, helping to mitigate climate change..

Course Outcomes:

PEC-ME03.1 understanding of basic energy concepts, including the principles of energy conversion and the environmental impact of energy utilization.

PEC-ME03.2: Analyze solar radiation data, estimate solar radiation on different surfaces, and comprehend the functioning of various solar thermal systems and photovoltaic systems. They will also gain knowledge about thermal energy storage methods..

PEC-ME03.3: Acquire expertise in wind energy, including the basics of fluid mechanics, wind turbine aerodynamics, and the different types of wind turbines. They will be capable of evaluating wind turbine siting and understanding wind energy conversion systems.

PEC-ME03.4: understanding of various renewable energy sources, including fuel cells and biomass energy. They will be able to classify fuel cells, grasp their operating principles and thermodynamics, as well as comprehend biomass conversion technologies and urban waste to energy conversion..

PEC-ME03.5.: Recognize the significance of nuclear, ocean, and geothermal energy.

Board of Study	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)	ME 03	Renewable Energy Engineering	3		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

Board of Study	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	ME 03	Renewable Energy 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.

AKS University

PEC-ME03.1 understanding of basic energy concepts, including the principles of energy conversion and the environmental impact of energy utilization.

Approximate Hours

Item	AppX Hrs
Cl	09
LI	
SW	01
SL	01
Total	11

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1 Understand fundamental energy concepts, types, and conversion principles. SO1.2 Identify and explain key renewable energy technologies and their applications. SO1. Grasp environmental impacts of energy, focusing on global warming and ozone layer depletion. SO1.4 Analyze the current status, trends, and challenges in global and Indian renewable energy landscapes. SO1.5 Recognize the significance of energy storage and explore methods like batteries and pumped hydro storage..		**Unit-1.0 Introduction** **1..Basic concepts of energy** **1.2 Introduction to Renewable Energy Technologies** **1.3 Energy and Environment** **1.4 global warming,** **1.5 Acid rains** **1.6 Depletion of ozone layer** **1.7 Global and Indian Scenario of renewable energy sources** **1.8 Energy storage - necessity** **1.9 Energy storage methods.**	**1.** Global warming

SW-1 Suggested Sessional Work (SW):

a. Assignments:

Explain energy storage methods

PEC-ME03.2: Analyze solar radiation data, estimate solar radiation on different surfaces, and comprehend the functioning of various solar thermal systems and photovoltaic systems. They will also gain knowledge about thermal energy storage methods

Approximate Hours

Item	AppX Hrs
Cl	10
LI	
SW	01
SL	02
Total	13

Session Outcomes (SOs)	LaboratoryInstruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Define key concepts related to solar energy, including solar radiation, photovoltaics, and solar thermal technologies. SO2.2 Describe the basic principles of thermodynamics and heat transfer as they apply to solar thermal systems. SO2.3 Explain the operation of flat plate collectors and evacuated tubular collectors. SO2.4 Understand the principles of solar concentrators and their role in enhancing solar energy utilization. SO2.5 Evaluate the use of solar energy in practical applications such as solar distillation, cooking, refrigeration, and air conditioning.		Unit-2.0 Solar Energy and Solar Thermal Systems 2.1 Fundamentals of Solar Radiation 2.2 Estimation of solar radiation on horizontal and inclined surfaces 2.3Measurement of solar radiation data 2.4Basics of thermodynamics and heat transfer 2.5Flatplatecollector 2.6Evacuated Tubular Collector 2.7Solar air collector; Solar concentrator 2.8 Solar distillation, Solar cooker 2.9 Solar refrigeration and air conditioning 2.10Thermal energy storage systems	1Flat plate collector 2 Solar air collector

SW-2 Suggested Sessional Work (SW):

a. Assignments:

Explain Solar distillation system.

PEC-ME03.3: **Acquire expertise in wind energy, including the basics of fluid mechanics, wind turbine aerodynamics, and the different types of wind turbines. They will be capable of evaluating wind turbine siting and understanding wind energy conversion systems.**

Approximate Hours

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

Session Outcomes (SOs)	LaboratoryInstruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1Understand the basic principles of the photovoltaic effect and semiconductor properties. SO3.2 Describe key solar cell characteristics and classify solar cells based on materials and structure SO3.3 Learn techniques for constructing solar cell modules, panels, and arrays. SO3.4 Acquire knowledge on factors influencing wind turbine siting and grasp basic fluid mechanics principles relevant to wind energy.		**Unit-3.0 Solar Photovoltaic Systems and wind energy** **3.1Introduction** **3.2 Solar cell Fundamentals** **3.3 Characteristics and classification of Solar cell** **3.4 Solar cell Module, panel and Array** **3.5constructionof Photovoltaic thermal systems.** **3.6 Introduction, Origin and nature of winds** **3.7Wind turbine sitting** **3.8Basics of fluid mechanics** **3.9Wind turbine aerodynamics** **3.10 wind turbine types and their construction** **3.11Wind energy conversion systems.**	1. **Solar cell Module, panel and Array**

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**

i. Explain types of wind turbine

PEC-ME03.4: understanding of various renewable energy sources, including fuel cells and biomass energy. They will be able to classify fuel cells, grasp their operating principles and thermodynamics, as well as comprehend biomass conversion technologies and urban waste to energy conversion.

Approximate Hours

Item	AppX Hrs
Cl	09
LI	
SW	1
SL	2
Total	12

Session Outcomes (SOs)	LaboratoryInstruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Understand the fundamentals of fuel cells. SO4.2 Explore the operating principles of various fuel cell types. SO4.3 Explain the electrochemical processes during power generatio SO4.4 Learn the thermodynamics behind fuel cell efficiency. SO4.5 Learn about biomass resources and conversion technologies.		**Unit-4.0 Fuel cells and Biomass energy 4.1 introduction of fuel cell 4.2Classification of fuel cells 4.3 Operating principles Fuel cell thermodynamics 4.4Introduction of biomass energy 4.5Photosynthesis Process 4.6 Biofuels 4.7Biomass Resources 4.8 Biomass conversion technologies 4.9 Urban waste to energy conversion; Biomass gasification.**	**1. Biofuels 2. Photosynthesis process**

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**

1 Explain operating principles Fuel cell.

PEC-ME03.5.: Recognize the significance of nuclear, ocean, and geothermal energy

Approximate Hours

Item	AppX Hrs
Cl	06
LI	
SW	01
SL	01
Total	08

Session Outcomes (SOs)	LaboratoryInstruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 - Explain nuclear energy principles, including fission and fusion. **SO5.2 Explore tidal, wave, and thermal energy from the ocean.** **SO5.3 Understand geothermal energy origins and working principles.** **SO5.4 Discuss variations in energy production methods within each category.**		**Unit-5.0 Other forms of Energy** **5.1 Introduction of nuclear energy ,ocean and geothermal energy** **5.2Applications of nuclear ,ocean and geothermal energy** **5.3 Origin and types of nuclear ,ocean and geothermal energy** **5.4 Working principles of nuclear energy** **5.8Working principles of ocean energy** **5.6Working principles of geothermal energy**	**1. Working principles of ocean energy**

SW-5 Suggested Sessional Work (SW):

a. Assignments:

1 Discuss about nuclear, ocean and geothermal energy

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)
PEC-ME03.1 understanding of basic energy concepts, including the principles of energy conversion and the environmental impact of energy utilization	09		01	01	11
PEC-ME03.2: Analyze solar radiation data, estimate solar radiation on different surfaces, and comprehend the functioning of various solar thermal systems and photovoltaic systems. They will also gain knowledge about thermal energy storage methods	10		01	02	13
PEC-ME03.3: Acquire expertise in wind energy, including the basics of fluid mechanics, wind turbine aerodynamics, and the different types of wind turbines. They will be capable of evaluating wind turbine siting and understanding wind energy conversion systems	11		01	01	13
PEC-ME03.4: understanding of various renewable energy sources, including fuel cells and biomass energy. They will be able to classify fuel cells, grasp their operating principles and thermodynamics, as well as comprehend biomass conversion technologies and urban waste to energy conversion.	09		01	02	12
PEC-ME03.5.: Recognize the significance of nuclear, ocean, and geothermal energy	06		01	01	08
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	**Introduction**	01	10	-	11
CO-2	**Solar Energy and Solar Thermal Systems**.	01	04	02	07
CO-3	**Solar Photovoltaic Systems and wind energy**.	03	08	05	16
CO-4	**Fuel cells and biomass energy**	01	10	05	16
CO-5	**Other forms of Energy**.	03	02	05	10
Total		09	34	17	50

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

The end of semester assessment for **Renewable Energy Engineering** 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	Energy Technology	O.P. Gupta	Khanna Book Publishing, New Delhi	
2	Renewable Energy Engineering and Technology	V.V.N. Kishore	Routledge	1st Edition, 2019.
3	Renewable Energy Engineering	N. Jenkins and J. Ekanayake	Cambridge University Press .	1st Edition, 2017
4	Renewable Energy	G. Boyle	OUP Oxford	2nd Edition, 2009.
5	Training Manual			
6	Training Manual			
7	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna .			

Curriculum Development Team

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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
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Cos,POs and PSOs Mapping

Programme Title: B. Tech Mechanical Engineering

Course Code : PEC ME03

Course Title: Renewable Energy Engineering

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
CO1 : Understand fundamental energy concepts, types, and conversion principles..	1	1	2	2	2	2	3	1	2	2	1	2	2	2	1	-
CO 2 : Analyze solar radiation data, estimate solar radiation on different surfaces, and comprehend the functioning of various solar thermal systems and photovoltaic systems. They will also gain knowledge about thermal energy storage methods	1	2	2	2	1	2	2	1	1	1	2	3	2	2	2	1
CO3 : Acquire expertise in wind energy, including the basics of fluid mechanics, wind turbine aerodynamics, and the different types of wind turbines. They	2	2	1	1	2	2	2	1	1	2	1	2	2	1	2	2

will be capable of evaluating wind turbine siting and understanding wind energy conversion systems.																
CO 4: understanding of various renewable energy sources, including fuel cells and biomass energy. They will be able to classify fuel cells, grasp their operating principles and thermodynamics, as well as comprehend biomass conversion technologies and urban waste to energy conversion..	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2
CO 5: Recognize the significance of nuclear, ocean, and geothermal energy.	1	2	2	-	1	1	3	1	1	1	2	2	3	3	1	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	CO1 : Understand fundamental energy concepts, types, and conversion principles..	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**Unit-1Introduction** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	As mentionedin page number 2 to 6
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2 : Analyze solar radiation data, estimate solar radiation on different surfaces, and comprehend the functioning of various solar thermal systems and photovoltaic systems. They will also gain knowledge about thermal energy storage methods	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		**Unit -2 Solar Energy and Solar Thermal Systems**. 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, 3, 4, 5	CO3 : Acquire expertise in wind energy, including the basics of fluid mechanics, wind turbine aerodynamics, and the different types of wind turbines. They will be capable of evaluating wind turbine siting and understanding wind energy conversion systems.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 : **Solar Photovoltaic Systems an wind energy** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9 3.10,3.11	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: understanding of various renewable energy sources, including fuel cells and biomass energy. They will be able to classify fuel cells, grasp their operating principles and thermodynamics, as well as comprehend biomass conversion technologies and urban waste to energy conversion.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 : **Fuel cells and biomass energy** 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, 3, 4, 5	CO 5: Recognize the significance of nuclear, ocean, and geothermal energy	SO5.1 SO5.2 SO5.3 SO5.4		Unit 5: **Other forms of Energy** 5.1,5.2,5.3,5.4,5.5 5.6	

Semester VIII

Course Code: PROJ-ME 402

Course Title: Engineering Project-3 (Prototype & Testing)

Pre- requisite: Basic Knowledge of Mechanical Industries

Rationale: The objectives of the Industrial Training include: To give students the opportunity to apply the knowledge and skills they have acquired on campus in a real-life work situation. To provide students with opportunities for practical, hands-on learning from practitioners in the student's areas of specialization. To expose students to a work environment, common practices, employment opportunities and work ethics in their relevant field. To enhance the employability skills of the students. To provide opportunities for students to be offered jobs in the organizations in which they undergo their Industrial Training.

Course Outcomes:

PROJ-ME 402.1: Understand the organizational environment and recognize the requirement of the organization and cope with the organizational scenario.
PROJ-ME 402.2: Identify career paths taking into account their individual strengths and aptitude and prepare a report about the work experience in the organization.
PROJ-ME 402.3: Develop the employability skills and Start-Up skills to increase his/her ability to engage in life-long learning
PROJ-ME 402.4: Develop individual confidence to handle various engineering assignments and acquire life skills to meet societal challenges.

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)	
PROJ	PROJ-ME 402	Engineering Project-3 (Prototype & Testing)	3	0	1	1	3	12

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:
Engineering Project

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)					Total Marks (PRA+ESA)
			Progressive Assessment (PRA)				End Semester Assessment Final Project Report + Seminar + Viva (ESA)	
			5 Internal Progress Report Monthly 7 marks each (IPR)	Seminar one (TSN)	Class Attendance (TA)	Total Marks (IPR+TSN+TA)		
PROJ	PROJ-ME 402	Engineering Project-3 (Prototype & Testing)	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.

On Job Industrial Training & Time Schedule

Activity	Broad Area of Training	Time Schedule
Plant Data	Product information, Capacity of the plant, is the company quoted on the stock exchange, locally, international, if so how has their share price varied during your time with the company? (Type of industry - Public Limited, Private Limited, Co-operative sector etc.) Site Plan, /Plant Layout, Flow Diagram / Process Diagram	48 Hours (1Week)
Process Technology	Manufacturing processes, Drawings (if available), specification of the machinery in use, The type of fuel, process control parameters, CCR operation	48 Hours (1Week)
Raw Materials	Quality and source of the various raw materials used by the Mechanical plant.	96 Hours (2Weeks)
Limestone Mining	Limestone Mining practices, quarry scale of operation, Pit head Quality control	96 Hours (2Week)
Homogenization and Raw meal preparation	Crushing of limestone pre homogenization stock pile, grinding and homogenisation of raw meal	96 Hours (2Weeks)
Fuel	Quality, source and preparation of fuel for firing including Alternate Fuel (if used by the plant)	96 Hours (2Weeks)
Pyro-processing and Clinker manufacture	Rotary kiln operation, pre heater , pre calciner technique , process control	96 Hours (2Weeks)
Clinker cooling	Clinker cooling practices	96 Hours (2Weeks)
Energy Management	The energy requirements of the company (machinery, lighting, heating and or air conditioning): Source, connected load, Surplus electricity, Correlate items that can reveal major outcomes, e.g. how power factor in electricity bill reveals production rate. Waste heat recovery system and cogeneration of power.	48 Hours (1Week)
Material Handling Systems	Material handling system of Mechanical plant	48 Hours (1Week)
Maintenance Practices of the plant	Maintenance schedule / Programmers: Preventive Maintenance, Stoppages, Breakdown Maintenance, Calibration Systems	48 Hours (1Week)

Instrumentation and control	Process automation, Type of Instrumentation and Control, Fully / Partially automated, Office Automation, Value and system analysis	48 Hours (1Week)
Plant Utilities:	Own source of water or else , Water reservoir, Boiler, DM Plant, Electricity, Power, Compressor, Air Conditioning, Effluent Treatment Plant Production of Mechanical and Despatch Systems	48 Hours (1Week)
Quality Control & Quality Assurance	Quality control system of the Mechanical plant and quality assurance practices in Mechanical manufacturing process of Mechanical	48 Hours (1Week)
Human Resource Planning and Management	Technical, Non-Technical, Administrative, Direct employment, Indirect employment, Turnover-capital employed	48 Hours (1Week)
Materials Management	Purchasing, Write-off policy, Inventory Control, Competitors, Export achievements, Building and Construction, Budgetary provisions, control and cost analysis, Budgets/Project planning/scheduling	48 Hours (1Week)
Safety and Hygiene	Environmental norms, Fire Safety norms, Industrial Safety norms.	48 Hours (1Week)
Marketing Strategy and Consumer Satisfaction measure	Marketing practices and consumer satisfaction measure taken by the Mechanical plant	48 Hours (1Week)
Total Hours		1152 Hours (24 Weeks)

OR (In campus Training)

Prototype & Testing & Time Schedule		
Activity	**Broad Area of Training**	**Time Schedule**
Project Planning/ Problem Designing /Gap Identification	This involves clearly defining the problem or research question that needs to be addressed in the laboratory. It includes understanding the context, scope, and significance of the problem.	144 Hours (3 Weeks)
Literature Review	This helps in identifying gaps in knowledge and determining the best approach to address the problem.	144 Hours (3 Weeks)
Experimental Methodology Development & Interpretation	Analysis and interpretation in lab research involve processing data for patterns, using statistical methods for insights, and contextualizing findings to draw conclusions that advance scientific understanding and guide further research.	384 Hours (8 Weeks)
Result & Discussion	Results and discussion in laboratory research entail presenting findings, interpreting their significance, and contextualizing them within existing knowledge to address research objectives and implications effectively.	192 Hours (4 Weeks)
Report Writing	Research writing involves synthesizing literature, presenting methods and findings, interpreting results, and discussing implications succinctly to contribute knowledge, validate findings, and propose further exploration in the field.	288 Hours (6 Weeks)
Total Hours		1152 Hours (24 Weeks)

Curriculum Development Team

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COs, POs and PSOs Mapping

Course Title: B. Tech Mechanical Engineering

Course Code: PROJ-ME 402

Course Title: Engineering Project-3 (Prototype & Testing)

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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
PROJ-ME 402.1: Understand the organizational environment and recognize the requirement of the organization and cope with the organizational scenario.	2	1	1	1	1	3	3	1	1	1	1	2	3	3	3	3
PROJ-ME 402.2: Identify career paths taking into account their individual strengths and aptitude and	3	1	2	2	2	3	3	1	1	1	1	2	3	3	3	3

prepare a report about the work experience in the organization.																
PROJ-ME 402.3: Develop the employability skills and Start-Up skills to increase his/her ability to engage in life-long learning	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**3**	**1**
PROJ-ME 402.4: Develop individual confidence to handle various engineering assignments and acquire life skills to meet societal challenges.	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**1**

Legend: 1 – Low, 2 – Medium, 3 – High

Semester-VIII

Course Code: **SEM-ME 403**

Course Title : **Seminar**

Pre-requisite: Students should have basic knowledge on design and presentation of technical seminar.

Rationale: The student possesses knowledge of the processes involved in the manufacture of Machines. Additionally, the student should be familiar with the latest trends in Mechaniacal manufacturing and the challenges faced by the Mechaniacal industry. Presenting the latest technological advanMechanicals in Mechanical manufacturing is essential for the seminar.

Course Outcomes:

CO.1: Identification and objective of the seminar topic, along with a literature review that includes recent technological trends.

CO.2: In-depth analysis and interpretation of technical data related to the seminar topic, including case studies and practical implementation examples.

CO.3: Preparation and delivery of the seminar presentation, including a question and answer session.

SchemeofStudies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Hours (CI+LI+SW+SL)	
PROJ	SEM-ME 403	Seminar		2		3	3	1

Legend:

CI: ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)andothers),
LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop, field or other locations using different instructional strategies)
SW: Sessional Work(includesassignment, seminar, miniprojectetc.),
SL: SelfLearning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback ofteacherto ensureoutcomeofLearning.

Scheme of Assessment:

Course Category	Course Code	Course Title	Scheme of Assessment (Marks)								
			Progressive Assessment (PRA)					End Semester Assessment			Total Marks (PRA+ESA)
			Identification of seminar topic	Data collection	Prepartionpresenation	Seminar presentation	Total Mark	Seminarcontent	Presentation and Questionanswer	Total Marks	
PROJ	SEM-ME 403	Seminar	05	05	25	15	50	10	40	50	100

Course-CurriculumDetailing:

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 Lab Work Assignment (LA) Best of 5 of the total, Viva-Voice on Lab Work (VV), and Lab Attendance (LA). 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.

Course Outcome	Activities	Time Schedule (in hours)	
		Class Activity Per week (1 Credit)	Self Learning /Home activity Per week
CO.1: Identification and objective of the seminar topic, along with a literature review that includes recent technological trends.	1. **Introduction and fundamentals Seminar** - Objectives of the Seminar - Identification and Overview of Topics to be Covered - Importance and Relevance of the Seminar	3	5

	in Current Industry Trends - Introduction to the Technical Field - Basic Concepts and Terminology - Historical Development and Milestones - Current State of the Technology		
CO.2: In-depth analysis and interpretation of technical data related to the seminar topic, including case studies and practical implementation examples	2.0 **In-depth Technical Sessions and preparation of presentation** **Module 1: Advanced Theoretical Concepts** - Key Theories and Principles - Mathematical Foundations - Models and Algorithms **Module 2: Practical Applications** - Industry Applications - Case Studies - Real-world Scenarios **Module 3 : Practical Implementation** - Step-by-step Guide to Solving a Problem - Coding and Development - Debugging and Optimization	7	15
CO.3: Preparation and delivery of the seminar presentation, including a question and answer session.	**Prepartion of seminar content in proper presentation format and seminar presentation** Prsentaion andQuartion answer session Seminar feed back and over view	5	10
Total		15	30

Suggestion for End Semester Assessment

SuggestedSpecificationTable(ForESA)

Course Outcome	UnitTitles	MarksDistribution			Total Marks
		R	U	A	
CO.1: Identification and objective of the seminar topic, along with a literature review that includes recent technological trends.	Introduction and fundamentals Seminar	05	05		10
CO.2: In-depth analysis and interpretation of technical	In-depth Technical Sessions and preparation of		10	05	15

data related to the seminar topic, including case studies and practical implementation examples	presentation				
CO.3: Preparation and delivery of the seminar presentation, including a question and answer session	Prepartion of seminar content in proper presentation format and seminar presentation		10	15	20
Total		05	25	20	50

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

Note. Detailed Assessment rubric need to be prepared by the course wiseteachers for above tasks. Teachers can also design different tasks as per requirement, for endsemesterassessment.

SuggestedInstructional/ImplementationStrategies:

1. ImprovedLecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. RolePlay
6. Visit to Mechanical plant
7. Demonstration
8. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp, Mobile,Onlinesources)
9. Brainstorming

SuggestedLearningResources:

(a) Books:

S.No.	Title	Author	Publisher	Edition &Year
1				
2				

3				
4	Manufacturing process			
5				

Curriculum Development Team

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COs, POsandPSOs Mapping

ProgramTitle:B.Tech Mechanical Engineering

Course Code:SEM-ME 403; **CourseTitle: Seminar**

CourseOutcomes	Program Outcomes												ProgramSpecificOutcome			
	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	Mechanical System Design and Analysis	Manufacturing Processes and Automation	Computational Modeling and Simulation.	Product Innovation and Development
CO.1: Identification and objective of the seminar topic, along with a literature review that includes recent technological trends.	2	1	1	1	1	3	3	1	1	1	1	2	3	3	3	3
CO.2: In-depth analysis and interpretation of technical data related to the seminar topic, including case studies and practical implementation examples	3	1	2	2	2	3	3	1	1	1	1	2	3	3	3	3
CO.3: Preparation and delivery of the seminar presentation, including a question and answer session.	3	3	3	3	3	3	3	2	3	1	3	3	3	2	3	1

Legend:1–Low,2–Medium,3–High

CourseCurriculumMap: Seminar

POs&PSOsNo.	COsNo.&Titles	SOsNo.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning(SL)
	CO.1: Identification and objective of the seminar topic, along with a literature review that includes recent technological trends.				
	CO.2: In-depth analysis and interpretation of technical data related to the seminar topic, including case studies and practical implementation examples				
	CO.3: Preparation and delivery of the seminar presentation, including a question and answer session.				