Curriculum Book

and

Assessment and Evaluation Scheme

based on

Outcome Based Education (OBE)

and

Choice – Based Credit System (CBCS)

in

Bachelor of Technology

B.Tech. (Computer Science and Engineering - Artificial Intelligence & Data Science)

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 Computer Science & Engineering

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Department of Computer Science & Application
AKS University, Satna (M.P.)

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Professor B.A. Chopade
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Satna, 485001 (M.P.)

A K S University, Satna

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum & Syllabus of B.Tech. Computer Science & Engineering - Artificial Intelligence and Data Science) Program

(Revised as of 01 August 2023)

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Foreword

I am thrilled to observe the updated curriculum of the Computer Science & Engineering Department for the B. Tech Computer Science & Engineering [Artificial Intelligence and Data Science] Program, which seamlessly integrates the most recent technological advancements and adheres to the guidelines set forth by AICTE. The revised curriculum also thoughtfully incorporates the directives of NEP-2020 and the Sustainable Development Goals.

The alignment of course outcomes (COs), Programme Outcomes (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 Computer Science & Engineering - Artificial Intelligence and Data Science program for implementation in the upcoming session.

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

01 August 2023

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Department of Computer Science & Engineering

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From the Desk of the Vice-Chancellor

AKS University is currently undergoing a process to revamp its curriculum into an outcome-based approach, to enhance 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 Computer Science & Engineering Department, in consultation with an array of experts from the Computer Science industry, research institutes, and academia. This curriculum effectively integrates the principles outlined in the NEP-2020 guidelines, as well as sustainable goals. It also adeptly incorporates the latest advancements in Computer Science manufacturing technology.

Furthermore, the curriculum takes into account the specific needs of the Indian Computer Science industry, focusing on the production of cost-effective, high-quality Computer Science. It extends its reach to optimizing power consumption by including insights on waste heat recovery systems utilized in Computer Science plants. This inclusion not only imparts knowledge but also encourages students' independent thinking for potential enhancements in this area.

The curriculum goes beyond theoretical learning and embraces practical applications by incorporating the utilization of industrial and domestic waste in Computer Science production. To enhance students' skills, the curriculum integrates Hands-On Training, industrial visits, on-the-job training experiences, research, and progress. This well-rounded approach ensures that students receive a comprehensive education, fostering their skill development and preparing them for success in the Computer Science industry.

I am confident that the updated curriculum for Computer Science & 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 Computer Science & Engineering department has diligently adhered to the guidelines provided by the AICTE. Additionally, they have maintained a total credit requirement of 170 for the B. Tech Computer Science & 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 expert 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.

AKS University, Satna ***Professor B. A. Chopade***

01 August 2023 *Vice-Chancellor*

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Preface

As part of our commitment to ongoing enhancement, the Department of Computer Science & Engineering consistently reviews and updates its B.Tech. Computer Science & 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. - Computer Science & Engineering AI-DS 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. 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-the-job training, have been incorporated. Furthermore, in alignment with AICTE's directives, the total credit allocation for the B. Tec Computer Science & Engineering program is capped at 169 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: 25 credits, Humanities and Social Sciences: 12 credits, Core Program Courses: 66 credits, Elective Program Courses: 9credits, Open Electives: 9 credits, Project and Practical Training: 17 credits, Seminars: 3 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 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 the independent thinking, skills, and overall employability of the students.

Professor Akhilesh A. Waoo
Associate Dean and Head CS/IT

A K S University

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Introduction:

Department of Computer Science & Engineering was established in the year 2012. The Computer Science department at AKS University, Satna is fully committed to preparing its students with a vision, creativity, and newness so that they can face the challenges of the corporate world. Highly qualified and experienced faculty members of the department play a major role in the university. The department aims to provide its students with an updated curriculum to analyze, develop, and monitor computers & and their various applications as a blend of theory, practical, projects, and seminars. The main goals are to enhance problem-solving skills, innovative thinking, analytics, teamwork, developing good communication skills, and readiness to learn new technologies such as artificial intelligence, IoT, machine learning, cloud computing, network security, etc. Top of Form

Vision

The aim of the Computer Science Commuter Science & Engineering Department is to proceed in the Information Technology field, produce skilled graduates, conduct impactful research, and contribute to the betterment of society through technology.

Mission

M01: To produce skilled students, contribute to research and innovation, and address the societal challenges associated with technology.
M02: To promote innovation and research in computer science.
M03: To educate and train the next generation of technology leaders.
M04: To Actively engage with industry and the wider community.
M05: To support and nurture the entrepreneurial spirit and startup culture among its students and faculty.

Program Educational Objectives

PEO1. Excel in professional career and/or higher education by acquiring knowledge in mathematical, computing, and engineering principles.
PEO2. Analyze real-life problems, and design computing systems appropriate to its solutions that are technically sound, economically feasible, and socially acceptable.
PEO3. Exhibit professionalism, ethical attitude, communication skills, and teamwork in their profession and adapt to current trends by engaging in lifelong learning.

Program Outcomes

Graduates in engineering will be able to:

- **PO1 - Engineering knowledge:** Use their understanding of physics, math, engineering fundamentals, and your chosen engineering specialty to solve challenging engineering challenges even in the field of AI and Data Science.
- **PO2 - Problem analysis:** Using the fundamental concepts of mathematics, the natural sciences, and engineering sciences, identify, formulate, study research material, and analyze difficult engineering problems to obtain justified findings.
- **PO3 - Design/development of solutions:** Designing complicated engineering problems' solutions and creating system elements or processes that satisfy the required requirements while taking into account factors like public health and safety, and cultural, societal, and environmental considerations.
- **PO4 - Conduct studies of difficult problems:** Apply research-based knowledge and research techniques, such as experiment design, data analysis and interpretation, and information synthesis,

to provide reliable results and current technological context.

- **PO5 - Utilization of modern tools:** Develop, pick, and apply appropriate methods, resources, and modern IT and engineering tools, such as modeling and prediction, to complex engineering operations while being aware of the technologies' limitations.
- **PO6 - Engineers, and society:** Assess societal, health, safety, legal, and cultural issues and the resulting obligations related to the professional practice of engineering by using reasoning informed by contextual knowledge.
- **PO7 - Environment and sustainability:** Understanding the effects of professional engineering solutions in societal and environmental contexts, as well as demonstrating an understanding of the need for sustainable development.
- **PO8 - Ethics:** Adhere to professional ethics, obligations, and standards of engineering practice. Apply ethical principles.
- **PO9 - Individual and team work:** Work effectively as an individual, a team member, or a leader in different teams and interdisciplinary situations.
- **PO10 - Communication:** Effectively communicate complex engineering tasks to the engineering community and the general public. This includes the ability to understand and produce effective reports and design documentation, deliver and receive clear directions, and make good presentations.
- **PO11 - Project management and finance:** Show knowledge and grasp of engineering and management principles and apply them to own work as a team member and leader to manage projects and in interdisciplinary settings.
- **PO12 - Life-long learning:** Recognize the need for, and possess the readiness and capacity for, autonomous and lifelong learning in the classroom.

Program Specific Outcomes

- **PSO1:** Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity.
- **PSO2:** Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings.
- **PSO3:** Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.
- **PSO4:** Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science.
- **PSO5:** Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.

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General Course Structure and Credit Distribution

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

B. Range of Credits:

As per the AICTE model Curriculum for the UG Degree Course in Computer Science and Engineering, the total number of credits proposed for the four-year B. Tech/B.E. in Computer Science and Engineering Artificial Intelligence and Data Science (AI-DS) is kept as 169.

C. Structure of UG Program in AI-DS:

The structure of the UG program in Artificial Intelligence and Data Science shall have essentially the following categories of courses with the breakup of credits as given:

S. No.	Category	Breakup of Credits
1.	Humanities & Social Science Courses	10
2.	Basic Science Courses	16
3.	Engineering Science Courses	08
4.	Program Core Courses (Branch specific)	71
5.	Professional Elective Courses (Branch specific)	16
6.	Open Elective Courses (from Humanities, Technical Emerging or otherSubjects)	06
7.	Project work, Seminars and Internships in Industry or elsewhere, or research courses	38
8.	Audit Courses Part-I [Environmental Sciences, Indian Constitution]	(non-credit)
9	Audit Courses Part-II [Sustainable Development Goals, Indian Knowledge System]	4
	TOTAL	**169**

D. Course Code and Definition:

Course code	Definitions
L	Lecture
T	Tutorial

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P	Practical
C	Credits
HS	Humanities & Social Science Courses
BS	Basic Science Courses
ES	Engineering Science Courses
PC	Program Core Courses
PE	Professional Elective Courses
OE	Open Elective Courses
AU	Audit Courses
EEC	Employment Enhancement Courses (Project/Summer Internship/Seminar)

- **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 a suffix with the Course Code for identifying the level of the course. The digit at hundred's place signifies the year in which the course is offered. e.g. 101, 102 … etc. for the first year. 201, 202 …. etc. for second year.301, 302 … for third year.

- **Category-wise Courses**

Humanities & Social Sciences Courses [HS]

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

(ii) Credits: 10

Sl. No	Course Code	Course Title	Sem	Total Credits	Hours per week			Total Hours [× 15]
					Lecture	Tutorial	Practical	
1	HS101	Communication Skills	1	3	2	0	2	60
2	HS102	Design Thinking	1	1	0	0	2	30
3	HS401	Personality Development through Life Enlighten Skills	4	3	3	0	0	45
4	HSMC (H-102)	Universal Human Values-II: Understanding Harmony and Ethical Human Conduct	3	3	2	1	0	45
Total Credits				10				

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Basic Science Courses [BS]

(i) Number of Basic Sciences Courses: 04 (ii) Credits: 16

Sl. No	Course Code	Course Title	Sem	Total Credits	Hours per week			Total Hours [× 15]
					Lecture	Tutorial	Practical	
1	BS101	Physics	1	4	3	0	2	75
2	BS102	Mathematics-I	1	4	3	1	0	60
3	BS201	Mathematics-II	2	4	3	1	0	60
4	BS202	Chemistry	2	4	3	0	2	75
Total Credits				**16**				

Engineering Science Courses [ES]

(i) Number of Engineering Sciences Courses: 02 (ii) Credits: 08

Sl. No	Course Code	Course Title	Sem	Total Credits	Hours per week			Total Hours [× 15]
					Lecture	Tutorial	Practical	
1	ES101	Problem Solving and Programming	1	4	3	0	2	75
2	ES103	Mathematical Concepts for AI	1	4	3	1	0	60
Total Credits				**8**				

Program Core Courses [PC]

(i) Number of Program Core Courses: 18 (ii) Credits: 71

Sl. No	Course Code	Course Title	Sem	Total Credits	Hours per week			Total Hours [× 15]
					Lecture	Tutorial	Practical	
1	PC202	Object Oriented Programming	2	4	3	0	2	75
2	PC203	Data Structures	2	4	3	0	2	75
3	PC204	Discrete Mathematical Structures	2	4	3	1	0	60
4	PC205	Modern Computer Architecture	2	3	3	0	0	45
5	PC301	Algorithm Analysis and Design	3	4	3	0	2	75
6	PC302	Database Systems	3	4	3	0	2	75
7	PC303	Computer Networks	3	4	3	0	2	75
8	PC304AI	Introduction to Machine Learning	3	4	3	0	2	75
9	PC305	Artificial Intelligence	3	4	3	1	0	60
10	PC401	Theory of Computation	4	4	3	1	0	60

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11	PC402	Software Engineering	4	4	3	0	2	75
12	PC403	Deep Learning	4	4	3	0	2	75
13	PC404	Operating System	4	4	3	0	2	75
14	PC501	Data and Visual Analytics in AI	5	4	3	0	2	75
15	PC502	Optimization Techniques in Machine Learning	5	4	3	1	0	60
16	PC503	Natural Language Processing	5	4	3	0	2	75
17	PC504	Advanced Machine Learning	5	4	3	0	2	75
18	PC701	Soft Computing	7	4	3	0	2	75
19	PC702	AI for Everyone	7	3	3	0	0	45
Total Credits				**74**				

Professional Elective Courses [PE]

(i) Number of Professional Elective Courses: 04 (ii) Credits: 16

Sl. No	**Course Code**	**Course Title**	**Sem**	**Total Credits**	**Hours per week**			**Total Hours [× 15]**
					Lecture	**Tutorial**	**Practical**	
1	PE701	Professional Elective-I	**7**	4	3	0	2	75
2	PE702	Professional Elective-II	**7**	4	3	0	2	75
3	PE801	Professional Elective-III	8	4	3	0	2	75
4	PE802	Professional Elective-IV	8	4	3	0	2	75
Total Credits				**16**				

For a detailed syllabus of the Professional Elective Course, Refer to Appendix II.

Open Elective Courses [OE]

(i) Number of Open Elective Courses: 2 (ii) Credits: 6

Sl. No	**Course Code**	**Course Title**	**Sem**	**Total Credits**	**Hours per week**			**Total Hours [× 15]**
					Lecture	**Tutorial**	**Practical**	
1	OE301	Open Elective – I	3	3	3	0	0	45
Total Credits				**3**				

For a detailed syllabus of the Open Elective Course, Refer to Appendix I.

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Project Work, Seminar, and Internship in Industry or Elsewhere

Sl. No	Course Code	Course Title	Sem	Total Credits	Hours per week			Total Hours [× 15]
					Lecture	Tutorial	Practical	
1	EEC 401, 501	Minor Project	4,5	3+3	0	0	6+6	90+90
2	EEC 601	Internship	6	16	-	-	-	-
3	EEC 701,801	Capstone Project I & II	7,8	6+10	-	-	-	-
Total Credits				**6**				

For some suggested internships, Refer to Appendix III.

Audit Courses [AU] Part-I

Note: These are mandatory non-credit courses.

S. No.	Course Code	Course Title	Sem	Credits	L	T	P	Total Hours [× 15]
1	AU202	Environmental Science	4	0	3	0	0	45
2	AU301	Indian Constitution	5	0	3	0	0	45
Total Credits				**0**				

Audit Courses [AU] Part-II

Note: These are mandatory non-credit courses.

S. No.	Course Code	Course Title	Semester	Credits	L	T	P	Total Hours [× 15]
1	AU203	Sustainable Development Goals	1	2	2	0	0	30
2	AU302	Indian Knowledge System	2	2	2	0	0	30
Total Credits				**4**				

Research Courses [RC] Part-I

Note: These are research-related courses.

S. No.	Course Code	Course Title	Sem	Credits	L	T	P	Total Hours [× 15]
1	RC601	English for Research Paper	6	2	2	0	2	60
2	RC602	Research Methodology and IPR	6	2	2	0	2	60
Total Credits				**4**				

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E. Mandatory Visits/ Workshop/Expert Lectures:

a. It is mandatory to arrange one industrial visit every semester for the students of each branch.

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

c. It is mandatory to organize at least one expert lecture per semester for each branch byinviting resource persons from domain-specific industries.

F. Evaluation Scheme (Suggestive only):

a. **For Theory Courses:**(The weightage of Internal assessment is 40% and for End Semester Exam is 60%) The student has to obtain at least 40% marks individually both in internal assessment and end-semester exams to pass.

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

c. **For Summer Internship / Projects / Seminar etc.** Evaluation is based on work done, quality of the report, performance in viva voce, presentation, etc.

Note: The internal assessment is based on the student's performance in mid-semester tests (two best out of three), quizzes, assignments, class performance, attendance, viva-voce in practical, lab record, etc.

G. Mapping of Marks to Grades

Each course (Theory/Practical) is to be assigned 100 marks, irrespective of the number of credits, and the mapping of marks to grades may be done as per the following table:

Range of Marks	Assigned Grade
91-100	AA/A^{+}
81-90	AB/A
71-80	BB/B^{+}
61-70	BC/B
51-60	CC/C^{+}
46-50	CD/C
40-45	DD/D
< 40	FF/F (Fail due to less marks)
-	F^{R} (Fail due to shortage of attendance and therefore, to repeatthe course)

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Semester-wise Structure and Curriculum

Semester I						
3-Week Orientation Programme						
S. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	HS101	Communication Skills	2	0	2	3
2.	BS102	Mathematics-I	3	1	0	4
3.	BS101	Physics	3	0	2	4
4.	ES103	Mathematical Concepts for AI and Data Science	3	1	0	4
5.	BS202	Chemistry	3	0	2	4
6.	ES101	Problem Solving and Programming	3	0	2	4
7.	AU203	Sustainable Development Goals	2	0	0	2
Total						**25**

Semester II						
S. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	BS201	Mathematics-II	3	1	0	4
2.	PC202	Object Oriented Programming	3	0	2	4
3.	PC203	Data Structures	3	0	2	4
4.	PC204	Discrete Mathematical Structures	3	1	0	4
5.	PC205	Modern Computer Architecture	3	0	0	3
6.	HS102	Design Thinking	0	0	2	1
7.	AU302	Indian Knowledge System	2	0	0	2
Total						**22**

Semester III						
S. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	PC301	Algorithm Analysis and Design	3	0	2	4
2.	PC302	Database Systems	3	0	2	4
3.	PC303	Computer Networks	3	0	2	4
4.	PC304AI	Introduction to Machine Learning	3	0	2	4
5.	PC305	Artificial Intelligence	3	1	0	4
6.	HSMC(H-102)	Universal Human Values-II: Understanding Harmony and Ethical Human Conduct	2	1	0	3
7.	Open Elective-I: [Choose Any 1]		3	0	0	3
	OE001	Internet of Things (IoT)				
	OE002	Robotics				
Total						**26**

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Semester IV						
S. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	PC401	Theory of Computation	3	1	0	4
2.	PC402	Software Engineering	3	0	2	4
3.	PC403	Deep Learning	3	0	2	4
4.	PC404	Operating System	3	0	2	4
5.	HS401	Personality Development through Life Enlighten Skills	3	0	0	3
6.	EEC401	Minor Project	3	0	0	3
7.	AU202	Environmental Science	3	0	0	0
Total						**22**

Semester V						
S. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	PC501	Data and Visual Analytics in AI	3	0	2	4
2.	PC503	Natural Language Processing	3	0	2	4
3.	PC504	Advanced Machine Learning	3	0	2	4
4.	PC502	Optimization Techniques in Machine Leaning	3	1	0	4
5.	EEC501	Minor Project	--	--	--	3
6.	AU301	Indian Constitution	3	0	0	0
Total						**19**

Semester VI						
S. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	EEC601	Internship	-	-	-	**12**
2.	RC601	English for Research Paper Writing OR	2	-	4	**4**
	RC602	Research Methodology and IPR				
Total Credit						**16**
Internship option						

- Within India or Abroad (MITACS/DAAD/Any other aligned with GOI schemes)
- To enhance hands-on skills (As per NEP-2020)
- Refer t o Appendix III for some suggested Internships.

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Semester VII						
S. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	PC701	Soft Computing	3	0	2	4
2	PC702	AI for Everyone	3	0	0	3
3.	Professional Elective-I: [Choose Any 1]		3	0	2	4
	PE001	Statistical Thinking for Data Science				
	PE002	Machine Learning for Data Science				
4.	Professional Elective-II: [Choose Any 1]		3	0	2	4
	PE004	Data Science & Visualization				
	PE005	Big Data Analytics				
5.	EEC701	Capstone Project (Part-I)	----	----	----	6
Total						21

Semester VIII						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	Professional Elective-III:[Choose Any 1]		3	0	2	4
	PE006	Pattern Recognition & Visual Recognition				
	PE007	Image and Video Processing				
2.	Professional Elective-IV:[Choose Any 1]					
	PE009	Autonomous Systems	3	1	0	4
	PE017	Predictive Analytics	3	0	2	4
3.	EEC801	Capstone Project (Part II)	-	-	-	6
Total						**18**

Semester - I

Semester-I

Course Code: HS101

Course Title: Communication Skills

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

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

Course Outcomes:

After completion of the course:

CO.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.

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

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

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

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

Scheme of Studies:

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)	
HS	HS101	Communication Skills	3	0	1	1	5	3

Legend: 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

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

.

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/HomeAssignment5 number 3 marks each (CA)	Class Test 2 (2 best out Of 3) 10	Seminar one **(Presentation)** (SA)	Class Activity any	Class Attendance	Total Marks (CA+CT+SA+CAT		
HS	HS101	Communication Skills	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

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

CO1: Students will be able to speak confidently in public as all the topics chosen emphasis on improving speaking skills and developing self confidence amongst them.

Approximate Hours

Item	Appx. Hrs.
Cl	11
LI	0
SW	1
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Students will be able to introduce themselves		**Unit 1- Self-grooming, Basic Etiquettes and Presentation Skill**	1. Prepare a presentation on the given topics.

SO1.2 Understand the concept of Oral Presentation SO1.3 Students will be able to dress and present effectively SO1.4 Understand the importance of Body Language SO1.5 Students will be able to influence mass through skit and dramas.		1.1 Self-introduction 1.2 Oral Presentation 1.3 Oral Presentation on: The importance of Education 1.4 The importance of English in Today's World 1.5 Necessity of uniforms in a college 1.6 Professional dressing and grooming etiquettes. 1.7 Body Language tips and techniques. 1.8 Role play 1.9 Role play was conducted on following topics: Classroom interaction, 1.10 Hospital Scene and 1.11 Scene at Railway station.	2. Prepare a play on the given topics.

CO2: Students will be able to interact properly with improved Leadership Skills, Problem Solving Skills, Social skills and Communication Skills. Students will also be able to understand the Importance of Team Work.

Approximate Hours

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

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Understand the techniques of Group	.	**UNIT 2 – Confidence building skills,**	1. Prepare

Discussion **SO2.2** Understand the concept of Debate **SO2.3** Students will be able to design a professional resume and crack interview **SO2.4** Explain the concept of how to ace in an interview.		**Interview Skills and Resume Writing** 2.1. Group Discussion on 2.2. Group Discussion on impact of covid 19 2.3. Group Discussion on mental health, i 2.4. Group Discussion impact of social media 2.5. Group Discussion on lives, pros and cons of technology 2.6. Students will be able to present debate 2.7. Debate on effectively on (Should the Use of Plastic Be Banned? 2.8. Debate on: Should Parents Decide Which Career Their Children Will Pursue? 2.9. . Debate on: Is Artificial Intelligence Useful or Dangerous?) 2.10. Interviews and their Kinds 2.11. Mock Interview Session 2.12. Resume Writing.	debate on given topics 2. Prepare a Resume

CO3: Students will be able to communicate effectively in Hindi and English languages without hindrances.

Approximate Hours

Item	Appx. Hrs.
Cl	11
LI	0
SW	1
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Students will be able to organize and prepare speeches.	.	**Unit-3: Public Speaking Skills& Conversational Skills**	1. Prepare a speech on thefollowing topics.

SO3.2 Students will be able to think and speak instantaneously. **SO3.3** To make them understand the inquiry procedure at public places. **SO3.4** To enable them to communicate effectivelythrough phones.		3.1 Speech/Anchoring 3.2 Speech/Anchoring on National Science Day 3.3 Valedictory Speech 3.4 Patriotic speech 3.5 Extempore 3.6 Extempore (Pros and Cons of Online teaching 3.7 Extempore : Environment Conservation and 3.8 Extempore : Education of a Girl Child) 3.9 Conversational Topics (Inquiry at bank, Airport, Station and Hospitals). 3.10 Telephonic Conversation (Describing about Your College Day to Your Parents from Hostel 3.11 Talking with Customer Care Executive of Any E-Commerce company).	2. Prepare on the following conversational topics.

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

Approximate Hours

Item	AppXHrs
Cl	6
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO4.1 Understanding about the use of Prepositions. **SO4.2**Students will be able to understand the usage of Tenses **SO4.3**Undesrtand the concept of Active and Passive Voice **SO4.4**To understand the usage of Modals		Unit-4: Functional Grammar and Vocabulary Building 4.1. Prepositions: Place 4.2. Time 4.3. Direction 4.4. Tenses: Present, Past, Future 4.5. Voice (Active and Passive) 4.6. Modals.	1. Prepare the Structure of Tenses and Active Passive. 2. Prepare 250 vocabularies.

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

Approximate Hours

Item	Appx. Hrs.
Cl	5
LI	0
SW	1
SL	1
Total	7

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO5.1 Students willbe able to understand the value of Indian Literature (R.K.Narayan) **SO5.2** Students will be able to understand the value of Indian Literature (NissimEzekiel) **SO5.3** Students willbe able to understand the value of Indian Literature (Khushwant Singh) **SO5.4** Students will be able to understand the value of Indian Literature (MulkRaj Anand) **SO5.5** Students will be able to understand the value of Indian Literature (PremChand)		**Unit 5-Indian Writing in English& Hindi** 5.1. The Axe- R.K. Narayan 5.2. The Night of the Scorpion- Nissim Ezekiel 5.3. The Portrait of a Lady -Khushwant Singh 5.4. The Lost Child- Mulk Raj Anand 5.5. The Shroud- Prem Chand	1. Prepare the summary of all the topics (The Axe, The Night of the Scorpion, The Portrait of a Lady, The Lost Child he Shroud).

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
CO.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.	11	1	1	13
CO..2: Students will be able to interact properly with improved Leadership Skills, Problem Solving Skills, Social skills and Communication Skills. Students will also be able to understand the Importance of Team Work.	12	1	1	14
CO.3: Students will be able to communicate effectively in Hindi and English languages without hindrances.	11	1	1	13
CO.4: Students will be able to convey their messages accurately by understanding the significance of grammar as it plays a vital role in improving speaking and writing skills.	6	1	1	8
CO.5: The Understanding of Indian Culture and English Language will be developed through the study of Dramas and Poems written by Indian Writers.	5	1	1	7
Total Hours	**45**	**5**	**5**	**55**

Suggested Specification Table (ForESA)

Suggested Instructional/Implementation Strategies:

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

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Communication Skills	Dr. Meenu Pandey	Nirali Praksahan.	2020
2	A Practical Guide to English Grammar	K.P. Thakur	Bharti Bhawan Publishers & Distributors.	2018
3	Living English Structure	W. Stannard Allen	Dorling Kindersley India Pvt. Ltd.	Fifth Edition,
4	Communication Skills for Engineers	Muralikrishna C., Sunita Mishra	Pearson, New Delhi.	Second edition (2010)
5.	Advanced Language Practice,	Michael Vince	Macmillan Education, Oxford	2003.
6.	English Conversation Practice	Grant Taylor	Tata McGraw Hill Education Private Limited.	1967
7.	Six Weeks to Words of Power	Wilfred Funk	W.R. Goyal Publishers and Distributors.	1990

Curriculum Development Team Curriculum Development Team

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COs, POs and PSOs Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]
Course Code : HS101
Course Title: Communication Skills

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO 1: Analyzing the graph of a function is a powerful way to understand its behavior, make predictions, and solve mathematical and real-world problems.	-	-	-	-	1	1	1	2	3	3	1	-	2	3	3	1	2
CO 2 : Discuss of Derivatives and optimization are closely related concepts in mathematics and have important applications in various fields, engineering, and machine learning.	-	1	1	-	-	2	2	2	3	3	2	-	2	2	2	1	3
CO 3: Use of operations involving vectors and matrices depend on the specific operations being performed.	-	-	-	-	-	-	-	-	2	3	1	-	1	1	2	2	2
CO 4: Use and apply hypothesis testing on different datasets.	-	-	-	-	-	-	-		1	3	-	-	3	3	3	2	2
CO 5: Use statistical methods to analyze and collect data.	-	-	1	-	-	1	-	-	1	3	-	-	3	3	1	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 1: 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.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1 Self-grooming, Basic Etiquettes and Presentation Skill 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	As mentioned in page number _ to _
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 interact properly with improved Leadership Skills, Problem Solving Skills, Social skills and Communication Skills. Students will also be able to understand the Importance of Team Work.	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2 Confidence building skills, Interview Skills and Resume Writing 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	CO 3: Students will be able to communicate effectively in Hindi and English languages without hindrances	SO3.1 SO3.2 SO3.3 SO3.4		Unit-3 Public Speaking Skills& Conversational Skills 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, 5	CO 4: Students will be able to convey their messages accurately by understanding the significance of grammar as it plays a vital role in improving speaking and writing skills.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 Functional Grammar and Vocabulary Building 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: The Understanding of Indian Culture and English Language will be developed through the study of Dramas and Poems written by Indian Writers	SO5.1 SO5.2 SO5.3 SO5.4		Unit-5 **Indian Writing inEnglish& Hindi** Statistics 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10, 5.11,5.12,5.13,5.14,5.15	

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

Semester-I

Course Code: BS102

Course Title : Mathematics-I

Pre-requisite:Rationale: Student should have basic knowledge of basic calculus and vector Calculus. It enables the development of pupils' natural ability to think logically,solve puzzles and apply these skills to real-life problems.

Course Outcomes:

BS102.1 Understand basic algebra.
BS102.2 Understand and apply calculus.
BS102.3 Understand and apply vector calculus.
BS102.4 Understand and apply differential equations.
BS102.5 Understand and apply multivariate calculus.

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)	
BS	BS102	Mathematics-I	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)

BS	BS-102	Mathematics-I	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

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

BS102.1 Understand basic algebra.

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 Understanding Vector spaces and Subspaces. SO1.2 Explain canonicalforms. SO1.3 Discuss symmetric bilinear forms. SO1.4 Define skew symmetric bilinear forms.	.	**Unit-1:(1) Linear Algebra** **1.1** Vector spaces, **1.2** Subspaces, **1.3** basis and dimension, **1.4** linear transformations , representationof transformationsby Matrices, **1.5** linear functionals, **1.6** transpose of linear transformations , **1.7** canonicalforms. **1.8** Linear functionals and **1.9** adjoints, **1.10** Bilinearforms, **1.11** symmetric bilinear forms, **1.12** skew symmetric bilinear forms	1. Learn about basis and dimension. 2. transpose of linear transformations.

SW-1 Suggested Sessional Work (SW):

a. Assignments:-

(1) Vector spaces, linear transformations, representation of transformations by Matrices.
(2) transpose of linear transformations, canonical forms.
(3) Linear functionals and adjoints, Bilinear forms, symmetric bilinear forms, skew symmetric bilinear forms.

b. Mini Project:

Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

BS102.2 Understand and apply calculus.

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)
SO2.1 Define Continuity and differentiability. SO2.2 Discuss Lagrange's mean value theorem. SO2.3 To learn about Rolle's Theorem. SO2.4 Explain Double and Triple Integrals.	.	Unit-2 : Calculus **2.1** Continuity **2.2** Differentiability of a function of single variable **2.3** statement of Rolle's Theorem, **2.4** Lagrange's mean value theorem **2.5** It's applications. **2.6** Double Integrals **2.7** Triple Integrals **2.8** Calculations **2.9** Areas **2.10** Volumes, **2.11** Change of variables 2.12 Based Numerical	1. statement of Rolle's Theorem. 2. Double and Triple Integrals.

SW-2 Suggested Sessional Work(SW):

a. Assignments:

Question based on Double and Triple Integrals.
(1) Explain Rolle's Theorem and Lagrange's mean value theorem.

b. Mini Project:

Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

BS102.3 Understand and apply vector calculus.

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)
O3.1 To Understand Integralsof Vector Functions. SO3.2 To learn Green's formula. SO3.3 Explain Surface integral. SO3.4 Explain Stoke's formula.	.	**3.1.** Unit-3 Vector Calculus **3.2.** Vector Calculus **3.3.** Applications. **3.4.** Integrals of Vector Functions: **3.5.** Line integrals, **3.6.** Green's formula **3.7.** Based Numerical **3.8.** path independence, **3.9.** Surface integral: definition, **3.10.** evaluation, **3.11.** Stoke's formula, **3.12.** Gauss-Ostrogradsky divergence theorem.	1. To learn about Green's formula. 2. Gauss-Ostrogradsky divergence theorem.

SW-3 Suggested Sessional Work (SW):

a. Assignments:-
(1) Question based on Integrals of Vector Functions.
(2) Question based on Surface integral.
(3) Gauss-Ostrogradsky divergence theorem.

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

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

BS102.4 Understand and apply differential equations.

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 Ordinary Differential Equations. SO4.2 To learn Bernoulli's equations. SO4.3 To understand Second order and Higher order linear differential equations. SO4.4 Explain Exact equations and Integrating factor	.	**4.1.** Unit-4 Differential Equations **4.2.** Ordinary Differential Equations **4.3.** Based Numerical **4.4.** First order linear equations, **4.5.** Bernoulli's equations **4.6.** Based Numerical **4.7.** Exact equations. **4.8.** Based Numerical	1. First order linear equations, 2. To learn about Exact equations.
		4.9. Integrating factor, **4.10.** Second order **4.11.** Higher order linear differential equations with constant coefficients **4.12.** Based Numerical	

SW-4 Suggested Sessional Work (SW):

a. Assignments:
(1) Question based on Ordinary Differential Equations.
(2) Bernoulli's equations, Exact equations.
(3) Second order and Higher order linear differential equations with constant coefficients.

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

c. Other Activities (Specify):
NA

BS102.5 Understand and apply multivariate calculus.

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 To understand Integral Calculus. SO5.2 To learn about surface area. SO5.3 Explain Improper integrals. SO5.4 define Lagrange multipliers.		**Unit** 5 Multivariate Calculus 5.1 Integral Calculus 5.2 Definite Integrals as a limit of sums, 5.3 Applications of integration to area, 5.4 Volume, 5.5 surface area, 5.6 Improper integrals 5.7 Functions of several variables 5.8 Continuity and differentiability, 5.9 mixed partial derivatives 5.10 local maxima and minima for function of two variables, 5.11 Lagrange multipliers 5.12 Based Numerical	1. Applications of integration to area. 2. local maxima and minima for function of two variables.

SW-5 Suggested Sessional Work (SW):

a. Assignments:-

(1) Applications of integration to area, volume, surface area, Improper integrals.
(2) Functions of several variables, Lagrange multipliers.

b. Mini Project:

NA

c. Other Activities (Specify):

NA

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (SI)	Total hour (Cl+SW+Sl)
BS102.1 Understand basic algebra.	12	2	1	15
BS102.2 Understand and apply calculus.	12	2	1	15
BS102.3 Understand and apply vector calculus.	12	2	1	15
BS102.4 Understand and apply differential equations.	12	2	1	15

BS102.5 Understand and apply multivariate calculus.	12	2	1	15
Total Hours	60	10	5	75

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Linear Algebra	03	01	01	05
CO-2	Calculus	02	02	01	05
CO-3	Vector Calculus	03	07	05	15
CO-4	Differential Equations	04	06	05	15
CO-5	Multivariate Calculus	03	04	03	10
Total		15	20	15	50

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

The end of semester assessment for Mathematics-I 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. Demonstration
6. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)

Suggested Learning Resources:

A. Books:

S.No.	Title	Author	Publisher	Edition & Year
1	Calculus and Analytic Geometry.	G. B. Thomas, R. L. Finney.	Pearson Education.	Ninth Edition 2010
2	Higher Engineering Mathematics,	B. V. Ramana	Tata McGraw Hill,	2017

3	Advanced Engineering Mathematics	E. Kreyszig	Wiley,	2015

B. Alternative NPTEL/SWAYAM Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Basic calculus for Engineers, Scientists and Economists	Prof. Joydeep Dutta	IIT Kanpur

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.
8. Ms. Pushpa Kushwaha, Assistant Professor, Department of Computer Science and Engineer

COs, POs and PSOs Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]
Course Code : BS102
Course Title: Mathematical -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	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO 1: Understand basic algebra	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1	2
CO 2 : Understand and apply calculus	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1	3
CO 3: Understand and apply vector calculus.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2	2
CO 4: Understand and apply differential equations.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2	2
CO 5: Understand and apply multivariate calculus	3	2	1	1	1	3	3	3	1	1	2	2	3	3	1	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 1: Understand basic algebra	SO1.1 SO1.2 SO1.3 SO1.4		Unit-1 Linear Algebra 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 _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2 : Understand and apply calculus	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2 Calculus 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 PSO 1,2, 3, 4, 5	CO 3: Understand and apply vector calculus.	SO3.1 SO3.2 SO3.3 SO3.4		Unit-3 Vector 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	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: Understand and apply differential equations.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 Differential Equation 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: Understand and apply multivariate calculus	SO5.1 SO5.2 SO5.3 SO5.4		Unit-5 Multivariate Calculus 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10, 5.11,5.12	

Semester-I

Course Code:	BS-101
Course Title:	Engineering Physics
Pre- requisite:	Students should be familiar with the fundamentals of laser, fiber optics, holography, diffraction, polarization, oscillations, ultrasonics, and SHM.
Rationale:	Engineering is a crucial part of our society because it provides solutions to the problems we face in our daily lives. Engineering physicists may help develop instruments, measurement techniques, or prototype systems related to: Acoustics such as sound reproduction, hall design, and speakers. Communications such as fiber optics, lasers, antenna design, and wireless communications.

Course Outcomes:

BS-101.1: Through this chapter students are brought to learn about Simple Harmonic Motion and particles executing S.H.M. Types of vibrations are also studied

BS-101.2: Harmonic motion gives the knowledge of composition of two simple harmonic motion and the construction of Lissajous figures. It also gives the true knowledge of various types of oscillations.

BS-101.3: Interference chapter gives the concept of light wave and its equation, meaning of coherence, interference fringes, interference by Fresnel's biprism, Newton's rings, Michelson interferometer and its applications for determination etc.

BS-101.4: Diffraction section explains about various types of diffractions in details, knowledge of grating and its resolving power and Polarization section gives the knowledge of production and analyzing of different polarized light, specific rotation

BS-101.5: To expose the students to the basic concepts of optical fibers and their properties also provide adequate knowledge about the Industrial applications of optical fibers, to expose the students to the Laser fundamentals, to provide adequate knowledge about Industrial application of lasers, to provide adequate knowledge about holography and medical applications of Laser

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] 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)	
BS	BS-101	Physics	3	2	1	1	7	4

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e., Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop,field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.
Note: SW & SL has to be planned and performed under the continuous guidance and feedback ofteacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Board ofStudy	CouseCode	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ESA)
			Class/Home Assignment5 number 3 marks each (CA)	Class Test2 (2 best out of 3) 10 marks each (CT)	Seminar one(SA)	Class Activityany one(CAT)	Class Attendance(AT)	Total Marks (CA+CT+SA+CAT+ AT)		
BS	BS 101	Physics	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		

BS	BS 101	Physics	35	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus outlines the expected learning outcomes that students should achieve through different modes of instruction, such as classroom instruction (CI), laboratory instruction (LI), sessional work (SW), and self-learning (SL), at both the course and session levels. Students should demonstrate their mastery of Session Outcomes (SOs) as the course proceeds, which will lead to their overall attainment of Course Outcomes (COs) at the end of the course.

BS-101.1: Through this chapter students are brought to learn about Simple Harmonic Motion and particles executing S.H.M. Types of vibrations are also studied

Approximate Hours

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

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO 1.1 Production, detection and uses of ultrasonics Wave SO 1.2 Reverberation & Sabine's formula (no derivation) SO 1.3 Review of Basic Kinematics (displacement, velocity, acceleration) SO 1.4 Review of Basic Kinematics (Time Period and Phase of Vibration) SO 1.5 Dynamics (restoring force and energetics) of Simple Harmonic Motion SO 1.6 Differential Equation of SHM SO 1.7 Superposition of two SHM in One Dimension SO 1.8 Charge Oscillations in LC Circuits	1. Experimental Analysis of Charge Oscillations in LC Circuits 2. Simple harmonic motion by using differential equation method. 3. Mathematical explanation of superposition of two 1-D SHM waves	Unit 1: **Ultrasonics & SHM** 1.1: History of Ultrasonics & SHM 1.2 Distinguish between Classical Waves and Mechanical Waves 1.3: Experimental explanation about displacement, velocity & acceleration 1.4: Experimental explanation about time period & Phase of Vibration 1.5: Experimental explanation about dynamics of simple harmonic motion 1.6: Mathematical explanation of simple harmonic motion by using differential equation method 1.7: Mathematical explanation of	1: Classification of Waves 2: Unterstand about (displacement, velocity, acceleration, time period & phase of vibration) according to basic kinematics 3: Mathematical explanation of SHM by using differential method

		superposition of two 1-D SHM waves 1.8: Mathematical explanation of charge oscillation in LC Circuits 1.9: Experimental explanation of charge oscillation in LC Circuits	

SW-1 Suggested Sessional Work (SW):

A. Assignments: Ultrasonic methods of NDT use beams of mechanical waves (vibrations) of short wavelength and high-frequency, transmitted from a small probe and detected by the same or other probes. Such mechanical waves can travel large distances in fine-grain metal, in the form of a divergent wave with progressive attenuation.

B. Mini Project: Make a Propulsion model

C. Other Activities (Specific):

BS-101.2: Harmonic motion gives the knowledge of composition of two simple harmonic motion and the construction of Lissajous figures. It also gives the true knowledge of various types of oscillations

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO 2.1 Differential Equation of a Damped Oscillator and Different Kinds of Damping	1. Experimental Analysis of Forced Oscillations in Series LCR Circuit. 2. Experimental explanation about Differential equation	Unit 2: **Oscillations** 2.1: Elementary Proof of Differential Equation of a Damped Oscillator and Explanation about different kinds of damping	1: Explain about Different Kinds of Damping

	of forced oscillator		
SO 2.2 Methods of describing damping of an oscillator - logarithmic decrement, Relaxation time, Quality factor, Band width. SO 2.3 Series LCR circuit as a damped oscillator SO 2.4 Forced Oscillations: States of forced oscillations SO 2.5 Differential equation of forced		2.2 Mathematical Methods of describing damping of an oscillators 2.3: Experimental explanation about Series LCR circuit as a damped oscillator 2.4 : Experimental explanation about Forced Oscillations 2.5 : Experimental explanation about Differential equation of forced oscillator (its displacement, velocity and Impedance) 2.6 : Mathematical explanation of Displacement and Velocity with	2: Explain about behavior of displacement and velocity with Driver's Frequency Power, bandwidth, Quality factor and amplification of forced oscillator. 3: Mathematical explanation of Damped
oscillator – its displacement, velocity and Impedance SO 2.6 Behavior of Displacement and Velocity with Driver's FrequencyPower, bandwidth, Quality factor and amplification of forced oscillator. SO 2.7 Resonance in forced oscillators SO 2.8 Forced Oscillations in Series LCR Circuit		Driver's Frequency Power, bandwidth, Quality factor and amplification of forced oscillator. 2.7: Mathematical explanation of Resonance in forced oscillators 2.8: Mathematical explanation of Forced Oscillations in Series LCR Circuit 2.9: Experimental explanation of Forced Oscillations in Series LCR Circuit	Oscillations by using differential method

SW-2 Suggested Sessional Work (SW):

A. Assignments:

B. **(1)** Determine the equation of motion for system.
(2) What would be the steady state of solution.

C. Mini Project:

D. Other Activities (Specific): Experimental Analysis of Forced Oscillations in Series LCR Circuit

BS-101.3: Interference chapter gives the concept of light wave and its equation, meaning of coherence, interference fringes, interference by Fresnel's biprism, Newton's rings, Michelson interferometer and its applications for determination etc.

Approximate Hours

Item	Appx Hrs.
Cl	9
LI	8
SW	2
SL	1
Total	20

Session Outcomes (SOs)	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO 3.1 Wave equation and its solution SO 3.2 Characteristic Impedance of a String,		**Unit-3: Wave Motion and interference** 3.1 Elemetry Proof of Wave equation and its solution 3.2 Explain the characteristic impedance of a String	
SO 3.3 Reflection and Transmission of waves on a string at a Boundary SO 3.4 Reflection and Transmission of Energy SO 3.5 The matching of impedances SO 3.6 Division of wave front and amplitude SO 3.7 Fresnel's biprism SO 3.8 Newton's rings SO 3.9 Michelson interferometer and its applications for determination of λ and dλ	1. To determine the wavelengthof Sodium light by using Fresnels biprism Method 2. To determine the wavelength of Sodium light by using Newtons Ring 3. Experiment To determine the wavelength of He-Ne Laser by using Michelson 4. Interferometer Experiment	3.3 Explain about reflection and transmission of waves on a string at a boundary 3.4 Discribe reflection and transmission of energy 3.5 The matching of impedances 3.6 Experimental explanation about Division of wave front and amplitude 3.7 Mathematical & Experimental explanation of Fresnel's biprism 3.8 Mathematical & Experimental explanation of Newton's rings 3.9 Mathematical & Experimental explanation of Michelson interferometer and its applications for determination of λ and dλ	Mathematical & Experimental explanation of Frenels biprism Mathematical & Experimental explanation of Newtons ring Experiment Mathematical & Experimental explanation of Frenels biprism Experiment

Suggested Sessional Work (SW):

A. Assignments:

(1). In the double-hole experiment using white light, consider two points on the projection screen, one corresponding to a path difference of 5000 Å (point A), and the other corresponding to a path difference of 40,000 Å (point B). (i) Find all the wavelengths (in the visible region) which correspond to constructive and destructive interference at point A. (ii) Find all the wavelengths (in the visible region) which correspond to constructive and destructive interference at point B.

(2) In Young's double-hole experiment, the distance between the two holes is 0.5 mm, $\lambda=5\times10^{-5}$ cm, and D = 50 cm. What will be the fringe width?

B. Mini Project: - Project on Wave Nature of light

C. Other Activities: -

1. To determine the wavelength of Sodium light by using Fresnel's biprism Method
2. To determine the wavelength of Sodium light by using Newtons Ring Experiment
3. To determine the wavelength of He-Ne Laser by using Michelson Interferometer Experiment

BS-101.4: Diffraction section explains about various types of diffractions in details, knowledge of grating and its resolving power and Polarization section gives the knowledge of production and analyzing of different polarized light, specific rotation

Approximate Hours

Item	Appx Hrs.
Cl	9
LI	8
SW	2
SL	1
Total	20

Session Outcomes (SOs)	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO 4.1 Fresnel and Fraunhofer diffraction SO 4.2 Qualitative Changes in Diffraction Pattern on Moving from single slit to Double Slit SO 4.3 Plane Transmission Grating SO 4.4 Dispersive Power & Resolving Power of a Grating SO 4.5 Methods of Polarization SO 4.6 Analysis of Polarized Light SO 4.7 Quarter and Half Wave Plates SO 4.8 Double Refraction	1. To determine the wavelength of monochromatic light by using Fresnel's & Fraunhofer Diffracting Method 2. To determine thewavelength of He-Nelaser using transmission grating. 3. To design a	**Unit-4 : Diffraction & Polarization** 4.1 Distinguish between Fresnel and Fraunhofer diffraction 4.2 Mathematical & Experimental method to explain about the Qualitative Changes in Diffraction Pattern on Moving from single slit to Double Slit 4.3 Experimental analysis about Plane Transmission Grating 4.4 Explain Dispersive Power & Resolving Power of a Grating 4.5 Explain mathematical methods of Polarization	Mathematical & Experimental explanation of Polarization Mathematical & Experimental explanation of Double Refraction Experiment

	hollow prism and used it find the refractive index of a given liquid. 4. To determine the double refraction by using Nicol Prism	4.6 Analysis of Polarized Light 4.7 Quarter and Half Wave Plates 4.8 Double Refraction part 1 4.9 Double Refraction part 2	

SW- 4 Suggested Sessional Work (SW):

A Assignments:

[1]. Polarizing angle.

a. At what incident angle is sunlight reflected from a lake plane- polarized?
b. What is the refraction angle?

[2]. In Young's double-hole experiment, the distance between the two holes is 0.5 mm, $\lambda=5\times10^{-5}$ cm, and D = 50 cm. What will be the fringe width?

B Mini Project: - Project on Polarized Light of light

C Other Activities: -

1. To determine the wavelength of He-Ne laser using transmission grating
2. To determine the slit width using the diffraction pattern.
3. To design a hollow prism and used it find the refractive index of a given liquid.

BS-101.5: To expose the students to the basic concepts of optical fibers and their properties also provide adequate knowledge about the Industrial applications of optical fibers, to expose the students to the Laser fundamentals, to provide adequate knowledge about Industrial application of lasers, to provide adequate knowledge about holography and medical applications of Laser.

Approximate Hours

Item	Appx Hrs.
Cl	9
LI	4
SW	2
SL	1
Total	18

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

SO 5.1 LASER Production SO 5.2 Spontaneous Emission & Stimulated Emission. SO 5.3 Einstein's Coefficients SO 5.4 Helium-Neon SO 5.5 Ruby and Semiconductor Lasers SO 5.6 Applications of Lasers	1. To observe the basic operation of a laser and measure its properties . 2. To derive and verify the relationship between the Einstein coefficients.	**Unit 5: Lasers, Fiber Optics and Holography** 5.1 Elementary idea of LASER Production 5.2 Distinguish between Spontaneous Emission & Stimulated Emission. 5.3 Mathematical proof of Einstein's Coefficients 5.5 Explain construction & working of Ruby and Semiconductor Lasers 5.6 Applications of Lasers	1. Mathematical & Experimental explanation of optical Fibre. 2. Mathematical & Experimental explanation of Holography Experiment.
SO 5.7 Basics of optical Fibre SO 5.8 Fibre Optics sensors & Applications of Optical Fibre in communication systems SO 5.9 Holography		5.7 Basics of optical Fiber (numerical aperture, coherent bundle, step index and graded index fiber, material dispersion) 5.8 Fiber Optics sensors & Applications of Optical Fiber in communication systems 5.9 Holography (Basic principle, theory and requirements).	

SW- 4 Suggested Sessional Work (SW):

A Assignments:

1. Basics of optical Fibre (numerical aperture, coherent bundle, step index and graded index fibre, material dispersion)
2. (2) Explain construction & working of Helium-Neon.

B Mini Project: - Project on Holograms in Real Life: How the Technology Works and Industry Use Cases

C Other Activities: -

1. To determine the wavelength of He-Ne laser using transmission grating
2. To determine the slit width using the diffraction pattern.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CI)	Laboratory Instruction [LI]	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
BS 101.1: Through this chapter students are brought to learn about Simple Harmonic Motion and particles executing S.H.M. Types of vibrations are also studied.	9	6	2	1	18

BS 101.2: Harmonic motion gives the knowledge of composition of two simple harmonic motion and the construction of Lissajous figures. It also gives the true knowledge of various types of oscillations.	9	4	2	1	16
BS-101.3: Interference chapter gives the concept of light wave and its equation, meaning of coherence, interference fringes, interference by Fresnel's biprism, Newton's rings, Michelson interferometer and its applications for determination etc.	9	8	2	1	20
BS-101.4: Diffraction section explains about various types of diffractions in details, knowledge of grating and its resolving power and Polarization section gives the knowledge of production and analyzing of different polarized light, specific rotation	9	8	2	1	20
BS 101.5: Classify the types of optical fibers and discuss the various losses and dispersion involved in optical fibers and discuss about various optical sources, optical detectors, optical connectors and splices.	9	4	2	1	16
Total Hours	45	30	10	5	90

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

Unit	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
Unit-1	Ultrasonics & SHM	03	01	01	05
Unit-2	Oscillations	02	06	02	10
Unit-3	Wave Motion and interference	03	07	05	15
Unit-4	Diffraction & Polarization	-	10	05	15

Unit-5	Lasers, Fibre Optics and Holography	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Engineering Physics 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	Engineering Physics	A.B. Bhattacharya	Khanna Publishing House, 2020	Revised edition 21 edition 2020
2	Physics for Engineers	N.K. Verma	Prentice Hall India	2017
3	Physics of Vibrations and Waves	H.J. Pain	National Council for Cement and Building Materials	5th Edition, Wiley, 2006
4	Optics	Ajoy Ghatak	McGraw Hill Education India,	2017
5	Department Provided Lab Manual			
6	Engineering Physics Lab Manual			
7	Lecture note provided by Dept. of Physics, AKS University, Satna.			

Curriculum Development Team

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COs, POs and PSOs Mapping

Program: B. Tech. AI-DS
Course Code: BS-101
Course Title: Engineering Physics

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO1: Students are brought to learn about Simple Harmonic Motion and particles executing S.H.M. Types of vibrations are also studied	1	1	2	2	3	2	3	2	2	1	3	2	3	3	3	1	-
CO 2: Harmonic motion gives the knowledge of composition of two simple harmonic motion and the construction of Lissajous figures. It also gives the true knowledge of various types of oscillations.	1	2	2	2	1	2	3	2	1	1	2	2	2	2	2	1	-
CO3 : Interference chapter gives the concept of light wave and its equation, meaning of coherence, interference fringes, interference by Fresnel's biprism, Newton's rings, Michelson interferometer and its applications for determination etc..	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2	-
CO.4: Diffraction section explains about various types of diffractions in details, knowledge of grating and its resolving power and Polarization section gives the knowledge of production and analyzing of different polarized light, specific rotation	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2	-
CO 5: Classify the types of optical fibers and discuss the various losses and dispersion involved in optical fibers and discuss about various optical sources, optical detectors, optical connectors and splices.	-	-	-	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: Students are brought to learn about Simple Harmonic Motion and particles executing S.H.M. Types of vibrations are also studied.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**Unit-1.0 Ultrasonics & SHM** **1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9**	As mentioned, above
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2: Harmonic motion gives the knowledge of composition of two simple harmonic motion and the construction of Lissajous figures. It also gives the true knowledge of various types of oscillations.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		**Unit-2- Oscillations** **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 : Interference chapter gives the concept of light wave and its equation, meaning of coherence, interference fringes, interference by Fresnel's biprism, Newton's rings, Michelson interferometer and its applications for determination etc..	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		**Unit-3: Wave Motion and interference** **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: Diffraction section explains about various types of diffractions in details, knowledge of grating and its resolving power and Polarization section gives the knowledge of production and analyzing of different polarized light, specific rotation	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		**Unit-4 : Diffraction & Polarization** **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: Classify the types of optical fibers and discuss the various losses and dispersion involved in optical fibers and discuss about various optical sources, optical detectors, optical connectors and splices	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		**Unit 5: Lasers, Fiber Optics and Holography** **5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9**	

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

Semester-I

Course Code: ES-103

Course Title: Mathematical Concepts for AI And DS

Pre-requisite:

Rationale: Mathematical concepts provide the foundation for understanding the algorithms, models, and methodologies used in AI and DS.

Math helps in understanding logical reasoning and attention to detail.

Course Outcomes:

ES-103.1: Analyzing the graph of a function is a powerful way to understand its behavior, make predictions, and solve mathematical and real-world problems.

ES-103.2: Discuss of Derivatives and optimization are closely related concepts in mathematics and have important applications in various fields, engineering, and machine learning.

ES-103.3: Use of operations involving vectors and matrices depend on the specific operations being performed.

ES-103.4: Use and apply hypothesis testing on different datasets.

ES-103.5: Use statistical methods to analyze and collect data.

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)	
ES	ES-103	Mathematical Concepts for AI And DS	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)
ES	ES-103	Mathematical Concepts for AI And DS	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.

ES-103.1. Analyzing the graph of a function is a powerful way to understand its behavior, make predictions, and solve mathematical and real-world problems.

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 To Understand The intercept and slope **SO1.2** To learn about the system of equation **SO1.3** To understand the exponentials and logarithms. **SO1.4** To know about quadratic equation.	.	**Unit-1.0 Equations, Functions and Graphs** **1.1** Introduction to linear equations **1.2** Intercepts and slopes **1.3** System of equations **1.4** Exponentials, radicals and logarithms, **1.5** Polynomials **1.6** Polynomial operations **1.7** Factorizations **1.8** Introduction to quadratic equations **1.9** Functions	1. Learn about Exponential and logarithms. 2. Learn about system of equations

SW-1 Suggested Sessional Work (SW):

a. Assignments: -
(1) Explain the system of equations with one – one example.
(2) Write the formula of Exponentials, radicals and logarithms.
(3) Questions based on polynomial, quadratic and intercepts.

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

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

ES-102.2: Discuss of Derivatives and optimization are closely related concepts in mathematics and have important applications in various fields, engineering, and machine learning.

Approximate Hours

Item	Appx. Hrs.
Cl	10

LI	0
SW	2
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1. To Understand Introduction to limits **SO2.2.** To learn about continuity and differentiability **SO2.3.** To understand the derivatives to analyse function **SO2.4.** To learn about the Second order derivatives	.	**Unit-2** : **Derivatives and Optimizations** 2.1. Rate of change 2.2. Introduction to limits 2.3. Continuity 2.4. Finding limits 2.5. Differentiability 2.6. Derivative rules and operations 2.7. Using derivatives to analyse functions 2.8. Second order derivatives 2.9. Optimization functions 2.10. Multivariate differentiation	1. About continuity and differentiability. 2. Understand the Optimization functions and Multivariate differentiation.

SW-2 Suggested Sessional Work (SW):

a. Assignments:
(1) Questions based on continuity, limits and differentiability.
(2) using derivatives to analyse functions and Second order derivatives.
(3) Questions based on Optimization functions and Multivariate differentiation.

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

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

ES-102.3: Use of operations involving vectors and matrices depend on the specific operations being performed.

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. To know about introduction to vectors **SO3.2.** To Understand the matrices **SO3.3.** To learn about system of equations with matrices, **SO3.4.** To Learn About Eigen values and eigen vectors.	.	**Unit-3 : Vectors and Matrices** 3.1 Introduction to vectors 3.2 Vector addition 3.3 Vector multiplication 3.4 Introduction to matrices 3.5 Matric multiplication 3.6 Properties of matrices 3.7 Types of matrices 3.8 Matrix division 3.9 Solving system of equations with matrices 3.10 Matrix transformations 3.11 Eigen values and eigen vectors 3.12 Rank of matrix	1.Matrix and types of matrices. 2. solving system of equations with matrices. 3.question based on Eigen values and eigen vector.

SW-3 Suggested Sessional Work (SW):

a. Assignments:
(1) Questions based on vector multiplication and matric multiplication.
(2) solving system of equations with matrices.
(3) Introductions of matrix and types of matrices.
(4) Questions based on Eigen values and eigen vectors and rank of matrix.

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

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

ES-102.4. Use and apply hypothesis testing on different datasets.

Approximate Hours

Item	Appx. Hrs.
Cl	14
LI	0
SW	2
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1. Understanding dependent and independent events **SO4.2.** Understanding the Randomvariables **SO4.3.** Understanding the types ofRandom variable **SO4.4.** Understand the joint probability distribution. **SO4.5.** To Know about Bayes' theorem.	.	**Unit-4 Probability** 4.1. Basic rules and axioms events 4.2. Sample space 4.3. Dependent and independent events 4.4. Conditional probability, 4.5. Random variables 4.6. Continuous and discrete, expectation 4.7. Variance 4.8. Distributions- joint and conditional 4.9. Bayes' Theorem 4.10. Popular distributions: binomial 4.11. Bernoulli 4.12. Poisson 4.13. Exponential 4.14. Gaussian	1. To Learn about dependent and independent events. . 2. Learn about random variables. 3. To Understand binomial, Bernoulli, Poisson, exponential, Gaussian,

SW-4 Suggested Sessional Work (SW):

a. Assignments:
(1) Explain types of random variable with example.
(2) State and prove Bayes' Theorem with example.
(3) Question based on joint and conditional probability.
(4) Question based on Binomial, Bernoulli, Poisson, gaussian.

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

c. Other Activities (Specify):
NA

ES-102 5: Use statistical methods to analyze and collect data.

Approximate Hours

Item	Appx. Hrs.
Cl	15
LI	0
SW	2
SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1. Understanding Sampling and Sampling Distributions **SO5.2 To** learn about Methods of Estimation **SO5.3** Understanding Z-interval, t-interval **SO5.4** To learn about Hypothesis Testing		**Unit 5 Statistics** 5.1 Fundamentals of Data: Collection 5.2 Summarization, and 5.3 Visualization 5.4 Sampling 5.5 Sampling Distributions, 5.6 Central Limit Theorem 5.7 Methods of Estimation, 5.8 Unbiased estimators 5.9 Confidence Interval Estimation: 5.10 Z-interval, 5.11 t-interval 5.12 Hypothesis Testing, 5.13 Types of Errors, 5.14 Rejection Region Approach and 5.15 p-value Approach.	1.To learn about Z-interval, t-interval. 2.To understand Collection, Summarization, and Visualization.

SW-5 Suggested Sessional Work(SW):

a. Assignments:-

(1) Explain types of Errors.
(2) Solve question based on Methods of Estimation and Unbiased estimators.
(3) Define Hypothesis Testing, Rejection Region Approach and p-value Approach.
(4) Question based on Central Limit Theorem, Collection, Summarization, and Visualization.

b. Mini Project:

NA

c. Other Activities (Specify):
NA

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
ES-103.1:Analyzing the graph of a function is a powerful way to understand its behavior, make predictions, and solve mathematical and real-world problems.	9	2	1	12
ES-103.2:Discuss of Derivatives and optimization are closely related concepts in mathematics and have important applications in various fields, engineering, and machine learning.	10	2	1	13
ES-103.3:Use of operations involving vectors and matrices depend on the specific operations being performed.	12	2	1	15
ES-103.4:Use and apply hypothesis testing on different datasets.	14	2	1	17
ES-103 5:Use statistical methods to analyze and collect data.	15	2	1	18
Total Hours	60	10	5	75

Suggestion for End Semester Assessment

Suggested Specification Table (ForESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Equations, Functions and Graphs	03	01	01	05
CO-2	Derivatives and Optimizations	02	02	01	05
CO-3	Vectors and Matrices	03	07	05	15
CO-4	Probability	04	06	05	15
CO-5	Statistics	03	04	03	10
Total		15	20	15	50

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

The end of semester assessment for Mathematical Concepts for AI And DS 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	Introduction to Applied Linear Algebra: Vectors, Matrices, and Least Squares.	StephenBoyd, Lieven Vandenberghe	Cambridge University Press.	2018
2	Probability and statistics for Engineers and Scientists	Walpole, Myers	Myers and Ye, Pearson Education	2012
3	Advanced Engineering Mathematics	Wylie and Barrett	McGraw Hill	1995

B. Alternative NPTEL/SWAYAM/MOOC Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Essential Mathematics for Machine Learning	Prof. Sanjeev Kumar Prof. S. K. Gupta	IIT Roorkee

Curriculum Development Team

1. Dr. Akhilesh K. Waoo, HOD, Department of Computer Science and Engineering.
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COs, POs and PSOs Mapping

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

Course Code : ES103

Course Title: Mathematical Concepts for AI And DS

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO 1: Analyzing the graph of a function is a powerful way to understand its behavior, make predictions, and solve mathematical and real-world problems.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1	2
CO 2 : Discuss of Derivatives and optimization are closely related concepts in mathematics and have important applications in various fields, engineering, and machine learning.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1	3
CO 3: Use of operations involving vectors and matrices depend on the specific operations being performed.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2	2
CO 4: Use and apply hypothesis testing on different datasets.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2	2
CO 5: Use statistical methods to analyze and collect data.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 1: Analyzing the graph of a function is a powerful way to understand its behavior, make predictions, and solve mathematical and real-world problems.	SO1.1 SO1.2 SO1.3 SO1.4		Unit-1 Equations, Functions and Graphs 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2 : Discuss of Derivatives and optimization are closely related concepts in mathematics and have important applications in various fields, engineering, and machine learning.	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2 Derivatives and Optimizations 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	CO 3: Use of operations involving vectors and matrices depend on the specific operations being performed.	SO3.1 SO3.2 SO3.3 SO3.4		Unit-3 Vectors and Matrices 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, 5	CO 4: Use and apply hypothesis testing on different datasets.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 Probability 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: Use statistical methods to analyze and collect data.	SO5.1 SO5.2 SO5.3 SO5.4		Unit-5 Statistics 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10, 5.11,5.12,5.13,5.14,5.15	

Semester-I

Course Code: BS-202

Course Title: Chemistry

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

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

Course Outcomes:

After the completion of this course, the learner will able to

BS- 202.1 Apply VSEPR theory to predict the three-dimensional shapes of molecules.

BS-202.2: Describe the concept of symmetry, chirality and optical activity and synthesize chiral drug molecule.

BS-202.3: Explain and apply the concept of Intermolecular forces, Hydrogen bond, and transition metal complexes.

BS- 202.4 Predict the concept of thermodynamics, free energy & entropy and apply Nernst equation, water chemistry as well as explain concept of acid-base, metallurgy, Emf cell and corrosion.

BS-202.5: Collectively aim to equip students with a comprehensive understanding of the theoretical principles, practical methodologies, and diverse applications of various spectroscopic techniques.

Scheme of Studies:

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)	
BS	BSC 103	Chemistry	3	2	2	1	8	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 projected.),

SL: Self-Learning,

C: Credits.

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

Scheme of Assessment:

Theory

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	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance	Total Marks (CA+CT+SA+CAT		
BS	Bs202	Chemistry	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
BS	Bs202	Chemistry	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.

BSC- 103.1 Apply VSEPR theory to predict the three-dimensional shapes of molecules.

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1. Describe the classification of	LI1.1. Determination of specific density of given liquid	**Unit 1: Atomic and Molecular Structure & Periodic properties**	**1.** History of development of periodic table
different types of orbit orbitals **SO1.2** Discuss the fundamental concept of wave function and probability distribution curve **SO1.3** Explain and apply Atomic Spectroscopy: - Energies of atomic orbital's **SO1.4** Apply concept of VSEPR in the determination of geometry of various molecules. **SO1.5** Restate molecular energy level diagram of N2 F2 and O2 molecules.	LI.1.2. Determination of viscosity of given liquid LI.1.3 Paper chromatography, Thin layer chromatography.	**1.1.** Introduction of orbit, orbitals and electronic configuration **1.2.** Schrodinger wave equation and its derivation. **1.3.** Hybridization and types of hybridization. Intermixing of orbitals **1.4.** VSEPR theory, bond pair and lone pair repulsion, **1.5.** 1.5 Determination of geometry of the molecules **1.6.** Molecular orbital theory, **1.7.** Molecular energy level diagram and bond order for homo and hetero atomic molecules **1.8.** Periodicity of atomic size and ionization energy **1.9.** Electron gain enthalpy and types of electron gain enthalpy	**2.** Electronegativity and its application

SW-1 Suggested Sessional Work (SW):

a. Assignments:
Applications of molecular orbital theory for the determination of bond order and magnetic behaviour.

b. Mini Project:
Hybridization and its application.

c. Other Activities (Specify):
Write an essay on different type of chemical bond.

BSC-103.2: Describe the concept of symmetry, chirality and optical activity and synthesize chiral drug molecule.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 understand the concept of representations of 3 dimensional structures SO2.2 explain structural isomers and stereoisomers SO2.3 describe symmetry, chirality and optical activity SO2.4 explain and identify different types of reactions with mechanisms SO2.5 apply the concept of mechanisms to synthesize drug molecules	LI.2.1.To Synthesize drug molecules and determine its percentage yield LI.2.2.To determine the acid value or saponification value of oil/fat LI2.3.To determine partition coefficient of a organic substance between two immiscible liquids.	**UNIT 2: Stereochemistry, Organic reactions and synthesis of a drug molecule** 2.1 Representations of 3 dimensional structures 2.2 Structural isomers and stereoisomers 2.3 Symmetry and chirality, optical activity and absolute configurations 2.4 enantiomers, diastereomers 2.5 Isomerism in transitional metal compounds 2.6 Introduction to reactions involving substitution reaction 2.7 Addition, elimination, oxidation, reduction reaction 2.8 cyclization and ring openings 2.9 Synthesis of a commonly used drug molecule	1. Plane of polarized light 2. Types of symmetry

SW-2 Suggested Sessional Work (SW):

Assignments: Conformational Isomerism and conformational analysis

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

Approximate Hours

Item	App X Hrs.
Cl	9

LI	6
SW	2
SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Describe Ionic, dipolar, London dispersion force, vander Waals interaction SO2.2 explain Hydrogen bond and types of hydrogen bond SO2.3 Coordination compounds SO2.4 describe Metal ligand bonding by VBT SO2.5 explain Metal ligand bonding by CFT	LI3.1. Synthesis a inorganic metal complex LI3.2. Determine the two acid and two basics radical LI.2.3.Determination of chloride content of water	**Unit-3: Intermolecular forces and Transition metal complexes** **3.1.** Ionic, dipolar, London dispersion force **3.2.** Vander Waals interactions **3.3.** Hydrogen bond, types of hydrogen bond. **3.4.** Coordination compounds **3.5.** Metal ligand bonding by VBT **3.6.** Metal ligand bonding by CFT **3.7.** The energy level diagrams for transition metal ions and their magnetic properties. **3.8.** The energy level diagrams for transition metal ions and their magnetic properties	1. Coordination compounds IUPAC name and Werner theory 2. The energy level diagrams for transition metal ions and their magnetic properties

SW-3 Suggested Sessional Work (SW):

2.2 Assignments: VBT theory, CFT theory, The energy level diagrams for transition metal ions and their magnetic properties

Mini Project: applications of transition metal complexes

Other Activities (Specify):

BSC- 103.4 Predict the concept of thermodynamics, free energy & entropy and apply Nernst equation, water chemistry as well as explain concept of acid-base, metallurgy, Emf cell and corrosion.

Approximate Hours

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 concept	LI.4.1.	**Unit 4: Use of free energy in**	**1**-derivation of

of free energy, Free energy, Enthalpy Entropy and types of different thermodynamic system **SO4.2**Discuss the fundamental concept of	Determination of hardness of water LI.4.2. Determination of alkalinity of water	**chemical equilibrium** **4.1**Introductionenergy, Enthalpy Entropy, system and surroundings **4.2** Cell notation of cell, Nernst equation and its application	Nernst equation.
cell representation standard EMF of cell **SO4.3** Explain and apply different types of concepts used in softening of water and purification of water **SO4.4** Understand and apply concept of corrosion for the development of green corrosion inhibitors **SO4.5** Understand different acid-base concepts, ionic and solubility product of salts	LI.4.3. Chemical analysis of a salt.	**4.3** Water chemistry, Hardness of water, Temporary and permanent hardness **4.4** Water softening methods **4.5** Introduction of Corrosion, Mechanism of corrosion **4.6** Factors affecting rate of corrosion **4.7** Various acid-base concepts, Arrhenius concept, **4.8** Lewis acid-base concept, Bronsted Lowry concept **4.9** Brief idea about ionic and solubility equilibria	

SW-4 Suggested Sessional Work (SW):

A. Assignments:

Applications of green corrosion inhibitors

b. Mini Project:

Analysis of water quality parameters.

c. Other Activities (Specify):

Write an essay on acid-base concepts, ionic and solubility product of salts.

BSC-103.5: Collectively aim to equip students with a comprehensive understanding of the theoretical principles, practical methodologies, and diverse applications of various spectroscopic techniques.

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)

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

SW-5 Suggested Sessional Work (SW):

A. Assignments:

Applications Nuclear magnetic resonance and magnetic resonance imaging

b. Mini Project:

Fluorescence and its applications in medicine

c. Other Activities (Specify):

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

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Instruction (LI)	Sessional Work (SW)	Self-Learning (SL)	Total hour (Cl+Li+SW+Sl)
BSC- 103.1: Apply VSEPR theory to predict the three-dimensional shapes of molecules.	09	04	02	01	16
BSC-103.2: Describe the concept of symmetry, chirality and optical activity and synthesize chiral drug molecule	09	06	02	01	18
BSC-103.3: Explain and apply the concept of Intermolecular forces, Hydrogen bond, and transition metal complexes	09	04	02	01	16
BSC- 103.4: Predict the concept of thermodynamics, free energy & entropy and apply Nernst equation, water chemistry as well as explain concept of acid-base, metallurgy, Emf cell and corrosion.	09	04	02	01	16
BSC-103.5: Collectively aim to equip students with a comprehensive understanding of the theoretical principles, practical methodologies, and diverse applications of various spectroscopic techniques.	09	04	02	01	14
Total Hours	45	22	10	05	80

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Atomic and Molecular Structure & Periodic properties**	03	01	01	05
CO-2	**Stereochemistry, Organic reactions and synthesis of a drug molecule**	02	06	02	10
CO-3	**Intermolecular forces and Transition metal complexes**	03	07	05	15

CO-4	**Use of free energy in chemical equilibrium**	-	10	05	15
CO-5	**Spectroscopic techniques and applications**	03	02	-	05
Total		11	26	13	50

The end of semester assessment for Organic Chemistry I 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 NCL, CSIR laboratories
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) Books:

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

Suggested Web Sources:

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

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

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

Curriculum Development Team

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Program: B.Tech. CSE [AI-DS]

Course Title: Chemistry

Course Code: BSC103

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO3	PO 1	PO 2	PO6	PO 1	PO 2	PO9	PO 1	PO 2	PO12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO1: Apply VSEPR theory to predict the three-dimensional shapes of molecules.	3	1	2	2	3	2	3	2	2	1	3	2	2	3	1	2	-
CO 2 Describe the concept of symmetry, chirality and optical activity and synthesize chiral drug molecule.	2	1	2	2	1	2	3	2	1	1	2	2	2	3	1	2	-
CO3 Explain and apply the concept of Intermolecular forces, Hydrogen bond, and transition metal complexes.	2	2	1	1	1	2	2	2	1	2	1	2	1	3	1	2	-
CO4: Predict the concept of thermodynamics, free energy & entropy and apply Nernst equation, water chemistry as well as explain concept of acid-base, metallurgy, Emf cell and corrosion.	2	2	2	2	3	2	3	2	2	1	2	3	3	3	2	2	-
CO5 Collectively aim to equip students with a comprehensive understanding of the theoretical principles, practical methodologies, and diverse applications of various spectroscopic techniques	2	-	-	1	1	3	3	3	1	1	2	2	3	3	2	2	-

Legend:1–Low,2–Medium, 3–High

Course Curriculum Map:

POs &PSOs No.	Cos. No. &Titles	SOs No.	Laboratory instruction (LI)	Classroom Instruction (CI)	Self-Learning(SL)
PO1,2,3,4,5, 6, 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO1:** Apply VSEPR theory to predict the three-dimensional shapes of molecules.	SO1.1 SO1.2 SO1.3, SO1.4 SO1.5	LI.1.1, LI.1.2, LI.1.3	**Unit-1.0 Atomic and Molecular Structure & Periodic properties** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	History of development of periodic table 2-Elecronegativity and its application
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO2:** Describe the concept of symmetry, chirality and optical activity and synthesize chiral drug molecule.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LI.2.1, LI.2.2, LI.2.3	Unit-2 **Stereochemistry, Organic reactions and synthesis of a drug molecule** 2.1,2.2,2.3,2.4,2.5,2.6, 2.7, 2.8,2.9	Resonance Raman Spectroscopy, coherent anti-stokes Raman Spectroscopy (CARS).
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO3** Explain and apply the concept of Intermolecular forces, Hydrogen bond, and transition metal complexes.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	LI.3.1, LI.3.2 LI.3.3	Unit-3 **Intermolecular forces and Transition metal complexes** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	Nature of M-L bond, coordination number, structure and detection of oxidation state.
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO 4** Predict the concept of thermodynamics, free energy & entropy and apply Nernst equation, water chemistry as well as explain concept of acid-base, metallurgy, Emf cell and corrosion	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LI.4.1, LI.4.2, LI.4.3	Unit-4: **Use of free energy in** chemical **equilibrium** 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9	Quadrupole nuclei, quadrupole moments, electric field gradient, coupling constant splitting. Applications
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO 5** Collectively aim to equip students with a comprehensive understanding of the theoretical principles, practical methodologies, and diverse applications of various spectroscopic techniques.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	LI.1.1, LI.1.2, LI.1.3	**Unit 5: Spectroscopic** techniques **and applications** 5.1,5.2,5.3,5.4,5.5,5.6,5.7	Low energy electron diffraction and structure of surfaces.

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

Semester-I

Course Code: ES-101

Course Title : Problem Solving and Programming

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 101.1: Understand the basic concept of Programming languages, software, algorithm and flowchart.
ES 101.2: Acquire knowledge regarding the building blocks of programming language.
ES 101.3: Apply python for solving basic programming solutions.
ES 101.4: Create algorithms using learnt programming skills.
ES 1015: 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)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
ES	ES 101	Problem Solving and Programming	3	2	2	1	8	4

Legend: **CI:**Classroom Instruction(Includesdifferentinstructionalstrategiesi.e.,Lecture(L)andTutorial (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 projected.),
SL: Self-Learning,
C:Credits.

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

Scheme of Assessment:

Theory

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)		
ES	ES101	Problem Solving and Programming	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
ES	ES104	Programming for 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.

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

Approximate Hours

Item	Appx. Hrs.
Cl	7
LI	4
SW	2
SL	1
Total	14

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.	**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

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

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
O2.1. To Understand 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 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.2.3. Using a for loop, write a program that prints out the decimal equivalents		
	of 1/2, 1/3, 1/4, . 1/10. **LI.2.4.** Write a program using a for loop that loops over a sequence. What is sequence? **LI.2.5.** 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

CO.3: Gain an understanding of the various types of Conditional Statements, Loops, Arraysand Strings.

Approximate Hours

Item	Appx. Hrs.
Cl	10
LI	8
SW	2

SL	1
Total	21

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 prints a countdown from that number to zero. **LI.3.3.** Write function to compute gcd, lcm of two numbers. **LI.3.4.** Write a program to implement Merge sort. Write a program to implement Selection sort, Insertion sort	**Unit-3 : Conditional Statements, Loops, Arrays and Strings, User Defined Data Types** 3.1 If-else statement, 3.2 For loop, 3.3 While Loop, 3.4 Nested Iteration, 3.5 Concept and use of arrays 3.6 Declaration and usage of arrays, 3.7 , 2-dimensionalarrays, 3.8 Different types of user defined datatypes 3.9 Structure 3.10Union	i. Loops to access array elements ii. Member access in user defined data type .

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

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

Approximate Hours

Item	Appx. Hrs.
Cl	10
LI	4

SW	2
SL	1
Total	17

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 the Functions/Methods **SO2.3.** Apply functions **SO2.4.** Use of Functions/ Methods	**LI.4.1.** Write a program to count the numbers of characters in the string and store them in a dictionary data structure. **LI.4.2.** Write a program to use split and join methods in the string and trace a birthday of a person with a dictionary data structure.	**Unit-4 : Dictionaries and Dictionary Accumulation, Functions/Methods** 4.1 Dictionary Basics 4.2 Operations 4.3 Methods, accumulation. 4.4 Advantage of modularizing program into functions. 4.5 Function definition. 4.6 Function invocation. 4.7 Positional Parameter Passing 4.8 Passing arrays to functions 4.9 Recursion 4.10 Library Functions	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.

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

Approximate Hours

Item	Appx. Hrs.
Cl	6

LI	4
SW	2
SL	1
Total	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Understanding the file handling task **SO2.2** know the functions of file handling **SO2.3** Importance of .csv file **SO2.4** Use of Memory Management	**LI.5.1.** Write a program to count frequency 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?	**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. 5.6 Memory Management Operations.	1. Role of file handling. 2.Working of .csv file

SW-5 Suggested Sessional Work (SW):

a. Assignments:

List the different file handling functions .

b. Mini Project:

Data base management of any fields by using file handling.

c. Other Activities(Specify):

NA.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	LI (Laboratory Instruction)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
ES 101.1**:** At the end of this chapter the student will know the basic concept of programming.	7	4	2	1	14

ES 101.2**:**At the end of this chapter the student will use Operators in programs**.**	12	10	2	1	25
ES 101.3:At the end of this chapter the student will describe the control flow statements**.**	10	8	2	1	21
ES 101.4: At the end of this chapter the student will make function and dictionary	10	4	2	1	17
ES101.5: Comprehend the functions of .csv and file handling functions.	6	4	2	1	13
Total Hours	45	30	10	5	90

Suggestion for End Semester Assessment

Suggested Specification Table(ForESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO.1	Understand the basic concept of Programming languages, software, algorithm and flowchart.	02	05	01	08
CO.2	Acquire knowledge regarding the building blocks of programming language.	02	03	05	10
CO.3	Apply python for solving basic programming solutions.	02	03	07	12
CO.4	Create algorithm using learnt programming skills.	1	3	7	10
CO.5	Understand real world problems and developing computer solutions for those.	1	05	05	10
Total		13	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 [Artificial Intelligence & Data Science]
Course Code : ES101
Course Title: Problem Solving and Programming

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

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 1: Understand the basic concept of Programming languages, software, algorithm and flowchart.	SO1.1 SO1.2 SO1.3 SO1.4	LI.1.1,LI1.2	Unit-1 Introduction to Programming 1.1,1.2,1.3,1.4,1.5,1.6,1.7	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2 : Acquire knowledge regarding the building blocks of programming language.	SO2.1 SO2.2 SO2.3 SO2.4	LI.2.1,LI2.2,LI 2.3,LI.2.4,LI.2. 5	Unit-2 Datatypes and Operators, Variables, Sequences and Iteration 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7,2.8,2.9,2.10,2.11,2.12	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 3: Apply python for solving basic programming solutions. .	SO3.1 SO3.2 SO3.3 SO3.4	LI3.1,LI3.2,LI3 .3,LI.3.4	Unit-3 Conditional Statements, Loops, Arrays and Strings, User Defined Data Types 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: Create algorithms using learnt programming skills.	SO4.1 SO4.2 SO4.3 SO4.4	LI4.1,LI.4.2	Unit-4 Dictionaries and Dictionary Accumulation, Functions/Methods: 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10,	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 5: Understand real world problems and developing computer solutions for those.	SO5.1 SO5.2 SO5.3 SO5.4	LI.5.1,LI5.2	Unit-5 File Handling and Memory Management: 5.1,5.2,5.3,5.4,5.5,5.6	

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

Semester-I

Course Code: AU-203

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:

AU203.1: Examine critically the 17 newly minted UN Sustainable Development Goals and understand the historical evolution, key theories, and concepts of sustainable development.
AU203.2: Identify and apply methods for assessing the achievement of sustainable development and discover the science, technology, economics, and politics underlying the concepts of sustainability.
AU203.3: 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.
AU203.4: 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.
AU203.5: 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 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	
AU	AU203	Sustainable Development Goal	2	0	1	1	4	2

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

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)		
AU	AU203	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.

AU203.1: Examine critically the 17 newly minted UN Sustainable Development Goals andunderstand 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.

AU203.2: : Identify and apply methods for assessing the achievement of sustainable development and discover the science, technology, economics, and politics underlying the concepts of sustainability and measuring.

Approximate Hours

Item	Appx. Hrs.
Cl	06
LI	0

SW	1
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Explain Sustainable Development **SO2.2** Understand the NEP-2020 and SDG **SO2.3** Discuss higher 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 2 Concept ,Tools and techniques for measuring sustainability

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)

AU203.3: 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 management practices. 2. Non-renewable energy resources.

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.

AU203.4: 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 2.Kyoto Protocol

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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AU203.5: 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** Understand role 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)
AU203.1: 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
AU203.2: 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
AU203.3: 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
AU203.4: 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
AU203.5: 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

Suggested Specification Table(For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Need and Importance of Sustainable Development	03	01	01	05
CO-2	Education for Sustainable Development (ESD): Tools, Systems, and Innovation 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

The end of semester assessment for Sustainable Development Goals 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, water treatment 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	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 : AU203
Course Title: Sustainable Development Goals (SDGs

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO1. Need and Importance of Sustainable Development	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1	2
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	3
CO3.Discuss the sustainable production and consumption	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	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	2
CO5. Role of Corporations and Ecological Sustainability	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	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	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO2. Education for Sustainable Development (ESD): Tools, Systems, and Innovation for Sustainability	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2 Special focus on SDG 4-Quality Education and Lifelong Learning: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 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	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 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	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 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	

Semester - II

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

Semester-II

Course Code: **BS201**

Course Title : Mathematics II

Pre-requisite: Understanding of basic concepts such as limits, derivatives, integration, and their applications.

Rationale: Mathematics is essential for everyday life and understanding our world. It helps us have better problem-solving skills.

Course Outcomes:

BS201.1: Students would be able to Understand the behavior of series and their applications.

BS201.2: Students would be able to Understand each series requires individual analysis and testing for convergence or divergence.

BS201.3: Understanding mathematical concepts, including logic, set theory, and proof techniques.

BS201.4: Students would be able to Understand number system and its applications.
BS201.5: Students would be able to Understand the concept of probability and statistics and apply in real life.

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)	
BS	BS201	Mathematics II	4	0	2	1	7	4

Legend:

CI: Classroom Instruction(Includesdifferentinstructionalstrategiesi.e.,Lecture(L)andTutorial (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 projected.),

SL: Self-Learning,

C:Credits.

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

Scheme of Assessment:

Theory

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	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)		
BS	BS-201	Mathematics II	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

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

BS-201.1**:-** Students would be able to Understand the behavior of series and their applications.

Approximate Hours

Item	Appx. Hrs.
Cl	11
LI	0
SW	2
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 To Understand Limit of a sequence **SO1.2** To learn about properties of convergent sequences. **SO1.3** To understand tests for convergence and	.	**Unit-1. Sequences and Series** 1.1 Limit of a sequence 1.2 monotone. 1.3 Cauchy sequences 1.4 Properties of convergent sequences 1.5 Examples. 1.6 Infinite series 1.7 Positive series. 1.8 tests for convergence	1. properties of convergent sequences with examples. 2. Question based on Leibnitz test.

divergence **SO1.4** To know about Leibnitz test.		and divergence. 1.9 integral test 1.10 Alternating series 1.11 Leibnitz test.	

SW-1 Suggested Sessional Work (SW):

a. Assignments:
(1) Limit of a sequence, Infinite series, positive series.
(2) Tests for convergence and divergence.
(3) integral test, alternating series, Leibnitz test.
(4) Cauchy sequences and properties of convergent sequences with example.

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

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

BS-201.2**:** Students would be able to Understand each series requires individual analysis and testing for convergence or divergence.

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)**
SO2.1 To Understand Pointwise and uniform convergence. **SO2.2**To learn about basic aspects of Power series. **SO2.3**To understand the Fourier series.	.	**Unit-2 : Functional Series** 2.1 Pointwise and uniform convergence. 2.2 basic aspects of Power series. 2.3 Fourier series. 2.4 Numerical based on it 2.5 Examples	1. About Pointwise and uniform convergence. 2. Understand the Fourier series.

SW-2 Suggested Sessional Work(SW):

a. Assignments:

(1) Pointwise and uniform convergence.
(2) basic aspects of Power series and Fourier series.

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

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

BS-201.3: Understanding mathematical concepts, including logic, set theory, and proof techniques.

Approximate Hours

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

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 To know about Statements. **SO3.2**To Understand the Operation on sets. **SO3.3 To** learn about functions. **SO3.4 To** Learn About Relations.	.	Unit-3 : Math Foundation 3.1Statements 3.2. Quantifiers. 3.3 Operation on sets 3.4. Numerical based on it 3.5 Functions. 3.6 Types of Functions	Question based on Statements. Functions and Relations
		3.7 Relations 3.8 Proofs. 3.9 Numerical based on it.	

SW-3 Suggested Sessional Work(SW):

a. Assignments:
(1) Question based on Statements and Quantifiers.
(2) Operation on sets and functions and Relations.

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

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

BS-201.4. Students would be able to Understand number system and its applications.

Approximate Hours

Item	Appx. Hrs.

Cl	9
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Understanding Countability of algebraic numbers. **SO4.2** Understanding the Equivalence classes. **SO4.3** Understanding the Fermat's little theorem. **SO4.4** Understand the Wilson's theorem and Primitive root theorem.	.	**Unit-4 Number System** **4.1** Countability of algebraic numbers **4.2** Transcendental numbers. **4.3** construction of Liouville's number, 4.4. Equivalence classes, **4.5** construction of real numbers (using Cauchy sequences), **4.6** Fermat's little theorem. **4.7** using it for Miller-Rabin primality test. **4.8** Wilson's theorem **4.9** Primitive root theorem.	1 To Learn about. . Countability of algebraic numbers. 2 Learn about Equivalence classes. 3 To Understand Fermat's little theorem.

SW-4 Suggested Sessional Work (SW):

a. Assignments:
(1) construction of Liouville's number and Equivalence classes.
(2) construction of real numbers (using Cauchy sequences) and Fermat's little theorem.
(3) Wilson's theorem and Primitive root theorem.
(4) Countability of algebraic numbers and Transcendental numbers.

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

c. Other Activities (Specify):
NA

BS-201. 5:- Students would be able to Understand the concept of probability and statistics and apply in real life.

Approximate Hours

Item	Appx. Hrs.
Cl	11
LI	0
SW	2
SL	1

Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 Understanding properties of probability and conditional probability. **SO5.2 To** learn about discrete and continuous random variables. **SO5.3** Understanding Chebyshev inequality. **SO5.4 To** learn about Normal distributions and Limit Theorems.		**Unit 5 :- Probability** **5.1** Sample space and events, **5.2** definitions of probability. **5.3** properties of probability, **5.4** conditional probability. **5.5** Random variables: distribution functions, **5.6** discrete and continuous random variables, **5.7** moments of random variables	1. To learn about discrete and continuous random variables . 2. To understand Special Distributions.
		5.8 conditional expectation, 5.9 Chebyshev inequality, functions of random variables. 5.10 Special Distributions: Bernoulli, Binomial, Geometric, Pascal, Poisson, Exponential, Uniform, 5.11 Normal distributions, Limit Theorems: Law of large numbers.	

SW-5 Suggested Sessional Work(SW):

a. Assignments:

(1) Definitions of probability, properties of probability and conditional probability.
(2) moments of random variables and conditional expectation.
(3) Random variables:- distribution functions, discrete and continuous random variables.
(4) Special Distributions:- Bernoulli, Binomial, Geometric, Pascal, Poisson, Exponential,Uniform.
(5) Normal distributions and Limit Theorems.

b. Mini Project:

NA

c. Other Activities (Specify):

NA

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
BS-201.1:- . Students would be able to Understand the behavior of series and their applications.	11	2	1	14
BS-201.2:- Students would be able to Understand each series requires individual analysis and testing for convergence or divergence	5	2	1	8
BS-201.3:- : understanding mathematical concepts, including logic, set theory, and proof techniques.	9	2	1	12
BS-201.4:- Students would be able to Understand number system and its applications.	9	2	1	12
BS-201.5:- Students would be able to Understand the concept of probability and statistics and apply in real life.	11	2	1	14
Total Hours	45	10	5	60

Suggestion for End Semester Assessment

Suggested Specification Table (ForESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Sequences and Series**	03	04	03	10
CO-2	**Functional Series**	02	02	01	05
CO-3	**Math Foundation**	03	02	05	10
CO-4	**Number System**	04	04	03	11
CO-5	**Probability**	03	06	05	14
Total		15	18	17	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. 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	Probability and statistics for Engineers and Scientists.	Walpole, Myers	. Myers and Ye, Pearson Education	2012
2	Advanced Engineering Mathematics.	Wylie and Barrett	McGraw Hill	1995
3	Advanced Engineering Mathematics	M.D. Greenberg	Pearson Education Asia	2002

B. Alternative NPTEL/SWAYAM/MOOC Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Engineering Mathematics - I	Prof. Jitendra Kumar	IIT Kharagpur
2.	Probability and Statistics	Prof. Somesh Kumar	IIT Kharagpur

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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.
8. Ms. Pushpa Kushwaha, Assistant Professor, Department of Computer Science and Engineering.

CO, PO and PSO Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]
Course Code : BS-201
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	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-long learning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science
BS-201.1:- . Students would be able to Understand the behavior of series and their applications.	2	2	3	1	1	1	1	1	1	1	1	2	2	2	2	2
BS-201.2:- Students would be able to Understand each series requires individual analysis and testing for convergence or divergence	2	3	2	1	2	2	1	1	1	1	1	1	3	2	3	2
BS-201.3:- : understanding mathematical concepts, including logic, set theory, and proof techniques.	2	2	2	2	2	2	1	1	1	1	1	2	1	2	1	2

BS-201.4:- Students would be able to Understand number system and its applications.	3	2	3	3	2	3	1	2	2	1	2	3	3	3	2	1
BS-201.5:- Students would be able to Understand the concept of probability and statistics and apply in real life.	3	2	3	2	3	2	1	2	1	1	2	3	2	3	2	1

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	BS-201.1:- . Students would be able to Understand the behavior of series and their applications.	SO1.1 SO1.2 SO1.3 SO1.4		**Unit-1. Sequences and Series** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	BS-201.2:- Students would be able to Understand each series requires individual analysis and testing for convergence or divergence	SO2.1 SO2.2 SO2.3		**Unit-2 : Functional Series** 2.1, 2.2, 2.3, 2.4, 2.5	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	BS-201.3:- : understanding mathematical concepts, including logic, set theory, and proof techniques.	SO3.1 SO3.2 SO3.3 SO3.4		**Unit-3 : Math Foundation** 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	BS-201.4:- Students would be able to Understand number system and its applications.	SO4.1 SO4.2 SO4.3 SO4.4		**Unit-4 Number 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	BS-201.5:- Students would be able to Understand the concept of probability and statistics and apply in real life.	SO5.1 SO5.2 SO5.3 SO5.4		**Unit 5 : Probability** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11	

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

Semester-II

Course Code:	PC202
Course Title:	Object Oriented Programming
Pre- requisite:	Programming in C
Rationale:	OOP concept helps the program to be closer to real-world objects. Also, OOP allows code to be reusable and make it simpler.

Course Outcomes:

PC 202.1: Understand the basic concepts of OOPs.
PC 202.2: Understand the concept of Polymorphism & Inheritance
PC 202.3: Apply different Python library to solve programming problems.
PC 202.4: Understand the advanced concepts of python and apply for Accessing web data.
PC 202.5: Understand the advanced concepts of python and apply for Accessing database.

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)	
PC	PC202	Object Oriented Programming	3	0	1	0	5	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.

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Scheme of Assessment:

Theory

Board of Study	Course	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks (PRA+ESA)
			Class/Home	Class Test 2 (2 best out of 3)	Seminar one	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)	(ESA)	
PC	PC 202	Object Oriented Programming	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PC	PC 202	Object Oriented Programming	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.

PC202.1: Understand the basic concepts of OOPs.

Approximate Hours

Item	Appx. Hrs.
Cl	8
LI	8
SW	2
SL	1
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the concept of Object-Oriented Programming. **SO1.2** Difference between OOP and POP **SO1.3** Apply OOP concept in real life problems.	LI.1.1 Write a Python program to create a calculator class. Include methods for basic arithmetic operations. LI.1.2Write a program in Python to demonstrate the Parameterized Constructor. LI.1.3 Write a program in Python to demonstrate Array of object.	**Unit-1.0 Introduction to Object Oriented Programming Paradigms** **(8- Lectures)** 1.1 Introduction to various programming paradigms 1.2 advantages of OOP, comparison of OOP with Procedural Paradigm 1.3 Classes and Objects: Prototyping 1.4 Referencing the variables in functions, Inline	1. Prepare a list for OOP & POP base Languages.

	LI.1.4 Write a NumPy program to compute the cross product of two given vectors.	1.5 static and friend functions 1.6 Memory allocation for classes and objects 1.7 Arrays of objects 1.8 Constructors	

SW-1 Suggested Sessional Work (SW):

Assignments:

i. Create a poster for OOP features.
ii. Explain Constructor with Example.
iii. Explain static and friend function.

PC**202.2: Understand the concept of Polymorphism & Inheritance.**

Approximate Hours

Item	Appx. Hrs.
Cl	12
LI	8
SW	2
SL	1
Total	23

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
2.1 Understand the concept of Polymorphism & Inheritance. **SO2.2** Use Polymorphism & Inheritance in problems **SO2.3** Demonstrate the use of meta class	LI.2.1. Write a NumPy program to calculate the QR decomposition of a given matrix. LI.2.2. Write a program in python to demonstrate multiple inheritance. LI.2.3. Write a program in python to	**Unit-2.0 Polymorphism & Inheritance** (12- Lectures) 2.1. Introduction to Polymorphism 2.2. Polymorphism with a Function and Objects 2.3. Overriding Methods 2.4. type conversions from basic data types to user defined and vice versa	1. How Polymorphism is used to solve real life problems.

	demonstrate Overriding Methods. LI.2.4. Write a program in python to demonstrate Exception Handling in an array using a function.	2.5. Base classes and Derived classes 2.6. types of inheritance 2.7. various types of classes 2.8. Invocation of Constructors and Destructors in Inheritance 2.9. aggregation, composition 2.10. classification hierarchies 2.11. meta class/abstract classes 2.12. Unit Testing and Exceptions.	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

iv. Prepare a chart for Inheritance types.
v. Explain overriding method.
vi. Explain unit testing and exceptions.

PC202.3: Apply different Python library to solve programming problems.

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)**
SO3.1 Understand the concept of Python Libraries. **SO3.2** Use various libraries in data modelling &	LI.3.1 Write a Pandas program to	**Unit-3.0 Python libraries** (10- Lectures) 3.1. Basics of open-source libraries for data	1. Learn all python libraries related to data visualization.

visualization. **SO3.3** Apply various libraries for data prepressing.	convert a Panda Module Series to Python list and its type. LI.3.2 Write a Pandas	preprocessing 3.2. Data Analysis with python 3.3. Data Analysis libraries 3.4. Data Modelling 3.5. Type of an object 3.6. Special Methods for Data Modelling in	
	program to convert a NumPy array to a Pandas series. LI.3.3 Write a program to interchange first and last elements in a list	Python 3.7. Data Visualization 3.8. Data Visualization in Python using Matplotlib. 3.9. Data Visualization in Python using Seaborn 3.10. Data Visualization in Python using Plotly	

SW-3 Suggested Sessional Work (SW):

a. Assignments:

vii. Explain data modelling.

viii. Explain data visualization.

.

PC202.4: Understand the advanced concepts of python and apply for accessing web data.

Approximate Hours

Item	Appx. Hrs.
Cl	8
LI	6
SW	2
SL	1
Total	1

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)

SO4.1 Understand the concept of access web data **SO4.2** Use of sockets **SO4.3** Demonstrate the use of Retrieving Web Page.	LI.4.1 Write a program to create grade calculator. LI.4.2 Write a program to read	**Unit-4.0** Using Python to Access Web Data **(4- Lectures)** 4.1. Regular Expressions 4.2. Regular Expression Functions. 4.3. Extracting Data 4.4. Sockets 4.5. Socket methods 4.6. Using the Developer Console to Explore	1. How can we handle network socket exceptions?
	and write data from a file. LI.4.3 Create a Python project to get the citation from Google scholar using title and year of publication, and volume and pages of journal.	HTTP 4.7. Retrieving Web Page 4.8. Parsing Web Pages	

SW-4 Suggested Sessional Work (SW):

a. Assignments:

ix. Program to establish a connection between server & client.

x. Explain Retrieving Web Page process in python

xi. Explain Regular Expression Functions.

PC202.5: Understand the advanced concepts of python and apply for accessing database.

Approximate Hours

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

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO5.1 Understand the concept of database in Python. **SO5.2** Demonstrate the use	LI.5.1 Create a Python project to get total Covid-19	**Unit-5.0** Using Databases with Python **(7- Lectures)**	1.Compare and analyze all JOIN.

of CRUD.	cases, total deaths due to Covid-19, total Covid-19 patients recovered in the world.	5.1. Using Databases 5.2. Single Table CRUD 5.3. Designing a Data Model. 5.4. Representing a Data Model 5.5. Inserting Relational Data 5.6. Reconstructing Data with JOIN 5.7. Many to Many Relationships.	

SW-5 Suggested Sessional Work (SW):

a. Assignments:

xii. Explain CRUD operation.

xiii. Write database Connectivity process in python.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
PC202.1: Understand the basic concepts of OOPs.	08	02	01	11
PC202.2: Understand the concept of Polymorphism & Inheritance.	12	02	01	15
PC202.3: Apply different Python library to solve programming problems.	10	02	01	13
PC202.4: Understand the advanced concepts of python and apply for Accessing web data.	08	02	01	11
PC202.5: Understand the advanced concepts of python and apply for Accessing database.	07	02	01	10
Total Hours	45	10	5	60

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	

CO-1	Introduction to Object Oriented Programming Paradigms	03	02	03	08
CO-2	Polymorphism & Inheritance	03	01	05	09
CO-3	Python libraries	03	07	02	12
CO-4	Using Python to Access Web Data	03	05	05	13
CO-5	Using Databases with Python	03	02	03	08
Total		15	17	18	50

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

The end of semester assessment for Introduction to Object Oriented Programming 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 software 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	How to Think Like a Computer Scientist: Learning with Python	Allen Downey, Jeff Elkner and Chris Meyers	SoHo Books	2009
2	Mastering Object-Oriented Programming	R.S. Salaria	Khanna Book Publishing Co., Delhi	2007
3	Lecture note provided by Dept. of CS&E, AKS University, Satna.			

B. Alternative NPTEL/SWAYAM/MOOC Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Python for Data Science	Prof. Raghunathan Rangaswami	IIT Madras
2.	The Joy of Computing Using Python	Prof. Sudarshan Prof.Yayati Gupta Iyengar	IIT Ropar, IIIT Dharwad

Curriculum Development Team

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CO-PO Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence and Data Science]
Course Code: PC202
Course Title: Object Oriented Programming

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
	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-long learning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies
CO1	3	2	3	3	3	3	1	3	1	1	1	3	2	2	3	2	3
CO2	3	3	2	3	2	2	1	2	1	1	1	3	2	3	2	**1**	3
CO3	3	2	3	3	3	2	1	2	1	1	1	3	2	2	2	**2**	3
CO4	3	2	3	2	3	2	1	3	1	1	1	3	2	2	3	**2**	2
CO5	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	**3**	2

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 the basic concepts of OOPs.	SO1.1 SO1.2 SO1.3	LI.1.1, LI.1.2, LI.1.3, LI.1.4	Unit-1.0 Introduction to Object Oriented Programming Paradigms 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	As Mentioned in Page no. ___to _
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO2: Understand the concept of Polymorphism & Inheritance	SO2.1 SO2.2 SO2.3	LI.2.1, LI.2.2, LI.2.3, LI.2.4	Unit-2 Polymorphism & Inheritance. 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 PSO: 1,2,3,4	CO3: Apply different Python library to solve programming problems.	SO3.1 SO3.2 SO3.3	LI.3.1, LI.3.2, LI.3.3, LI.3.4	Unit-3: Python libraries 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO: 1,2,3,4	CO4: Understand the advanced concepts of python and apply for Accessing web data.	SO4.1 SO4.2 SO4.3	LI.4.1, LI.4.2, LI.4.3, LI.4.4	Unit-4: Using Python to Access Web Data 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	CO 5: Understand the advanced concepts of python and apply for Accessing database.	SO5.1 SO5.2	LI.5.1	Unit5: Using Databases with Python 5.1,5.2,5.3,5.4,5.5,5.6,5.7	

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Semester-II

Course Code: **PC203**

Course Title: **Data Structures**

Pre-requisite: To study this Course, a student must have basic knowledge of computers

Rationale: Data structures are used to implement the physical forms of abstract data types. Data structures are a crucial part of designing efficient software

Course Outcomes:

After completion of course, students would be able to:

PC203.1: Understand the different types of data structure to be implemented using any programming language

PC203.2: Choose the data structures that effectively model the information in a problem and an analysis the efficiency trade-offs (run time and memory usage) among alternative data structure implementation so combinations.

PC203.3: Design, implement, test, and debug programs using a variety of data structures including stacks, queues, hash tables, binary and general tree structures, search trees, and graphs.

PC203.4: Apply efficient data structure (linked lists, stacks and queues) to solve a particular problem.

PC203.5: Apply Sorting and Searching

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)	
PC	PC203	Data Structures.	3	2	2	1	8	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 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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activityany one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PC	PC 203	Data Structures	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PC	PC 203	Data Structures	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 show casetheirmasteryofSessionOutcomes(SOs),culminatingintheoverallachievementof Course Outcomes (COs) outercourse's conclusion.

PC203.1: Understand the different types of data structure to be implemented using any programming Language.

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Approximate Hours

Item	Appx. Hrs.
Cl	12
LI	6
SW	2
SL	2
Total	22

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the Data Structures and data types **SO1.2** Explain Recursion, time and space complexity of algorithms **SO1.3** Discuss Stacks, queues, Infix, Postfix & Prefix **SO1.4** Definition double Ended dequeue **SO1.**5 Explain priority queues	LI.1.1 Write a program to implement stack in c using an array. LI.1.2 Write a program to implement queue in c using an array. LI.1.3 Write a program to implement post fix conversion in c using stack.	**Unit-1 Introduction**: (12-Lectures) 1.1 Introduction to Data Structures and data types 1.2 Efficient use of memory 1.3 Recursion 1.4 time and space complexity of algorithms 1.5 Big O Notation and the notations 1.6 Elementary Data Structures: Stacks and queues 1.7 Infix Postfix & Prefix conversions 1.8 evaluations of expressions 1.9 multiple, stacks and queues. 1.10 priority queues 1.11 double end dequeue. 1.12 implementation of stacks and queues	1.Recursion, time and space complexity of algorithms 2.Stacks, queues, Infix, Postfix & Prefix conversions

SW-1: Suggested Sessional Work (SW):

- **a. Assignments:**
  - i. Stacks, queues, Infix
  - ii. multiple, stacks and queues,
  - iii. implementation of stacks and queues
- **b. Mini Project:** None
- **c. Other Activities (Specify):** Seminar

PC203.2: Choose the data structures that effectively model the information in a problem and analyses the efficiency trade-offs (run time and memory usage) among alternative data

structure implementations or combinations.

Approximate Hours

Item	Appx. Hrs.
Cl	10
LI	6
SW	2
SL	2
Total	20

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 To Understand the Singly linked lists **SO2.2** To learn polynomial addition, sparse matrices **SO2.3** To lean about doubly linked lists **SO2.4** Explain circular linked list **SO2.5** Explain Applications of Stacks.	LI.2.1 Write a program to insert and delete elements from a singly linked list. LI.2.2 Write a program to implement doubly linked list. LI.2.3 Write a program to implement polynomial addition.	**Unit2: Linked Lists (10-Lectures)** **2.1** Singly linked lists **2.2** linked stacks and queues **2.3** polynomial addition **2.4** sparse matrices **2.5** doubly linked lists, circular linked list **2.6** dynamic storage management **2.7** Applications of Stacks **2.8** Queues and Linked lists **2.9** Garbage collection, **2.10** Josephus Problem	1.Linked stacks and queues 2. Doubly linked lists

SW-2 Suggested Seasonal Work (SW):

a. Assignments:

iv. Queues and Linked lists.
v. Garbage collection, Josephus Problem
vi. Polynomial addition, sparse matrices

PC203.3: Design, implement, test, and debug programs using a variety of data structures including stacks, queues, hash tables, binary and general tree structures, search trees, and graphs.

Approximate Hours

Item	Appx. Hrs.

Cl	8
LI	6
SW	2
SL	2
Total	18

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 To Understand Basic terminology **SO3.2**To learn binary trees, binary tree **SO3.3**To understand traversal, representations of binary tree **SO3.4 Explain t**hreaded Trees **SO3.5** learn about AVL tree-tree	LI.3.1 Write a program to implement binary tree. LI.3.2 Write a program to implement binary search tree. LI.3.3 Write a program to implement AVL tree.	**Unit3: Trees (8-Lectures)** 3.1 Basic terminology, 3.2 binary trees 3.3 traversal, representations of binary tree, 3.4 application of trees 3.5 decision tree, game trees, 3.6 Threaded Trees 3.7 Binary Search Tree, 3.8 AVL tree, B-tree	1. binary trees, binary tree 2. traversal, representations of binary tree

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**

vii. Application of trees, decision tree, game trees,

viii. traversal, representations of binary tree

ix. AVL tree, B-tree

PC203.4: Apply efficient data structure (linked lists, stacks and queues) to solve a particular problem.

Approximate Hours

Item	Appx. Hrs.
Cl	6
LI	6
SW	2
SL	2
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Evaluation of Graph presentations **SO4.2** Understanding the Graph Traversals **SO4.3** To learn 3Dijkstra's algorithm for shortest path **SO4.4** To lean about Prim's and Kruskal's Algorithm **SO4.5** Discuss Minimal Spanning tree	LI.4.1 Write a program to implement graph in c. LI.4.2 Write a program to implement graph traversal in c. LI.4.3 Write a program to implement shortest path algorithm.	**Unit-4: Graph Theory (6-Lectures)** 4.1Graph representations I 4.2 1Graph representations II 4.3 Graph Traversals I 4.4 Graph Traversals II 4.5 Dijkstra's algorithm for Shortest path 4.6 Prim's and Kruskal's Algorithm for Minimal Spanning tree.	1.Graphrepresentations 2. Prim's and Kruskal's Algorithm for Minimal Spanning tree

SW-4 Suggested Sessional Work (SW):

a. Assignments:

x. Graph Traversals

xi. 3Dijkstra's algorithm for shortest path

xii. Prim's and Kruskal's Algorithm for Minimal Spanning tree

PC203.5: Apply Sorting and Searching

Approximate Hours

Item	Appx. Hrs.
Cl	9
LI	6
SW	2
SL	2
Total	19

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

SO5.1 To Understand Linear search **SO5.2** Explain binary search and hash search **SO5.3** learn this Sorting: Insertion sort **SO5.4** To understand quick sort **SO5.5** Explain heap sort, and Bucket sort	LI.5.1 Write a program to implement linear search and binary search. LI.5.2 Write a program to implement hash search. LI.5.3 Write a program to implement all sorting methods.	**Unit5: Sorting and Searching (Lectures 9)** 5.1 Searching: Linear search, 5.2 binary search 5.3 hash search. 5.4 Sorting: Insertion sort, 5.5 selection sort bubble sort, 5.6 quick sort, 5.7 Merge sort, 5.8 heap sort 5.9 Bucket sort	1. Bubble sort 2. Bucket sort

SW-5 Suggested Sessional Work (SW):

a. Assignments:

xiii. Binary search and hash search.

xiv. Selection sort, bubble sort, quick sort

xv. Heap sort, and Bucket sort

Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
PC203.1: Understand the different types of data structure to be implemented using any programming Language.	12	02	02	16
PC203.2: Choose the data structures that effectively model the information in a problem and analyses the efficiency trade-offs (run time and memory usage) among alternative data structure implementations or combinations.	10	02	02	14

PC203.3: Design, implement, test, and debug programs using a variety of data structures including stacks, queues, hash tables, binary and general tree structures, search trees, and graphs.	08	02	02	12
PC203.4: Apply efficient data structure (linked lists, stacks and queues) to solve a particular problem	06	02	02	10
PC203.5: Apply Sorting and Searching.	09	02	02	13
Total Hours	45	10	10	65

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction and Elementary Data Structures	03	02	03	08
CO-2	Linked Lists	03	01	05	09
CO-3	Trees	03	07	02	12
CO-4	Graph Theory	03	05	05	13
CO-5	Sorting and searching	03	02	03	08
Total		15	17	18	50

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

The end of semester assessment for Introduction to Object Oriented Programming 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 software 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	Data Structures	R.S. Salari,	Khanna Book Publishing	2019
2	Data Structures and Program Design in CByRobertL Kruse,	C.L. Tondo, Bruce Leung	Pearson Education	2007
3	Expert Data Structures with C/3rdEdition	R.B. Patel	Khanna Book Publishing	2020

Curriculum Development Team

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CO, PO and PSO Mapping

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

Course Code: PC203

Course Title: Data Structures

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
	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-long learning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	
CO 1	2	2	3	3	2	1	1	1	1	1	1	3	2	2	3	2	3
CO 2	2	3	2	3	2	2	1	1	1	1	1	3	2	3	2	3	3
CO 3	2	2	2	3	2	2	1	1	1	1	1	3	2	2	2	2	3
CO 4	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	2	2
CO 5	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	2	2

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self learning (SL)
PO 1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO-1: Understand the different types of data structure to be implemented using any programming Language.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	LI.1.1, LI.1.2, LI.1.3	Unit-1.0 Introduction 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 above
PO 1,2,3,4,5,6,7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2: Choose the data structures that effectively model the information in a problem and analyses the efficiency trade-offs (run time and memory usage) among alternative data structure implementations or combinations.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LI.2.1, LI.2.2, LI.2.3	Unit-2 Linked Lists 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 : Design, implement, test, and debug programs using a variety of data structures including stacks, queues, hash tables, binary and general tree structures, search trees, and graphs.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	LI.3.1, LI.3.2, LI.3.3	Unit-3 : Trees 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: Apply efficient data structure (linked lists, stacks and queues) to solve a particular problem.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LI.4.1, LI.4.2, LI.4.3	Unit-4: Graph Theory 4.1, 4.2,4.3,4.4,4.5,4.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 5: Apply Sorting and Searching	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	LI.5.1, LI.5.2, LI.5.3	Unit-5: Sorting and searching 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	

Semester-II

Course Code: PC 204

Course Title : Discrete Mathematical structures.

Pre-requisite: Understanding of basic concepts such as groups, rings, set theory and their application.

Rationale: Mathematics is essential for everyday life and understanding our world. It helps us have better problem-solving skills.

Course Outcomes:

PC 204.1: Students would be able to Understand the concept of mathematical reasoning and their applications.

PC 204.2: Students would be able to Understand The concept of set theory and its properties.

PC 204.3: understanding mathematical concepts, including logic, set theory, and proof techniques.

PC 204.4: Students would be able to Understand Graph theory and its application.

PC 204.5: Students would be able to Understand the concept of Groups, rings fields and discrete probability and apply in real life.

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)	
PC	PC204	Discrete Mathematical structures.	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 out come 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)		
PC	PC-204	Discrete Mathematical structures.	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.

PC 204.1: Students would be able to Understand the concept of mathematical reasoning and their applications.

Approximate Hours

Item	AppX Hrs
Cl	08
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO1.1 To Understand Preposition and nigation **SO1.2** To learn about properties of conjunction form **SO1.**3 To understand The implication and equivalence **SO1.4** To know about Reasoning structure	.	**Unit-1. Mathematical reasoning** **1.1** The concept of preposition and nigation **1.2** Disjunction and conjunction **1.3** the property of conjunction and disjunction **1.4** The Implication and equivalence. **1.5** the truth table predicates quantifiers natural deduction. **1.6** The rules of inference**.** **1.7** The methods of proofs, Resolution principles. **1.8** The Application to PROLOG.	1. properties of conjunction and disjunction form with examples. 2. Question based on truth table.

W-1 Suggested Sessional Work (SW):

a. Assignments:-

i. To Evaluate prepositions and negation.
ii. The concept of disjunction and Conjunction form.
iii. Draw the truth table.
iv. Application to PROLOG.

b. Mini Project:

Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities.

PC 204.2: Students would be able to Understand The concept of set theory and its properties.

Approximate Hours

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

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO2.1 To Understand the concept of poset. **SO2.2** To learn about basic concepts of Power series. **SO2.3** To understand the Application of function.	.	**Unit-2** : **Set Theory** 2.1 paradoxes in set theory 2.2 inductive definition of sets and proof by in duction. 2.3 peano postulates. 2.4 the concept of relation. 2.5 Properties of Relation. 2.6. equivalence relation with example. 2.7 partition of sets 2.8 partial order relation or poset. 2.9 well-ordered sets.	1. About set theory. 2. Understand the concept of Relations with example .

SW-2 Suggested Sessional Work (SW):

a. Assignments:

v. Inductive definition of sets and proof by

vi. The definition of relation with example and their types

b. Mini Project:

Oral presentation, Poster presentation, Power Point Presentation.

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

Quiz,

PC 204.3: understanding mathematical concepts, including logic, set theory, and proof techniques.

Approximate Hours

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

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 To know about Statements. **SO3.2** To Understand the Operation on sets. **SO3.3** To learn about functions. **SO3.4** To Learn About Relations.	.	**Unit-3: Combinatorics and Function**. **3.1** Elementary Combinatorics. **3.2** Operation on sets and functions. **3.3** counting techniques**.** **3.4** The concept of Recurrence relation . **3.5** generating functions. **3.6** The concept of function; mappings **3.7** Injection and surjections function. **3.8** The concept of composition of function. **3.9** Inverse and special functions. **3.10** Recursive function theory.	1. Question based on Statements. 2. Functions and Relations

SW-3 Suggested Sessional Work (SW):

a. Assignments:-

vii. Question based on composition of function.
viii. Operation on sets and functions and Relations.

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

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

PC 204.4: Students would be able to Understand Graph theory and its application.

Approximate Hours

Item	AppX Hrs
Cl	9
LI	0
SW	2
SL	1
Total	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO4.1 Understanding the elements of graph theory **SO4.2** Understanding the Equivalence classes. **SO4.3**Understanding the spanning trees **So4.4** Understand the hamiltonian path	.	**Unit-4 Graph theory**. **4.1** The concept of Graph theory **4.2** definition of graph **4.3**elements of growth theory **4.4** the definition of eular graph. **4.5** the hamitonial path **4.6** The concept of tree **4.7** The tree traversals **4.8** The spanning trees. **4.9** The properties of trees. **4.10** The Represention of relations by graphs**.**	i. To Learn about. Eular graph. ii. Learn about Equivalence classes. iii. To Understand the spanning trees.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

ix. The definition and example of Graph
x. construction of trees, Spanning trees with example.
xi. The theorem based on the trees.
xii. The Representation of relation by graphs.

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

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

PC 204.5: Students would be able to Understand the concept of Groups, rings fields and discrete prob ability and apply in real life.

Item	AppX Hrs
Cl	09
LI	0
SW	2
SL	1
Total	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO5.1 Understanding properties of probability and conditional probability. **SO5.2** To learn about discrete and continuous random variables. **SO5.3** Understanding group, rings and fields theory. **SO5.4** To learn about properties of groups.		**Unit5:- Groups, rings, fields, discrete probability**. **5.1** definition and elementary properties of groups **5.2** semi groups **5.3** monaids **5.4** The concept of rings **5.5** The concept of fields **5.6** understand the vector space and lettice **5.7** Introduction discrete random variables **5.8** Application to binary search trees. **5.9** The properties of probability.	1. To learn about discrete and continuous random variables. 2. To understand the group theory.

SW-5 Suggested Sessional Work (SW):

a. Assignments:-

xiii. Definitions of probability, properties of probability and conditional probability.
xiv. moments of random variables and conditional expectation.
xv. definition and elementary properties of Groups
xvi. The concept of ring theory**.**

b. Mini Project:
NA

c. Other Activities (Specify):
NA

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
PC204.1: Students would be able to Understand the concept of mathematical reasoning and their applications.	8	2	1	11
PC204.2: Students would be able to Understand The concept of set theory and its properties.	9	2	1	12
PC204.3: understanding mathematical concepts, including logic, set theory, and proof techniques.	10	2	1	13
PC204.4: Students would be able to Understand Graph theory and its application	09	2	1	12
PC204.5: Students would be able to Understand the concept of Groups, rings fields and discrete probability and apply in real life.	09	2	1	12
Total Hours	45	10	5	60

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Mathematical reasoning.**	03	04	03	10
CO-2	**The concept of Set theory.**	02	02	01	05
CO-3	**Combinatorics and function.**	03	02	05	10
CO-4	**Graph theory.**	04	04	03	11
CO-5	**Groups, rings ,fields and discrete probability.**	03	06	05	14
Total		15	18	17	50

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

The end of semester assessment for Discrete Mathematical structures will be held with written exami-nation 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	Discrete mathemat-ics and applications.	K.H.Rosen	Tata McGraw Hill	2007 6th edi-tion
2	Discrete structures**.**	S.B.Singh	Khanna book publishing	2019 3rd edi-tion
3	Combinatorics and Graph theory.	S.B. Singh	Khanna book publishing	2018 3rd edition

B. Alternative NPTEL/SWAYAM/MOOC Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Discrete mathematical structures video course.	Prof. Ka-mala krithi vasan	IIT Madras
2.	Discrete mathematics	Prof. Su-darshan Iyengar.	IIT Ropar, IIT Gandhinagar

Curriculum Development Team

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8. Ms.Pushpa Kushwaha, Assistant Professor, Department of Computer Science and Engineering.
9. Ms.Arpana Tripathi, Assistant Professor, Department of Computer Science and Engineering.

CO, PO and PSO Mapping

Program : B. Tech. (AI/DS)
Course Code : PC-204
Course Title: Discrete Mathematical structures Concepts for AI And DS.

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
PC204.1: Students would be able to Understand the concept of mathematical reasoning and their applications.	2	2	3	1	1	1	1	1	1	1	1	2	2	2	3	3	1
PC204.2: Students would be able to Understand The concept of set theory and its properties.	2	3	2	1	2	2	1	1	1	1	1	1	2	3	2	1	1
PC204.3: understanding mathematical concepts, including logic, set theory, and proof techniques.	2	2	2	2	2	2	1	1	1	1	1	2	3	2	2	1	1
PC204.4: Students would be able to Understand Graph theory and its application	3	2	3	3	2	3	1	2	2	1	2	3	3	3	1	2	2
PC204.5: Students would be able to Understand the concept of Groups, rings fields and discrete probability and apply in real life.	3	2	3	2	3	2	1	2	1	1	2	3	2	2	1	2	2

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	**PC204.1:** Students would be able to Understand the concept of mathematical reasoning and their applications.	SO1.1 SO1.2 SO1.3 SO1.4		**Unit-1. Mathematical reasoning** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**PC204.2:** Students would be able to Understand The concept of set theory and its properties.	SO2.1 SO2.2 SO2.3 SO2.4		**Unit-2 : Set Theory** 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	**PC204.3:** understanding mathematical concepts, including logic, set theory, and proof techniques.	SO3.1 SO3.2 SO3.3 SO3.4		**Unit-3: Combinatorics and Function** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**PC204.4:** Students would be able to Understand Graph theory and its application	SO4.1 SO4.2 SO4.3 SO4.4		**Unit-4 Graph theory** 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	**PC204.5:** Students would be able to Understand the concept of Groups, rings fields and discrete probability and apply in real life.	SO5.1 SO5.2 SO5.3 SO5.4		**Unit5:- Groups, rings, fields, discrete probability** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

Semester-II

Course Code: PC205

Course Title: Modern Computer Architecture

Pre- requisite: Basics of understanding of operating system, digital system, low level programming knowledge etc.

Rationale: The computer architecture governs the design of a family of computers and defines the logical interface that is targeted by programming languages and their compilers.

Course Outcomes:

On successful completion of this course, the students will be able to:

PC205.l Understand the organization of the Control unit, Arithmetic and Logical unit, Memory unit and the I/O unit.

PC205.2 Analyze different computer architectures and their applications.

PC205.3 Understand modern design structures of Pipelined and Multiprocessors systems.

PC205.4 Understand distributed computing architecture and high-performance computing.

PC205.5 Work on CUDA programming that enable them to harness the computational power of GPUs for general-purpose computing tasks.

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)	
PC	PC205	Modern Computer Architecture	3	0	2	2	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 teachers ensure outcome of Learning.

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

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 Test2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activityany one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PC	PC 205	**Modern Computer Architecture**	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.

PC205.l Student will able to understand the organization of the Control unit, Arithmetic and Logical unit, Memory unit and the I/O unit.

Approximate Hours

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

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

SO1.1 Understand the logic of combinational and sequential circuits. **SO1.2** Understanding computer registers and instructional cycle. **SO1.3** Understand adder and subtractor circuits. **SO1.4** Understanding pipelining. **SO1.5** Understand cache characteristics and architecture. .		**Unit-1.0 Basics** **(12 Lectures)** **1.1** Designing combinational and sequential logic **1.2** computer registers and instructions **1.3** timing and control and instructions cycle **1.4** memory reference instruction **1.5** I/O interruption **1.6** Adder and Subtractor circuits **1.7** Booth Multiplication Algorithm **1.8** Pipelining Review **1.9** control hazards and the motivation forcaches **1.10** cache characteristics and basic superscalar architecture basics	1. Read the topics related to digital logic design, computer architecture, and computer organization.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Explain Booth multiplication algorithm for multiplying binary numbers using shifts and additions.

ii. Explain I/O operations that may interrupt the normal program execution for handling external events.

b. Mini Project: Design combinational and sequential circuits.

b. Other Activities (Specify): Evaluate the purpose of cache memory & it's types.

PC205.2 Analyze different computer architectures and their applications.

Approximate Hours

Item	Appx. Hrs.
Cl	14
LI	0
SW	2
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self learning (SL)
SO2.1 To Understand memory technologies use in computers. **SO2.2** To learn about locality principles and caching. **SO2.3** To understand the working of cache memory and problems. **SO2.4** To learn about various optimization techniques to improve overall system performance. **SO2.**5 To learn about Advanced NoC topics may include fault tolerance, power management, and Quality of Service (QoS).		**Unit 2.0- Multi-core Architecture** **(15 Lectures)** 2.1 Memory technologies 2.2 Hierarchical memory systems 2.3 the locality principle and caching 2.4 direct- mapped caches and block size 2.5 cache conflicts 2.6 associative caches 2.7 write strategies 2.8 advanced optimizations 2.9 performance improvement techniques 2.10 DRAM – organization, access techniques, scheduling algorithms and signal systems. 2.11 Tiled Chip Multicore Processors (TCMP) 2.12 Network on Chips (NoC) 2.13 NoC router – architecture, design, routing algorithms and flow control techniques 2.14 Advanced topics in NoC and storage – compression, prefetching, QoS	1. Learn about NoC that is a communication infrastructure for connecting cores on a chip.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Explain hierarchical memory systems involve organizing memory into multiple levels with different access speeds and capacities.

ii. Explain cache conflicts occur when multiple memory blocks map to the same cache location.

b. Mini Project:

Write down memory scheduling algorithms and signal systems govern how memory requests are prioritized and managed.

c. Other Activities (Specify):

Collect information about Advanced NoC topics.

PC205.3 Understand modern design structures of Pipelined and Multiprocessors systems.

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Understand how Parallel multiprocessors and multicomputer systems involve multiple processors or computers working together to solve a problem. **SO3.2** Understand distributed and concurrent programs. **SO3.3** Differentiate between Synchronous vs. Asynchronous Executions.		**Unit-3.0 Distributed Computing Systems and Concurrency** (11 Lectures) 3.1 Relation to Parallel Multiprocessors/multicomputer System Design Concepts 3.2 Distributed and Concurrent Programs 3.3 Message Passing vs. Shared Memory Systems 3.4 Synchronous vs. Asynchronous Executions 3.5 Design Issues and Challenges 3.6 Distributed Computing Technologies 3.7 Clocks and Synchronization 3.8 Coordination and Agreement Algorithms 3.9 Global state and distributed Transactions I	1. Read about Researches in these fields need to consider issues like scalability, fault tolerance, and communication protocols to design robust and high-performance distributed applications.

SO3.4 Understand clock and synchronization. **SO3.5** Understand how to Manage a global state in a distributed system.			

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. How distributed transactions ensure atomicity, consistency, isolation, and durability across multiple nodes.

ii. Differentiate between Synchronous vs. Asynchronous Executions.

b. Mini Project:

c. Other Activities (Specify):

i. How Parallel Multiprocessors/Multicomputer Systems can improve performance and solve larger computational tasks.

PC205.4 Understand distributed computing architecture and high-performance computing.

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)
SO4.1 Understanding HPC architecture involves designing systems that can deliver high performance for demanding computational tasks. **SO4.2** Understand about		**Unit-4 : High Performance Computing (HPC)** (12 Lectures) 4.1 HPC Architecture 4.2 Parallel Processing 4.3 Parallel Memory Models 4.4 Data vs. Task Parallelism 4.5 High Throughput	1. Use of HTC in scientific computing, data analysis, and distributed computing environments.

Parallel processing involves breaking down a computational task into smaller subtasks that can be executed simultaneously. **SO4.3**Understand Data vs. Task Parallelism **SO4.4** Understand vectorization that involves performing multiple operations simultaneously by applying the same operation to elements of a vector or array. **SO4.5** Understanding concurrent execution of multiple threads within a single process.		Computing 4.6 Vectorization 4.7 Multithreading	

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Explain how multithreading is important.

ii. Explain how parallel processing speed up the execution of complex computations.

b. Mini Project:

c. Other Activities (Specify):

Understanding these concepts is crucial for designing and optimizing applications for high-performance computing environments.

PC205.5 Student will able to work on CUDA programming that enable them to harness the computational power of GPUs for general-purpose computing tasks.

Approximate Hours

Item	Appx. Hrs.
Cl	5
LI	0
SW	2
SL	1
Total	08

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Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Understand basic principles of CUDA programming. **SO5.2** Understanding the concept of threads and blocks. **SO5.3** Learn CPU and GPU. **SO5.4** Understanding GPU and CPU data exchange.		**Unit-5 : High Performance Computing with CUDA (9 Lectures)** 5.1 CUDA programming model 5.2 Basic principles of CUDA Programming. 5.3 Concepts of threads 5.4 Concept of blocks 5.5 GPU and CPU data exchange	1. Learn GPU and CPU data exchange.

SW-5 Suggested Sessional Work (SW):

a. Assignments

i. Explain CUDA programming model

ii. Explain threads and clocks.

b. Mini Project:

i. Implement CUDA programming.

c. Other Activities (Specify):

Explain how GPU and CPU data exchange can take place.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
PC205.l Understand the organization of the Control unit, Arithmetic and Logical unit, Memory unit and the I/O unit.	10	2	1	15
PC205.2 Analyze different computer architectures and their applications.	14	2	1	18
PC205.3 Understand modern design structures of Pipelined and Multiprocessors systems.	9	2	1	14

PC205.4 Understand distributed computing architecture and high-performance computing.	7	2	1	15
PC205.5 Student will able to work on CUDA programming that enable them to harness the computational power of GPUs for general-purpose computing tasks.	7	2	1	13
Total Hours	45	10	5	60

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
PC205.l	Understand the organization of the Control unit, Arithmetic and Logical unit, Memory unit and the I/O unit.	02	02	01	05
PC205.2	Analyze different computer architectures and their applications.	03	04	02	09
PC205.3	Understand modern design structures of Pipelined and Multiprocessors systems.	03	04	03	10
PC205.4	Understand distributed computing architecture and high-performance computing.	02	07	05	14
PC205.5	Student will able to work on CUDA programming that enable them to harness the computational power of GPUs for general-purpose computing tasks.	03	05	04	12
Total		13	22	15	50

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

The end of semester assessment for modern computer architecture 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 area where HPC is used
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 System & Architecture	M. Morris Mano	Prentice Hall of India	2002
2	Computer Architecture-A quantitative approach	John L. Hennessy and David A Patterson	Morgan Kaufmann/ Elsevier	4th Edition, 2007
3	Computer architecture and organization	Hayes. J.P	McGraw-Hill Companies	1998
4	Parallel Computer Architecture: A Hardware/Software Approach	David Culler and J.P.Singh with Anoop Gupta	Morgan Kaufmann	1998
5	https://onlinecourses.nptel.ac.in/noc20_cs41/preview			
6	https://www.coursera.org/learn/introduction-high-performance-computing#syllabus			

Curriculum Development Team

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7. Ms. Pinki Sharma, Assistant Professor, Department of Computer Science and Engineering.
8. Ms. Pushpa Kushwaha, Assistant Professor, Department of Computer Science and Engineering.

CO, PO and PSO Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence and Data Science]
Course Code: PC205
Course Title: Modern Computer Architecture

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
	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-long learning	knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO1	2	2	3	3	2	1	1	1	1	1	1	3	2	2	3	3	3
CO2	2	3	2	3	2	2	1	1	1	1	1	3	2	3	2	3	3
CO3	2	2	2	3	2	2	1	1	1	1	1	3	2	2	2	3	3
CO4	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	2	2
CO5	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	2	2

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self learning (SL)
PO 1,2,3,4,5,6,7,8,9 ,10,11,12 PSO 1,2, 3, 4	CO-1: Understand the organization of the Control unit, Arithmetic and Logical unit, Memory unit and the I/O unit.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 Basics 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9.1.10	As mentioned in page numbe r
PO 1,2,3,4,5,6,7,8,9 ,10,11,12 PSO 1,2, 3, 4	CO 2: Analyze different computer architectures and their applications or combinations.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2 Multi-core Architecture 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	**CO 3:** Understand modern design structures of Pipelined and Multiprocessors systems.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3: Distributed Computing Systems and Concurrency 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:** Understand distributed computing architecture and high-performance computing.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4: High Performance Computing (HPC) 4.1,4.2,4.3,4.4,4.5,4.6,4.7	
PO 1,2,3,4,5,6,7,8,9, 10,11,12 PSO 1,2, 3, 4	**CO 5**: Apply CUDA programming that enable them to harness the computational power of GPUs for general-purpose computing tasks.	SO5.1 SO5.2 SO5.3 SO5.4		Unit 5: High Performance Computing with CUDA 5.1,5.2,5.3,5.4,5.5	

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(Revisedason01August2023)

Semester II

Course Code: HS102

Course Title: Design Thinking

Pre- requisite: Strong background in Basic Design Skills, Understanding of Databases, Security & Privacy Basics.

Rationale: Design thinking is an extension of innovation that allows you to design solutions for end users with a single problem statement in mind.

Course Outcomes:

HS102.1: Demonstrate knowledge of An Insight to Learning

HS102.2: Apply Security in Remembering Memory.

HS102.3: Use Emotions: Experience & Expression

HS102.4: Basics of Design Thinking

HS102.5: Being Ingenious & Fixing Problem and Process of Product 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)	
HS	HS102	Design Thinking	0	2	0	1	3	1

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

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

Scheme of Assessment:

Practical

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)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
ES	ES104	Programming for 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.

HS102.1: Demonstrate knowledge of An Insight to Learning

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)

SO1.1 Understand the Learning Process **SO1.2** Interpreting	**Unit-1.0** An Insight to Learning 1.1 Understanding the Learning Process 1.2 Kolb's Learning Styles 1.3 Assessing Interpreting.		1.Practice on the Learning Process

HS102.2: Exploring Remembering Memory

Approximate Hours

Item	AppX Hrs.
Cl	0
LI	6
SW	2
SL	1
Total	9

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Understand Memory process **SO2.2** Use retention	**Unit-2.0** Remembering Memory 2.1. Understanding the Memory process, 2.2. Problems in retention 2.3. Memory enhancement techniques.		1. How security is achieved in Memory process

HS102.3: Exploring Security Issues and Access Management in cloud system.

Approximate Hours

Item	AppX Hrs.
Cl	0
LI	6
SW	2
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Understand the Emotions	**Unit-3.0** Emotions: Experience & Expression 3.1. Understanding Emotions 3.2. Experience & Expression, 3.3. Assessing Empathy, Application with Peers		1. Analyze Data Security Emotions

HS102.4: Familiarize with Security Management in the Cloud and Privacy Issues.

Approximate Hours

Item	AppX Hrs.
Cl	0
LI	6
SW	2
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand the concept and purpose of Design Thinking.	**Unit-4.0** Basics of Design Thinking 4.1. Definition of Design Thinking, Need for Design Thinking, 4.2. Objective of Design Thinking, Concepts & Brainstorming, 4.3. Stages of Design Thinking Process (explain with examples) – Empathize,		1. Compare Design Thinking

	Define, Ideate, Prototype, Test		

HS102.5: Comprehend the use of data visualization.

Approximate Hours

Item	AppX Hrs.
Cl	0
LI	6
SW	2
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand the Creative thinking process	**Unit-5.0** Being Ingenious & Fixing Problem 5.1Understanding Creative thinking process 5.2Understanding Problem Solving Testing Creative Problem Solving Process of Product Design 5.3 Process of Engineering Product Design Design Thinking Approach Stages of Product Design Examples of best product designs and functions Assignment – Engineering Product Design		1. Compare and analyze Creative thinking process

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
HS102.1: Demonstrate knowledge of An Insight to Learning	00	06	02	01	9

HS102.2: Apply Security in Remembering Memory.	00	06	02	01	9
HS102.3: Use Emotions: Experience & Expression	00	06	02	01	9
HS102.4: Basics of Design Thinking	00	06	02	01	19
HS102.5: Being Ingenious & Fixing Problem and Process of Product Design	00	06	02	01	11
Total Hours	00	30	09	06	15

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	An Insight to Learning	03	02	03	08
CO-2	Remembering Memory	03	01	04	08
CO-3	Emotions, Experience & Expression	02	05	02	10
CO-4	Basics of Design Thinking	02	05	04	08
CO-5	Being Ingenious & Fixing Problem	03	02	03	08

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

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

Suggested Instructional/Implementation Strategies:

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

Suggested Learning Resources:

A. Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Design Thinking for Innovation Research and Practice	Walter Brenner, Falk Uebernickel	Springer	2016
2	Design your Thinking	Pavan Soni	Penguin Random House India Private Limited	2020
3	Design Thinking for beginners	Kilian Langenfeld	Tim Ong	2019

Curriculum Development Team

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CO-PO Mapping:

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence and Data Science]
Course Code: HS102
Course Title: Design Thinking

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
	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-long learning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies
HS102.1: Demonstrate knowledge of An Insight to Learning	3	2	3	3	3	3	1	3	1	1	1	3	2	2	3	2	3
HS102.2: Apply Security in Remembering Memory.	3	3	2	3	2	2	1	2	1	1	1	3	2	3	2	1	3
HS102.3: Use Emotions: Experience & Expression	3	2	3	3	3	2	1	2	1	1	1	3	2	2	2	2	3
HS102.4: Basics of Design Thinking	3	2	3	2	3	2	1	3	1	1	1	3	2	2	3	2	2
HS102.5: Being Ingenious & Fixing Problem and Process of Product Design	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	3	2

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: Demonstrate knowledge of An Insight to Learning.	SO1.1 SO1.2	1.1, 1.2, 1.3		As Mentioned in Page no. ___to _
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO2: Apply Security in Remembering Memory.	SO2.1 SO2.2	2.1, 2.2		
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO: 1,2,3,4	CO3: Use Emotions: Experience & Expression	SO3.1	3.1, 3.2, 3.3		
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO: 1,2,3,4	CO4: Basics of Design Thinking.	SO4.1	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	CO 5: Being Ingenious & Fixing Problem and Process of Product Design	SO5.1	5.1, 5.2, 5.3, 5.4	.	

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(Revisedason01August2023)

Semester-II

Course Code: AU302

Semester-II

Course Title: Indian Knowledge System

Pre- requisite: Creating awareness among the youths about the true history and past rich culture of India.

Rationale: India has very rich and versatile knowledge system and cultural heritage since antiquity. The Indian Knowledge systems was developed on life science, medical science, literature, drama, art, music, dance, astronomy, mathematics, architecture (Sthapatyaveda), chemistry, aeronautics etc, during ancient period. In this basic course, a special attention is given to the ancient and historical perspective of ideas 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- AU302 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- AU302II: Students will have the ability to learn about ancient books, Religious places, basic concept of Indian dance, music and arts, and fundamental aspects of Sangeeta and Natyashashtra etc.

CO- AU302III: 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- AU302 IV: Understanding on ancient Engineering, Science and Technology, Town Planning, Temple architecture, Chemistry and Metallurgy, Metal manufacturing etc.

CO- AU302 V: Student will able to understand about the Life, Nature and Health through basic concept of Ayurveda and Yoga, Traditional Medicinal Systems, Ethnomedicine, Nature conservation, World Heritage Sites etc.

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

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	
AU	**AU302**	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.

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.

AU302**. 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) SO 1.2. Understand Classification of Ancient IKS texts SO 1.3. Understand Introduction to Panch Mahabhutas (Earth, Water, Fire, Sky and Air) SO 1.4. Understand Origin of the name Bharatvarsha: the Land of Natural Endowments SO 1.5. Understand Rivers of ancient India (The Ganga, Yamuna, Godawari, Saraswati, Narmada, Sindhu and Kaveri) SO 1.6. Understand Ancient		**Unit-1. Indian Civilization and Indian Knowledge Systems** 1.1. Overview of Indian Knowledge Systems (IKS) 1.2 Classification of Ancient IKS texts 1.3 Introduction to Panch Mahabhutas (Earth, Water, Fire, Sky and Air) 1.4 Origin of the name Bharatvarsha: the Land of Natural Endowments 1.5 Rivers of ancient India (The Ganga, Yamuna, Godawari, Saraswati, Narmada, Sindhu and Kaveri) 1.6 Agriculture system in ancient India, Ancient Universities: Takshashila	Golden era of ancient India
Agriculture and ancient Universities: Takshashila and Nalanda, Gurukul system		and Nalanda, Gurukul system	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Concepts of Panch Mahabhuta, Classification of ancient texts, origin of ancient rivers

b. Mini Project:

i. Ancient Universities: Takshashila and Nalanda,

c. Other Activities (Specify):

AU302. 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,		**Unit-2. Indian Art, Literature and Religious Places**	**1.** Indian Art, Music and Dance
Upanishads, Mahakavyas (Ramayana & Mahabharata), Smrities, Samhitas SO 2.2. 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		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	

regions of India		India	

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):

AU302. 3: Student will be able to understand Ancient 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		**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	1. Ancient Science, Astronomy and Vedic Mathematics

planetary model of Aryabhatta SO 3.6. Understand the Varanamala of Hindi language based on classification of sounds on the basis of their origin, Basic purpose of science of Vyakarana		model of Aryabhatta 3.6. Varanamala of Hindi language based on classification of sounds on the basis of their origin, Basic purpose of science of Vyakarana.	

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):

AU302. 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		**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	2. Ancient Science, Astronomy and Vedic Mathematics

as gleaned from archeological artifacts SO 4.4. Understand the Chemistry of Dyes, Pigments used in Paintings, Fabrics, Potteries and Glass SO 4.5. Understand the Temple Architecture: Khajuraho,		Metallurgy as gleaned from archeological artifacts 4.4 Chemistry of Dyes, Pigments used in Paintings, Fabrics, Potteries and Glass 4.5.Temple Architecture:	
Sanchi Stupa, Chonsath Yogini temple SO 4.6. Understand the Mining and manufacture in India of Iron, Copper, Gold from ancient times		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):

AU302. 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		**Unit-5. Life, Nature and Health** 5.1.Fundamentals of Ayurveda (Charaka & Shushruta) and Yogic Science (Patanjali), Ritucharya and Dinacharya	1. Concept of Ayurveda and Yoga 2. Traditional system of Indian medicines 3. Ethnobotan
(Ayurveda, Siddha, Unani and Homoeopathy) SO 5.3. 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		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	y 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)
AU302 1: To understand Indian Civilizationand Indian Knowledge Systems	**6**	**2**	**1**	**9**

AU302 2: Students will have the ability to apply the knowledge gained about Indian Art, Literature and Religious Places	**6**	**2**	**1**	**9**
AU302 3: Student will be able to understand the Ancient Science, Astronomy and VedicMathematics	**6**	**2**	**1**	**9**
AU302 4: Understand the Engineering, Technology and Architecture	**6**	**2**	**1**	**9**
AU302. 5: Understand about the Life, Natureand 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 Someswvara's Manasollasa*	Mishra, Shiv Shankar	Krishnadas Academy, Varanasi	1982
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 : BS-201

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	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	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science
BS-201. **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
BS-201. **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
BS-201. **3:** Student will be able to understand the Ancient Science, Astronomy and Vedic Mathematics	2	2	2	2	2	2	1	1	1	1	1	2	1	2	1	2
BS-201. **4:** Understand the Engineering, Technology and Architecture	3	2	3	3	2	3	1	2	2	1	2	3	3	3	2	1
BS-201. **5:** Understand about theLife, Nature and Health	3	2	3	2	3	2	1	2	1	1	2	3	2	3	2	1

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	**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	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 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	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**IKS. 3:** Student will be able to understand the Ancient Science, Astronomy and Vedic Mathematics	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5 SO3.6		**Unit-3. Ancient Science, Astronomy, Mathematics** 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, 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	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 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 - III

Semester-III

Course Code: PC301

Course Title: Algorithms Analysis and Design

Pre- requisite: Data Structures and

Rationale: Study of this subject help students to understand different problem-solving skills like divide and conquer, Dynamic programming, Greedy Strategy and Back Tracking. These problem-solving skills will develop intelligence in student to solve real time problems of society and Industry.

Course Outcomes:

CO.1. Demonstrate knowledge of Graph and its applications.
CO.2. Apply greedy approach and Huffman coding.
CO.3. Use various divide and conquer algorithm and recurrence relation
CO.4. Familiarize with the dynamic programming approach
CO.5. Comprehend the use of concept of computation and network flow.

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)	
PC	PC301	Algorithm Analysis and Design	3	2	1	1	7	4

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

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

Scheme of Assessment:

Theory

Board of Study	Course	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment5 number3 marks	Class Test2(2 best out of 3)10 markseach CT)	Seminar one(SA)	Class Activityany one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+ AT)		
PC	PC301	Algorithms Analysis and Design	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PC	PC301	Algorithms Analysis and Design	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.

CO.1: Demonstrate knowledge of Graph and its applications.

Approximate Hours

Item	Appx Hrs.
Cl	5
LI	8
SW	2
SL	1
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the concept of Graph **SO1.2** Compare DFS and BFS **SO1.3** Analyze connectivity of graphs.	1. Program to implement Heap sort 2. Program to implement Quick sort. 3. Program to implement Graph Traversal: Breadth First Traversal 4. Program to implement Graph Traversal: Depth First Traversal	**Unit-1.0** Applications of Graph Search 1.1 Intro Graph Search algorithms 1.2 BFS, Application and example of BFS 1.3 DFS, Application and Example of DFS 1.4 Checking if an undirected graph is 2-edge connected 1.5 Checking if a directed graph is strongly connected	1. Discuss terminology related to graph. 2. See applications of graph.

SW-1 Suggested Sessional Work (SW):

Assignments:

i. Numerical based on BFS.
ii. Numerical based on DFS
iii. Numerical based on Graph

CO.2: Apply greedy approach and Huffman coding.

Approximate Hours

Item	Appx. Hrs.
Cl	7
LI	6
SW	2
SL	1
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Understand the concept of Greedy approach. **SO2.2** Use of Kruskal and prim algorithms. **SO2.3** Demonstrate the use of Huffman coding.	1. Program to implement Knapsack problem using Greedy method. 2. Program to implement Prim's algorithm using Greedy method. 3. Program to implement Kruskal's algorithm using Greedy method	**Unit-2.0** Greedy algorithms 2.1. Introduction to the greedy paradigm 2.2. Some Greedy algorithms 2.3. Examples of activity selection 2.4. Examples of deadline scheduling 2.5. fractional knapsack 2.6. Kruskal's algorithm for minimum spanning trees 2.7. Huffman coding	1. Prim's algorithm for minimum spanning trees. 2. Examples where greedy algorithms are not optimal.

SW-1 Suggested Sessional Work (SW):

Assignments:

iv. Other algorithms based on Greedy approach.
v. Numerical based on fractional knapsack.
vi. Numerical based on Huffman Coding.

CO.3: Use various divide and conquer algorithm and recurrencerelation.

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)
SO3.1 Understand the concept of Divide and conquer **SO3.2** Use various Divide and conquer algorithms. **SO3.3** Solve recurrence relation	1. Program to implement Binary Search using Divide and Conquer. 2. Program to implement minimum and maximum using Divide and Conquer. 3. Program to implement Merge sort using Divide and Conquer	**Unit-3.0** Divide and Conquer 3.1. Intro to Divide and conquer approach Explain why the divide andconquer paradigm is useful. 3.2. Illustrate the paradigm through integer multiplication. 3.3. Writing recurrence relations and solving them.Various methods to solve recurrence relation -I 3.4. Various methods to solve recurrence relation -II 3.5. Further examples from geometry – domination numberof a set of points, 3.6. Identifying maximal points, closest pair of points. 3.7. Linear time algorithm for finding the median. 3.8. Randomized divide and conquer algorithms: 3.9. randomizedquicksort and 3.10. selection	1. Solve some recurrence relations. 2. Modify discussed algorithms (e.g., dividing into three parts instead of two parts, or two unequal parts, etc.)and analyze using recurrences. 3. Some elementary exercises on expectation calculation.

SW-1 Suggested Sessional Work (SW):

Assignments:

vii. Numerical based on Fuzzy logic.
viii. Numerical based on Membership Function.
ix. Numerical based on Genetic algorithm.

CO.4: Familiarize with the dynamic programming approach.

Approximate Hours

Item	Appx. Hrs.
Cl	9
LI	6

SW	2
SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand the concept of Dynamic Programming **SO4.2** Understand the concept of shortest paths **SO4.3** Analyze various dynamic programming algorithms.	1. Program to implement 8-Queen's problem using Backtracking 2. Program to implement All Pairs Shortest Path Using Dynamic Programming. 3. Write a program to solve N-QUEENS problem	**Unit-4.0** Dynamic Programming and shortest paths 4.1. Computing Fibonacci numbers and why divide-and- conquer is not a good idea. Ideaof storing function calls, tables 4.2. Notion of sub problems and optimal substructure. Illustration through subset sum 4.3. (integer) knapsack 4.4. longest increasing subsequence 4.5. longestcommon subsequence 4.6. matrix chain multiplication 4.7. Dijkstra's algorithm for single-source shortest paths 4.8. Bellman-Ford forSSSP with negative weights 4.9. Floyd Warshall for APSP	1. Exercises on dynamic programming.

SW-1 Suggested Sessional Work (SW):

Assignments:

i. Questions based on frames.
ii. Questions based on scripts.
iii. Questions based on formal logic.

CO.5: Comprehend the use of concept of computation and network flow.

Approximate Hours

Item	Appx. Hrs.
Cl	14
LI	04
SW	02
SL	01
Total	21

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO5.1 Understand the concept of Network flows. **SO5.2** Understand the concept of computations.	1. Write a program to solve Sum of subsets problem for a given set of distinct numbers. 2. Write a program to find Maximum and Minimum of the given set of integer values.	**Unit-5.0** Network flows & Intractability 5.1. The maximum s-t flow problemin capacitated networks 5.2. Ford Fulkerson algorithm or maximum flow 5.3. Max-flow min-cut theorem, integrality of maximum flow for integral capacities 5.4. Applications of max flow to maximum bipartite matching, max disjoint paths 5.5. Models of computation, Turing machines 5.6. PRAM model, Brief discussion on other modelsof computation e.g. PRAM model 5.7. Memory Hierarchy 5.8. Notion of polynomial timecomputation 5.9. Polynomial time reductions 5.10. Yes and No	1. Exercises on reductions 2. Exercises on NP-completeness. 3. Problems which areNP-hard but not in NP. 4. Examples of poly time reductions.

		instances of decision problems. Decision vs optimization. 5.11. NP as a class of problems with Yes certificates which can be efficiently checked 5.12. NP-hardness and Cook-Levin theorem (just the statement). 5.13. NP-completeness. 5.14. Examplesof Reductions.	

SW-1 Suggested Sessional Work (SW):

Assignments:

i. Different types of learning techniques.
ii. Use of Dempster-Shafer Theory of Evidential reasoning

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)
CO.1 Demonstrate knowledge of Graph and its applications.	05	08	02	01	16
CO2. Apply greedy approach and Huffman coding.	07	06	02	01	16
CO3. Use various divide and conquer algorithm and recurrence relation	10	06	02	01	19
CO4. Familiarize with the	09	06	02	01	18

dynamic programming approach					
CO5. Comprehend the use of concept of computation and network flow.	14	04	02	01	21
Total Hours	45	30	10	5	90

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Applications of Graph Search	03	02	03	08
CO-2	Greedy algorithms	03	01	05	09
CO-3	Divide and conquer	03	07	02	12
CO-4	Dynamic Programming and shortest paths	03	05	05	13
CO-5	Network flows & Intractability	03	02	03	08
Total		15	17	18	50

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

The end of semester assessment for Introduction to Portland cement 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:

A. Books:

S.No.	Title	Author	Publisher	Edition &Year
1	Algorithm Design	Jon Kleinberg and Éva Tardos	Pearson.	1st Edition
2	Algorithms	Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani	MIT Press	3rd Edition
3	Introduction to Algorithms	Thomas H Cormen, Charles E Lieserson, Ronald L Rivestand Clifford Stein	McGraw-Hill	2nd Edition
4	Algorithm Design: Foundations, Analysis, and Internet Examples	Michael TGoodrich and Roberto Tamassia	Wiley	2nd Edition

B. Alternative NPTEL/SWAYAM/MOOC Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Design and Analysis of Algorithms	Prof. Madhavan Mukund	Chennai Mathematical Institute
2.	Design and Analysis of Algorithms	Prof. Abhiram Ranade	IIT Bombay

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CO, PO and PSO Mapping

Program Name: Algorithm Analysis and Design
Course Code :PC301
Course Title: Design and Analysis of Algorithm

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Computational information	Difficulty Analysis	Drawing / Improvement of Solutions	Accomplish Investigations of Compound Computing Troubles	: Current Implement Procedure	Proficient Principles	Ultimate Education	Mission Administration	Announcement Usefulness	Public & Ecological Alarm	Personality & Group Job	Modernization and Private Enterprise	An ability to enhance the application of knowledge of theory subjects in diverse fields	Develop language proficiency to handle corporate communication demands.	Preparing students in various disciplines of technologies such as computer applications, computer networking, software engineering, JAVA, database concepts and programming	In order to enhance programming skills of the young IT professionals, the concept of project development in using the technologies learnt during the semester has been introduced
CO.1 Demonstrate knowledge of Graph and its applications.	3	2	3	3	2	1	1	1	1	2	1	3	2	2	3	3
CO2. Apply greedy approach and Huffman coding.	2	3	3	3=2	2	2	1	2	1	2	1	3	2	3	2	3
CO3. Use various divide and conquer algorithm and recurrence relation	2	2	2	3	2	2	2	1	1-2	1	1	3	2	2	2	3
CO4. Familiarize with the dynamic programming approach	2	2	3	2	2	2	1	1	1	1	2	3	2	2	3	2
CO5. Comprehend the use of concept of computation and network flow.	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	2

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 Demonstrate knowledge of Graph and its applications	SO1.1 SO1.2 SO1.3	LI1.1,LI1.2 ,LI1.3,LI1. 4	Unit-1.0 Applications of Graph Search 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	As Mentioned in Page no. _____to _____
PO: 1,2,3,4,5,6, 7,8,9,10,11, 12 PSO:1,2,3,4	CO.2 Apply greedy approach and Huffman coding	SO2.1 SO2.2 SO2.3	LI2.1,LI2.2 ,LI2.3,	Unit-2 Greedy algorithms 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	CO.3 Use various divide and conquer algorithm and recurrence relation	SO3.1 SO3.2 SO3.3	LI3.1,LI3.2 ,LI3.3,	Unit-3: Divide and Conquer 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	
PO: 1,2,3,4,5,6, 7,8,9,10,11, 12 PSO:1,2,3,4	CO.4 Familiarize with the dynamic programming approach	SO4.1 SO4.2 SO4.3	LI4.1,LI4.2 ,LI4.3,	Unit-4 : Dynamic Programming and shortest paths 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	CO.5 Comprehend the use of concept of computation and network flow	SO5.1 SO5.2	LI5.1,LI5.2	Unit5: Network flows & Intractability 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10, 5.11,5.12,5.13,5.14,5.16,5.17,5.18	

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

Semester-III

Course Code: PC302

Course Title: Database Systems

Pre- requisite: Student should have a basic understanding of fundamental computer knowledge that includes concepts of computer architecture, storage and hardware.

Rationale: Database systems help users share data quickly, effectively, and securely across an organization.

Course Outcome:

PC302.1: Understand the basics of databases and data management.

PC302.2: Understand various theoretical and practical principles involved in the design and use of databases systems with the help of database.

PC302.3: Understand Transaction management.

PC302.4: Design and implement databases for various scenarios.

PC302.5: Design a database scenario for handling big data.

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 (PC)	PC302	**Database Systems**	3	2	1	1	7	4

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

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

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

SL: Self Learning,

C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback 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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PCC	PC302	Database System	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PC	PC302	Database System	35	5	5	5	50	50	100

Course-Curriculum Detailing: This course syllabus illustrates the expected learning achievements, bothat 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), andSelf 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.

PC302.1. Understand the basics of databases and data management.

Item	AppX Hrs
Cl	8
LI	2
SW	1
SL	1
Total	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand about concept of DBMS **SO1.2** Understand about Data Models **SO1.3** Understand about DBMS Elements **SO1.4** Classification of DBMS. **SO1.5** Understand about concurrency control. **SO1.**6 use of Lock based concurrency control **SO1.7** Learn about Time stamping	LI1.1 Installation process of RDBMS (Oracle, MYSQL). LI1.2 Create a database using database templates.	**Module-1.0** **Introduction**: 1.1 Characteristics and fundamental concepts of Databases 1.2 Types of Data Models and Data Modelling 1.3 Elements of Database Systems. 1.4 Classification and comparison of Database Management Systems (Regular	1. Learn about data structure and algorithm.

methods.		and NoSQL Page). 1.5 concurrency control 1.6 Lock based concurrency control 1.7 Time stamping methods.	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. What do you mean by data models? Explain network, hierarchical and relational model in detail.

ii What do you mean by database? What is the purpose of a database system? Explain.

b. Mini Project:

i. Draw the scheme of university database.

c. Other Activities (Specify):

Main problems in using Concurrency

PC302.2 Understand various theoretical and practical principles involved in the design and use of databases systems with the help of database.

Item	AppX Hrs
Cl	8
LI	3
SW	2
SL	1
Total	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Understand Structure data. **SO2.2** About relational database	LI 2.1 Create an ER-Diagram for College. LI 2.2 Create a relationship in	**Module-2.0 Structured and semi-structured data management:**	SL1. Learn about E-R model and how are they represented in an E-R model.

SO2.3 About relational model **SO2.4** Understand about functional Dependencies **SO2.5** use of normalization. **SO2.**6 understand query optimization **SO2.7** understand semi-structured data abstraction. **SO2.**8 about representation of data, and search.	Employee Database between two tables. LI2.3 Given a relation R (A, B, C, D) and Functional Dependency set FD = {AB → CD, B → C}, determine whether the given R is in 2NF? If not convert it into 2 NF.	2.1 Structured data. 2.2 Relational databases. 2.3 Relational model 2.4 Functional Dependencies 2.5 normal forms 2.6 algorithms for query optimization 2.7 Semi-structured data, document-databases, semi-structured data abstraction 2.8 Representation, and search.	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Explain the various terms of an E-R model and how are they represented in an E-R model.

b. Mini Project:

Faculty to follow the transactions and processes of textbooks distributed to the students. Complete an information level design for a database that must satisfy the following constraints and requirements:

- Each student can be enrolled in many courses.
- A given course is proposed by one department, but one department can propose many courses.
- Any course is given by one lecturer.
- Each lecturer belongs to one department.
- At the beginning of the semester, each department sends to the "book unit" a document containing the list of requested books.
- Any student receives one book for each course in which he is enrolled.

Based on the previous requirements, do the following:

A. Define the necessary entities and the attributes for each entity type.
B. Explain the meaning of each relationship defined between the entities.

C. Draw the entity relationship Model.
D. Other Activities (Specify):

Constructor E-R Diagram for registrar office of university which store the data about:

I. Student(Sid, name, program)
II. .Course offering(time, secno, room no, year, semester)
III. Instructor (id, name, dept. ,title)
IV. Course (Syllabus, credits, courseno, title)

Each course offering provides the grade to the student who are enrolled with that course. Give the appropriate mapping constraints.

PC302.3. Understand Transaction management.

Item	AppX Hrs
Cl	8
LI	3
SW	2
SL	1
Total	14

Session Outcomes (SOs)	**Laboratory Instruction**	**Class room Instruction (CI)**	**Self-Learning**
	(LI)		**(SL)**
SO3.1 Understand about Transaction concept and its state. **SO3.2** Understand about ACID. **SO3.3** Use of serializability **SO3.4** use of Recoverability **SO3.5** Implementation of Isolation. **SO3.6** understand about Testing for serializability.	LI 3.1 Consider the following two transactions and schedule (time goes from top to bottom). Is this schedule conflict-serializable? Explain why or why not **Transaction T0** r0[A] w0[A] r0[B] w0[B] c0	**Module-3.0 Transaction Management** 1.1 Transaction concept, transaction state. 1.2 ACID properties 1.3 serializability 1.4 Recoverability 1.5 Implementation of Isolation	1. Various types of Locks in Detail.

	Transaction T1 r1[A] r1[B] c1 LI 3.2Show how the use of locks without 2PL can lead to a schedule that is NOT conflict serializable. LI3.3 What happens if we use "With NOLOCK" on a table.	1.6 Testing for serializability	

SW-1 Suggested Sessional Work (SW):

a. Assignments:
   i. What is system log?
   ii Explain various transaction operations.

b. Mini Project:
   i. Explain Concurrency problems in DBMS Transactions.

c. Other Activities (Specify):
   Explain state of transaction with suitable example.

PC302.4 Design and implement databases for various scenarios.

Item	AppX Hrs
Cl	9
LI	3
SW	1
SL	1
Total	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO4.1 Understand about Unstructured text **SO4.2** About information retrieval system **SO4.3** understand about document retrieval and ranking system	LI.4.1. How to Manage unstructured data. LI4.2 What does AI have to do with unstructured data.	**Module-4.0 Unstructured Data Management** 4.1 Unstructured text 4.2 Information retrieval	1. Source of data 2. About Unstructured text

	LI4.3 implement different AI technologies is emerging for handling unstructured data	systems 4.3 document retrieval and ranking .	

SW-1 Suggested Sessional Work (SW)

a. Assignments:

i. All businesses have both structured and unstructured data explain it.

b. Mini Project:

i. Why the rapid growth of unstructured data is putting greater pressure on businesses. Explain it.

c. Other Activities (Specify):

Explain the difference between unstructured data and structured data.

PC302.5: Design a database scenario for handling big data

Item	AppX Hrs
Cl	7
LI	4
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand about Platforms of big data. **SO5.2** Understand about algorithms for Map-Reduce & Hadoop	LI.5.1 Describe Big data and use case from selected business domain.	**Module -5.0 Big Data Management** 5.1 Platforms for Big Data	1.Big Data

SO5.3 Learn about Platforms for Big Graphs **SO5.4** Understand about algorithms for large graphs.	LI.5.2 Perform Map reduce analytics using HADOOP. LI.5.3 Develop a map reduce program to find the grade of student LI.5.4 Develop a map reduce program to find maximum electrical consumption in each year.	5.2 algorithms for Map-Reduce & Hadoop 5.3 Platforms for Big Graphs 5.4 algorithms for large graphs	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. What is Big Data, and where does it come from? How does it work?

Ii Why businesses are using Big Data for competitive advantage.

b. Mini Project:

i. A survey of data partitioning and sampling methods to support big data analysis

c. Other Activities (Specify):

The Impact of Big Data in Healthcare Analytics

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)
PC302.1. Understand the basics of databases and data management.	8	2	2	1	11
PC302.2. Understand various theoretical and practical principles involved in the design and use of databases systems with the help of database.	8	3	2	2	12

PC302.3. Understand Transaction management.	8	3	2	2	12
PC302.4. Design and implement databases for various scenarios.	9	3	2	1	12
PC302.5. Design a database scenario for handling big data.	7	4	1	1	10
Total Hours	40		10	7	67

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
TMC A01. 1	Introduction	03	04	03	10
TMC A01. 2	Structured and semi-structured data management	05	03	02	10
TMC A01. 3	Transaction Management	05	03	02	10
TMC A01. 4	Unstructured Data Management	04	05	01	10
TMC A01. 5	Big Data Management.	03	05	2	10
Total		20	17	13	50

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

The end of semester assessment for Database Systems will be held withwritten examination of 50 marks

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

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

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to 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	Database System Concepts	Abraham Silberschatz, Henry F. Korth, S. Sudharshan	Tata McGraw Hill	2006
2	Database Management Systems	R.P. Mahapatra	Khanna Book Publishing	2016
3	Fundamentals of Database Systems	Elmsari and Navathe	Pearson Education	2013
4	Principles of Database Systems	J. D. Ullman	Galgotia Publications	2004
5	. Introduction to Information Retrieval / Christopher Manning	Prabhakar Raghavan, Hinrich Schütze	Oxford University Press India, Noida	2006

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- Ms. Pushpa Kushwaha, Assistant Professor, Department of Computer Science and Engineering.

COs, POs and PSOs Mapping

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

Course Code: PC302

Course Title: Database Systems

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

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 1: Understand the basics of databases and data management.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5 SO1.6 SO1.7	LI.1.1,LI1.2	Unit-1 Introduction: 1.1,1.2,1.3,1.4,1.5,1 .6,1.7	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2: Understand various theoretical and practical principles involved in the design and use of databases systems with the help of database.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5 SO2.6 SO2.7 SO2.8	LI.2.1,LI2.2,LI2. 3	Unit-2 Structured and semi-structured 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7,2.8	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 3: Understand Transaction management.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5 SO3.6	LI3.1,LI3.2,LI3. 3	Unit-3 Transaction Management 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, 5	CO 4: Design a database scenario for handling big data	SO4.1 SO4.2 SO4.3	LI4.1,LI.4.2, LI.4.3	Unit-4 Unstructured Data Management 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: Understand real world problems and developing computer solutions for those.	SO5.1 SO5.2 SO5.3 SO5.4	LI.5.1,LI5.2, LI.5.3, LI.5.4	Unit-5 Big Data Management 5.1,5.2,5.3,5.4	

SEMESTER- III

Course Code: **PC-303**

Course Title: Computer Networks

Pre-requisite: Student should have basic knowledge of Computer fundamentals.

Rationale: A computer network allows for the sharing of resources such as printers, files, and data storage, as well as the ability to communicate with other computers and access the internet.

Course Outcome:

PC303.1. Understand basic computer network technology
PC303.2. Understand the different types of network topologies and protocols
PC303.3. Analyse the different types of network devices and their functions within a network
PC303.4. Analyse the architecture and principles of today's computer networks
PC303.5. Understand the requirements for the future Internet and its impact on the computer network architecture.

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)	
PC	PC303	Computer Networks	3	2	1	1	7	4

Legend: **CI:** Classroom Instruction(Includesdifferentinstructionalstrategiesi.e.,Lecture(L)andTutorial (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 projected.),
SL: Self-Learning,
C: Credits.

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

Scheme of Assessment:

Theory

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	Class Test 2 (2 best out of 3) 10 marks each	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PC	PC303	Computer Networks	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PC	PC303	Computer Networks	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.

PC303.1. Understand basic computer network technology.

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)
SO1.1 Understand Internet **SO1.2** Learn about the Network **SO1.3**Understand the core concepts and components of Network **SO1.4** Learn about Delay, Loss and throughput in Packet-Switched Networks. **SO1.5**Understand Protocol Layers and their Service Model	1. Manually configure TCP/ IP parameters. 2. Use various networking commands in cmd prompt. 3. Study various types of network cables and practically implement the straight-through cable using the clamping tool.	**Unit 1: Computer Networks and The Internet** 1.1 What is the Internet 1.2 Network edge 1.3 Network core 1.4 Delay, 1.5 Loss and 1.6 throughput in Packet-Switched Networks 1.7 Protocol Layers and 1.8 their Service Model	1. Study about the Internet and other types of Networks.

SW-1 Suggested Sessional Work (SW):

a. Assignments:
   i. Explain Internet and its origin.
   ii Describe Protocol Layer and its service model.

PC303.2. Understand the different types of network topologies and protocols

Item	Appx Hrs.
Cl	11
LI	6
SW	1
SL	1
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Learn about Principles of Network Applications **SO2.2** Understand the Web, HTTP and FTP **SO2.3** Learn about Email and DNS **SO2.4** Understand Peer-to-Peer applications **SO2.5** Learn about Socket Programming	1. Designing and implementing Class A, B, C Networks. 2. Implementation of file and printer sharing. 3. Study of various LAN topologies and their creation using network devices, Cables and computers.	**Unit 2: Application Layer** 2.1. Principles of Network 2.2. Applications 2.3. The Web and 2.4. HTTP; 2.5. File Transfer: FTP 2.6. Electronic Mail In the Internet 2.7. DNS - The Internet's Directory Service 2.8. Peer-to-Peer applications 2.9. Socket Programming – 2.10. Creating network 2.11. applications	Study about Email and FTP

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Describe the working of Electronic Mail
ii Differentiate between HTTP and FTP.

PC303.3. Analyse the different types of network devices and their functions within a network

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 Learn about Transport-Layer Service **SO3.2** Understand Multiplexing and Demultiplexing **SO3.3** Learn about UDP **SO3.4** Learn about principles of reliable data transfer **SO3.5** Learn about TCP **SO3.6** Learn about Congestion Control	1. Implement DHCP, DNS, HTTP using packet tracer. 2. Enable various modes of switches also provide security into it by using packet Tracer. 3. Write the steps to provide static routing by using packet tracer.	**Unit 3: Transport Layer** 1.1 Introduction and Transport-Layer Service 1.2 Multiplexing and 1.3 Demultiplexing 1.4 Connectionless Transport: UDP 1.5 Principles of Reliable of Data Transfer 1.6 Connection-Oriented Transport: TCP 1.7 Principles of Congestion Control, 1.8 TCP Congestion Control	Study about Data Transfer and Transport Layer

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Differentiate between Multiplexing and Demultiplexing.

ii. Describe principles of Congestion Control.

PC303.4. Analyse the architecture and principles of today's computer networks

Item	Appx. Hrs.
Cl	11
LI	6
SW	1
SL	1
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Introduction to Network Layer **SO4.2** Learn about Virtual circuit and datagram networks **SO4.3** Understand about router and Internet Protocol (IP) **SO4.4** Learn about Forwarding and Addressing in the Internet **SO4.5** learn about Routing Algorithms **SO4.6** Understand Broadcast and Multicast Routing	1. Write the steps to provide dynamic (RIP) routing by using packet tracer 2. How to use telnet protocol. 3. To study ARP, RARP protocol using packet tracer.	**Unit 4: Network Layer** 4.1 Introduction to Network Layer 4.2 Virtual circuit and datagram networks 4.3 What is inside a router; 4.4 Internet Protocol(IP) 4.5 Forwarding and 4.6 Addressing in the Internet-1 4.7 Routing Algorithms-1 4.8 Routing Algorithms-2 4.9 Routing in the Internet 4.10 Broadcast and 4.11 Multicast Routing	Study about Routers and routing in Internet

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Write short note on Broadcast and Multicast.

ii .Explain Addressing in the Internet.

PC303.5. Understand the requirements for the future Internet and its impact on the computer network architecture

.

Item	Appx. Hrs.
Cl	7
LI	6
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 Introduction to the Data Link Layer **SO5.2** Understand Error Detection and Correction Techniques **SO5.3** Learn about Multiple Access links and Protocols **SO5.4** Understand Switched local area networks	1. Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool. 2. Connect the computers in Local Area Network 3. Connecting a Switch	**Unit 5: Data Link Layer** 5.1 Introduction to the link layer 5.2 Error Detection and Correction Techniques-1 5.3 Error Detection and Correction Techniques-2 5.4 Error Detection and Correction Techniques-3 5.5 Error Detection and Correction Techniques-4 5.6 Multiple Access links and Protocols 5.7 Switched local area networks.	Study about different types of LANs

SW-1 Suggested Sessional Work (SW):

a. Assignments:
   i. Elaborate Error Detection and correction Techniques.
   ii. What do you understand by Switched Local Area Networks.

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)
PC303.1. Understand basic computer network technology.	8	6	1	1	16
PC303.2. Understand the different types ofnetwork topologies and protocols	11	**6**	1	1	19
PC303.3. Analyse the different types of network devices and their functions within anetwork	8	**6**	1	1	16

PC303.4. Analyse the architecture and principles of today's computer networks	11	6	1	1	19
PC303.5. Understand the requirements for the future Internetand its impact on the computer network architecture	7	**6**	1	1	15
Total Hours	45	30	5	5	85

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
PC303.1	Understand basic computer network technology	03	04	03	10
PC303.2	Understand the different types of network topologies and protocols	05	03	02	10
PC303.3	Analyze the different types of network devices and their functions within a network	05	03	02	10
PC303.4	Analyze the architecture and principles of today's computer networks	04	05	01	10
PC303.5	Understand the requirements for the future Internet and its impact on the computer network architecture	03	05	2	10
Total		20	17	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 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	Computer Networking: A top-down approach	James F. Kurose and Keith W. Ross	Pearson Education	6th edition, 2012
2	Computer Networks	A.S. Tanenbaum	PHI	5th Edition, 2010
3	An Integrated Approach to Computer Networks	Bhavneet Sidhu	Khanna Book Publishing House	2019
4	Data & Computer Communication	William Stallings	PHI	10th Edition 2013
5	Data communications and networking	B.A. Forouzan	TMH	5th Edition, 2012

Curriculum Development Team

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COs, POs and PSOs Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]
Course Code: PC303
Course Title: Computer Network

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO 1: Understand basic computer network technology	2	2	3	3	3	1	1	1	1	1	1	3	2	3	3	1	2
CO 2 : Understand the different types of network topologies and protocols	1	3	2	3	2	2	2	1	1	1	1	3	2	2	2	1	3
CO 3: Analyse the different types of network devices and their functions within a network	2	2	2	3	3	2	1	1	1	1	1	3	1	1	2	2	2
CO 4: Analyse the architecture and principles of today's computer networks	1	2	3	2	3	2	1	1	1	2	1	3	3	3	3	2	2
CO 5: Understand the requirements for the future Internet and its impact on the computer network architecture.	1	2	2	3	3	1	1	2	1	2	1	3	3	3	1	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	PC303.1. Understand basic computer network technology.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	LI.1.1,LI1.2,LI3	Unit-1 **Computer Networks and The Internet** 1.1,1.2,1.3,1.4,1.5,1.6,1.7	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	PC303.2. Understand the different types of network topologies and protocols	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LI.2.1,LI2.2,LI2.3	Unit-2 **Application Layer** 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 PSO 1,2, 3, 4, 5	PC303.3. Analyse the different types of network devices and their functions within a network	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5 SO3.6	LI3.1,LI3.2,LI3.3	Unit-3 **Transport Layer** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	PC303.4. Analyse the architecture and principles of today's computer networks	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5 SO4.6	LI4.1,LI.4.2,LI4.3	Unit-4 **Network Layer** .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	PC303.5. Understand the requirements for the future Internet and its impact on the computer network architecture	SO5.1 SO5.2 SO5.3 SO5.4	LI.5.1,LI5.2,LI5.3	Unit-5 **Data Link Layer** 5.1,5.2,5.3,5.4,5.5,5.6	

Semester-III

Course Code**:** PC304AI

Course Title: Introduction to Machine Learning

Pre- requisite: Basic Mathematics

Rationale: The aim of the course is to introduce to the field of Machine Learning with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach. It explores the essential theory behind methodologies for developing systems that demonstrate intelligent behavior including dealing with uncertainty, learning from experience and following problem-solving strategies found in nature.

Course Outcomes:

CO.1: Demonstrate knowledge of the fundamental principles of Machine Learning.
CO.2: Applications of machine learning.
CO.3: Use various supervised learning.
CO.4: Familiarize knowledge of Unsupervised learning.
CO.5: Introduction to Deep learning.

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)	
PC	PC304 AI	Introduction to Machine Learning	3	2	1	1	7	4

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

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

ensure outcome of Learning.

Scheme of Assessment:

Theory

Board of Study	Course	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ESA)
			Class/HomeAssignment5 number 3 markseach (CA)	Class Test2 (2 best out of 3)	Seminarr one	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PC	PC304AI	Introduction to Machine Learning	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 (ESA)	Total Marks (PRA+ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
P C	PC304AI	Introduction to Machine Learning	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.

CO.1: Demonstrate knowledge of the fundamental principles of Machine learning.

Approximate Hours

Item	Appx Hrs.
Cl	8
LI	6
SW	2
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the concept of machine learning. **SO1.2** Compare types of machine learning. **SO1.3** Apply types of neural network inreal life problems	1. Make use of Data sets in implementing the machine learning algorithms. 2. Implement the machine learning concepts and algorithms in any suitable language of choice. 3. Write a program to 4. implement a perceptron .	**Unit-1.0 Introduction** 1.1 What Is Machine Learning? 1.2 How Do We Define Learning? 1.3 How Do We EvaluateOur Networks? 1.4 How Do We LearnOur Network? 1.5 What are datasets and how to handlethem? 1.6 Feature sets, Dataset division: test, 1.7 train and validation set, 1.8 cross validation.	1. Search devices using machine learning. 2. Test, train datasets.

SW-1 Suggested Sessional Work (SW):

Assignments:

i. What is network?
ii. What is Learning?

iii. Explain test, train. And validation sets.

CO.2: Applications of machine learning.

Approximate Hours

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

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Understand the concept of Machine learning. **SO2.2** Use the machine learning in problems **SO2.3** Demonstrate the use machinelearning	1. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets. 2. Write a program to implement KNN model.	Unit – 2 Basicsof machine learning 2.1. Basics of machine learning 2.2. Applicationsof Machine Learning, 2.3. processes involved in Machine Learning 2.4. Introductionto Machine Learning Techniques 2.5. Supervised Learning, 2.6. Unsupervised Learning and 2.7. Reinforcement Learning, 2.8. Examples 2.9. Real life examples of Machine Learning.	1. How machine learning is used to solve real life problems. 2.Real life examples of machine learning.

SW-1 Suggested Sessional Work (SW):

Assignments:

iv. Applications of machine learning.
v. Difference between supervised and unsupervised learning.
vi. Compare unsupervised and reinforcement learning.

CO.3: Use various supervised learning.

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)**
SO3.1 Understand the concept of supervised learning **SO3.2** Use various supervised learning algorithms **SO3.3** Apply various supervised learning algorithms.	1. Write a program to implement the Naïve Bayesian Classifier. 2. Write a program to construct Naive Bayes model. 3. Construct a Decision Tree Learning model.	**Unit-3.0** Supervised Learning 3.1. Basics of Supervised Learning 3.2. Classification and Regression: K-Nearest Neighbor 3.3. Linear Regression, 3.4. Logistic Regression 3.5. Support Vector Machine (SVM), 3.6. Evaluation Measures: SSE 3.7. MME 3.8. R2 3.9. Confusion matrix, 3.10. precision, recall-score, Roc curve.	1. Compare and analyze all supervised learning algorithm.

SW-1 Suggested Sessional Work (SW):

Assignments:

vii. Numerical based on KNN
viii. Numerical based on Linear regression.

ix. Numerical based on SVM.

CO.4: Familiarize knowledge of unsupervised learning.

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)**
SO4.1 Understand the concept of unsupervised learning. **SO4.2** Use of clustering. **SO4.3** Apply k means clustering.	1. Write a program to implement Linear Classification model. 2. Constructing and demonstrating the Supervised Learning. 3. Constructing and demonstrating the Un-supervised Learning. .	**Unit-4.0 Unsupervised learning** 4.1.Basics of Unsupervised Learning 4.2.Introduction to clustering 4.3.Types of Clustering 4.4.Examples of clustering 4.5.Hierarchical, Agglomerative Clustering 4.6.Example 4.7.Divisive clustering 4.8.Partitional Clustering 4.9.K-means clustering. 4.10. examples	1. Compare and analyze all unsupervised learning algorithm.

SW-1 Suggested Sessional Work (SW):

Assignments:

i. Questions based on frames.
ii. Questions based on scripts.
iii. Questions based on formal logic.

CO.5: Introduction to deep learning.

Approximate Hours

Item	Appx Hrs.
Cl	8
LI	8
SW	2
SL	1
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand the concept of deep learning. **SO5.2** Demonstrate the use deep learning.	1. Constructing and demonstrating the Markov Model. 2. Constructing and demonstrating the Reinforcement Learning Model. 3. Write a program to implement hierarchical clustering. 4. Write a program to implement random forest regression..	**Unit-5.0** Miscellaneous 5.1. Dimensionality reduction techniques 5.2. PCA, 5.3. LDA, 5.4. ICA 5.5. Introduction to Deep Learning, 5.6. Gaussian Mixture Models, 5.7. Natural language processing, 5.8. computer vision.	1. Compare and analyze all learning techniques.

SW-1 Suggested Sessional Work (SW):

Assignments:

i. Different types of learning techniques.
ii. Use of natural language processing.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)

CO.1: Demonstrate knowledge of the fundamental principles of Machine Learning	08	06	02	01	17
CO.2: Applications of machine learning	09	04	02	01	16
CO.3: Use various supervised learning	10	06	02	01	19
CO.4 Familiarize knowledge of Unsupervised learning	10	06	02	01	19
CO-5: introduction to deep learning.	08	08	02	01	19
Total Hours	45	30	10	5	90

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Introduction**	03	02	03	08
CO-2	Basics of machine learning.	03	01	05	09
CO-3	Supervised learning	03	07	02	12
CO-4	Unsupervised learning.	03	05	05	13

CO-5	Miscellaneous	03	02	03	08
Total		15	17	18	50

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

The end of semester assessment for Introduction to Machine Learning 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 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:

A. Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Introduction to Machine Learning	Jeeva Jose	Khanna Book Publishing Co	2020
2	Artificial Intelligence: A Modern Approach	Russell S. and Nerving P	Prentice-Hall	3rd Edition 2009
3	Lecture note provided by Dept. of CS&E, AKS University, Satna.			

B. Alternative NPTEL/SWAYAM/MOOC Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Introduction to Machine Learning	Prof. Balarama Ravindran	IIT Madras

2.	Machine Learning	Prof. Carl Gustaf Jansson	KTH, The Royal Institute of Technology

Curriculum Development Team

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

CO, PO and PSO Mapping

Course Title: B. Tech. [Artificial Intelligence & Data Science]
Course Code :PC304AI
Course Title: Introduction to Machine Learning

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	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-long learning				
CO1	2	2	3	3	2	1	1	1	1	1	1	3	2	2	3	3
CO2	2	3	2	3	2	2	1	1	1	1	1	3	2	3	2	3
CO3	2	2	2	3	2	2	1	1	1	1	1	3	2	2	2	3
CO4	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	2
CO5	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	2

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: Demonstrate knowledge of the fundamental principles of Machine Learning.	SO1.1 SO1.2 SO1.3		Unit-1.0 Biological foundations to intelligent systems I. 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	As Mentioned in Page no. _____to _____
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO 2 : Applications of machine learning.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2 Biological foundations to intelligent systems II. 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 : Use various supervised learning.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 : Search Methods 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO4: Familiarize knowledge of Unsupervised learning.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 : Knowledge representation and logical inference 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.0	
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO 5: Introduction to Deep learning.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit5:Learning Techniques 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

Semester-III

Course Code: PC305

Course Title: Artificial Intelligence

Pre- requisite: To study this Course, a student must have basic knowledge of computers

Rationale: AI can automate routine tasks, analyze data, and improve decision-making

Course Outcomes:

PC305.1. Understand the basic concepts and techniques of Artificial Intelligence.
PC305.2. Apply AI algorithms for solving practical problems
PC305.3. Describe human intelligence and AI
PC305.4. Explain how intelligent system works.
PC305.5. Apply basics of Fuzzy logic and neural networks

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)	
PC	PC305	Artificial Intelligence	3	2	1	1	7	4

Legend:
CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, fieldor 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	Coure	CourseTitle	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks
			Class/HomeAssignment5 number 3 markseach (CA)	Class Test2 (2 best out of 3)	Seminarr one	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PC	PC305	Artificial Intelligence	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.

PC305.1: Understand the basic concepts and techniques of Artificial Intelligence.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	0
SW	2
SL	1
Total	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1 Understand the Artificial Intelligence and its applications **SO1.2 Explain** Level of models, criteria of success **SO1.3 Discuss** advantages, and limitations of AI **SO1.4 Definition** Impact and Examples of AI **SO1.**5 Explain Advice for a career in AI		**Unit-1 Introduction** 1.1Artificial Intelligence and its applications 1.2 Artificial Intelligence Techniques 1.3 Level of models, criteria of success 1.4 Intelligent Agents, 1.5 Nature of Agents 1.6 Learning Agents. 1.7 AI Techniques 1.8 advantages, and limitations of AI 1.9 Impact and Examples of AI 1.10 Application domains of AI 1.11 The AI Ladder - The Journey for Adopting AI Successfully 1.12 Advice for a career in AI 1.11 Hotbeds of AI Innovation	**1.** Artificial Intelligence Techniques **2.** Intelligent Agents, Nature of Agents

SW-1 Suggested Sessional Work (SW):

1. Assignments:

a. Intelligent Agents, Nature of Agents
b. Impact and Examples of AI, Application domains of AI
c. The AI Ladder - The Journey for Adopting AI Successfully

2. Other Activities (Specify): Seminar

PC305.2: Apply AI algorithms for solving practical problems

Approximate Hours

Item	Appx Hrs.
Cl	12
LI	0
SW	2
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 To Understand the Problem-solving techniques **SO2.2** To learn heuristic search **SO2.3** To lean about Hill climbing, best first search **SO2.4 Explain** Max Search, Alpha-Beta Pruning **SO2.**5 Explain Additional refinements		Unit 2: **Problem solving techniques** 2.1 State space search, control strategies 2.2 heuristic search, problem characteristics 2.3 production system characteristics, 2.4 Generate and test 2.5 Hill climbing, 2.6 best first search, 2.7 A* search 2.8 Constraint satisfaction problem, 2.9 Mean-end analysis 2.10 Min-Max Search, 2.11 Alpha-Beta Pruning 2.12Additional refinements, Iterative Deepening	1. State space search, control strategies 2. production system characteristics

SW-2 Suggested Sessional Work (SW):

A. Assignments:

a. Heuristic search, problem characteristics
b. Min-Max Search, Alpha-Beta Pruning
c. Additional refinements

PC305.3: Describe human intelligence and AI

Approximate Hours

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

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO3.1 To Understand Logic **SO3.2** To learn predicate logic **SO3.3** To understand the Resolution in proportional l o g i c **SO3.4 Explain** unification algorithm **SO3.5** learn about unification algorithm		**Unit3: Logic** 3.1 Propositional logic I 3.2 Propositional logic II 3.3 Propositional logic III 3.4 predicate logic I 3.4 predicate logic II 3.5 Resolution 3.6 Resolution in proportional logic and 3.7 Resolution in predicate logic 3.8 unification algorithm I 3.9 unification algorithm II	1. predicate logic, Resolution 2. Resolution in proportional logic and predicate logic

SW-3 Suggested Sessional Work (SW):

3. Assignments:

a. Resolution in proportional logic and predicate logic
b. Clause form
c. predicate logic, Resolution

3. Major - Paper I:
Other Activities (Specify):

PC305.4: Explain how intelligent system works

Approximate Hours

Item	AppX Hrs
Cl	17
LI	0
SW	2
SL	1
Total	20

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Evaluation of Mapping between facts and representations **SO4.2** Understanding the Approaches to knowledge representation **SO4.3** To learn Matching, conflict resolution **SO4.4** To lean about statistical reasoning, fuzzy logic Weak and Strong **SO4.**5 **Discuss** conceptual dependency, scripts		**Unit-4: Knowledge Representation schemes and reasoning: -** **4.1** Mapping between facts and representations **4.2** Approaches to knowledge representation **4.3** proceduralvs declarative knowledge 4.5 Forward vs. Backward reasoning 4.6 Matching, 4.7 conflict resolution 4.8 Non- monotonic reasoning, 4.9 Default reasoning 4.10 statistical reasoning, 4.11 fuzzy logic I 4.12 fuzzy logic I 4.13 Weak and Strong filler structures 4.14 semantic nets, 4.15 frame 4.16 conceptual dependency, 4.17 scripts	**1.** proceduralvs declarative knowledge **2.** proceduralvs declarative knowledge

SW-4 Suggested Sessional Work (SW):

A. Assignments:

a. Approaches to knowledge representation
b. statistical reasoning, fuzzy logic Weak and Strong filler structures
c. Conceptual dependency, scripts

B. Other Activities (Specify):

PC305.5: Apply basics of Fuzzy logic and neural networks

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 To Understand Logic the Planning problem **SO5.2 Explain** planning graphs **SO5.3 learn** this Analysis of planning approaches **SO5.4** To understand conditional planning **SO5.**5 Explain Continuous and Multi Agent planning		**Unit 5: Planning:** 5.1 The Planning problem 5.2 planning with state space search 5.3 partial order planning 5.4 planning graphs 5.5 planning with propositional logic 5.6 Analysis of planning approaches 5.7 Hierarchical planning 5.8 conditional planning 5.9 Continuous and 5.10 Multi Agent planning	1. planning with state space search 2. Analysis of planning approaches

SW-4 Suggested Sessional Work (SW):

A. Assignments:

a. Continuous and Multi Agent planning
b. Planning with state space search
c. Hierarchical planning

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
PC305.1: Understand the basic concepts and techniques of Artificial Intelligence.	12	02	01	15
PC305.2: Apply AI algorithms for solving practical problems	12	02	01	15
PC305.3: Describe human intelligence and AI	9	02	01	12
PC305.4: Explain how intelligent system works	17	02	01	20
PC305.5: Apply basics of Fuzzy logic and neural networks	10	02	01	13
Total Hours	60	10	5	61

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction Artificial Intelligence	03	02	03	08
CO-2	Problem solving techniques	03	01	05	09
CO-3	Logic	03	07	02	12
CO-4	Knowledge Representation schemes and reasoning	03	05	05	13
CO-5	Planning	03	02	03	08
Total		15	17	18	50

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

The end of semester assessment for Artificial Intelligence 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	A Classical Approach to Artificial Intelligence	M.C. Trivedi	Khanna Book Publishing	2019

2	Artificial Intelligence	A modern approach by Stuart Russel	Pearson Education	2010
3	Artificial Intelligence	Rich and Knight	The McGraw Hill	2017

B. Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	An Introduction to Artificial Intelligence	Prof. Mausam	IIT Delhi
2.	Artificial Intelligence	Prof. Sudeshna Sarkar	IIT Kharagpur

Curriculum Development Team

Mr. Anurag Tiwari teaching associate, Department of Computer Science and Engineering.

CO, PO and PSO Mapping

Course Title: B.C.A
Course Code: PC305
Course Title: Artificial Intelligence

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
	Engineering	Problem	Design/develop	Conduct	Utilization of	Engineers and	Environment and	Ethics	Individual and	Communication	Project	Life-long learning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmed in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO1	2	2	3	3	2	1	1	1	1	1	1	3	2	2	3	3	2
CO2	2	3	2	3	2	2	1	1	1	1	1	3	2	3	2	3	2
CO3	2	2	2	3	2	2	1	1	1	1	1	3	2	2	2	3	2
CO4	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	2	2
CO5	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	2	2

Curriculum Mapping

POs & PSOs No.	COs No.& Titles	SOs No.	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**PC305.1:** Understand the basic concepts and techniques of Artificial Intelligence.	SO1.1 SO1.2 SO1.3 SO1.4	Unit-1 Introduction 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**PC305.2**: Apply AI algorithms for solving practical problems	SO2.1 SO2.2 SO2.3 SO2.4	Unit-2 Problem solving techniques 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 PSO 1,2, 3, 4, 5	**PC305.3:** Describe human intelligence and AI	SO3.1 SO3.2 SO3.3 SO3.4	Unit-3 Logic 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	**PC305.4:** Explain how intelligent system works	SO4.1 SO4.2 SO4.3 SO4.4	Unit-4 Knowledge Representation schemes and reasoning 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10,4.11,4.12,4.13,4.14,4.15,4.15,4.16,4.17	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**PC305.5:** Apply basics of Fuzzy logic and neural networks	SO5.1 SO5.2 SO5.3 SO5.4	Unit-5 Planning 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10	

Semester III

Course Code: HSMC(H-102)

Course Title: Universal Human Values

Pre- requisite: Creating awareness among the students on a holistic perspective about life

Rationale: The purpose is to help develop a holistic perspective about life. A self-reflective methodology of teaching is adopted. It opens the space for the student to explore his/her role (value) in all aspects of living – as an individual, as a member of a family, as a part of the society and as an unit in nature. Through this process of self-exploration, students are able to discover the values intrinsic in them.

Course Outcomes:

HSMC(H-102).1**:** To understanding Value Education

HSMC(H-102).2**:** Students will have the ability to learn about Harmony in theHuman Being**.**

HSMC(H-102).3**:** Student will be able to gain knowledge on Harmony in theFamily and Society.

HSMC(H-102).4: Understanding Harmony in the Nature/Existence.

HSMC(H-102).5: Student will able to understand about Implications of HolisticUnderstanding- 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	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: Session Work (includes assignment, seminar, mini project etc.),

SL: Self Learning,

C: Credits.

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	Class Test 2 (2 best out of 3)	Seminar one (SA)	Class Activity any one	Class Attendance (AT)	Total Marks (CA+CT+S		
HS	HSMC(H-102)	Universal Human Values	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. Student will be able to Understand the Value Education

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 Self-exploration as the Process for Value		**Module-I Understanding Value Education** 1.2 Self-exploration as the	Human values to become a

Education SO 1.2. Understand Continuous Happiness and Prosperity – the Basic Human Aspirations SO 1.3. Understand Right Understanding SO1.4. Understand Relationship and Physical Facility SO 1.5. Understand Happiness and Prosperity – Current Scenario SO 1.6. Understand Method to Fulfill the Basic Human Aspirations		Process for Value Education 1.2 Continuous Happiness and Prosperity – 1.3 the Basic Human Aspirations 1.4 Right Understanding 1.4 Relationship and 1.5 Physical Facility 1.6 Happiness and Prosperity – 1.7 Current Scenario 1.8 Method to Fulfill the Basic Human Aspirations-1 1.9 Method to Fulfill the Basic Human Aspirations-2	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 on Harmony in the Human Being

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. Understanding Human being as the Co-existence of the Self and the Body SO 2.2. Understand the Distinguishing between the Needs of the Self and Body SO 2.3. Understand the Body as an Instrument of the Self SO 2.4. Understanding Harmony in the Self SO 2.5. Understanding Harmony of the Self with the Body SO2.6. Understand Programme to ensure self-regulation and Health		**Module-II Harmony in the Human Being** 2.1. Human being as theCo-existence of the Selfand the Body 2.2. Distinguishing between the Needs of the Self and 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 .6 Programme to ensure self-regulation and Health	**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):

CO3: Student will be able to understand Harmony in the Family andSociety

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 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	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):

CO4: Student will be able to understand Harmony in the Nature/Existence

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. 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 4.4 Realizing Existence as Co-existence at All Levels 4.5 The holistic Perceptions of Harmony in Existence 4.6 The Exploring Co-Existence in Existence	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):

CO5: Students will have the ability to apply the gained knowledge inImplications of Holistic Understanding- A Look at Professional Ethics

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 Natural acceptance of Human Values SO 5.2 Understand Definitiveness of (Ethical) Human Conduct SO 5.3. 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 SO 5.6. Understand Strategies for Transition towards value based Life and Profession		**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 5.5 Competence in Professional Ethics 5.6 Strategies for Transition towards value based Life and Profession	Holistic understanding of human values

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	**6**	**2**	**1**	**9**
UHV Module. II: Students will have the ability to apply the knowledge gained about Harmony in the Human Being	**6**	**2**	**1**	**9**
UHV Module. III: Student will be able to understand the Harmony in the Family and Society	**6**	**2**	**1**	**9**
UHV Module. IV: Understand the Harmony in the Nature/Existence	**6**	**2**	**1**	**9**

UHV Module. V: Understand about the Implications of Holistic Understanding- A Look at Professional Ethics	**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	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.	-

Curriculum Development Team:

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COs, POs and PSOs Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]
Course Code : UHV
Course Title: Universal Human Values

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO1: Student will be able tounderstand The Value Education	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1	2
CO2: Students will have the ability to apply the knowledge gained aboutHarmony in the Human Being	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1	3
CO3: 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	2
CO4 UnderstandtheHarmony in the Nature/Existence	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2	2
CO5 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	3

ii. 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:** 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	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO2:** Students will have the abilityto 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	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO3:** Student will be able to understand the Harmony in the Family and Society	SO3.1 SO3.2 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	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO4:** 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	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO5:** 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	

Course Code: OE001

Course Title : Internet of Things

Pre-requisite: Student should know basic knowledge of computer & digital electronics.

Rationale: It's all about the role of Sensors log Data 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. To understand the concepts of web of Things, Cloud of Things and emphasis on Mobile cloud.

Course Outcomes:

CO1. Acquire the knowledge of IoT concept and its Architecture.

CO2. Acquire the basic concept of Software defined networking and Machine-to-Machine (M2M).

CO3. Exposed to various web communication Protocols for connected devices & Message communication Protocols for connected devices.

CO4. Familiarize and understand the basic Sensor data Communication Protocols.

CO5. Develop the application skills regarding the Smart City Streetlights control & monitoring.

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)	
OE	OE001	Internet of Things	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 instructionalstrategies)

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)		
OE	OE001	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.

CO1. Acquire the knowledge of IoT concept and its Architecture

Approximate Hours

Item	Appx. Hrs.
Cl	8
LI	0
SW	2
SL	1
Total	13

Session Outcomes (SOs)	(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	1. Learn basics of IoT 2. Design of IoT

CO.2: Acquire the basic concept of Software defined networking and Machine-to-Machine (M2M).

Approximate Hours

Item	Appx Hours
Cl	7
LI	0
SW	2
SL	1
Total	10

Session Out comes (SOs)	**(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 Intro to M2M 2.2 SDN (Software defined networking) and 2.3 NFV (Network function virtualization) for IoT 2.4 Data Storage in IoT-I 2.5 Data Storage in IoT-II 2.6 IoT cloud Based Services.-I 2.7 IoT cloud Based Services.-II	1. Workflow of Machine Learning

CO3. Exposed to various web communication Protocols for connected devices & Message communication Protocols for connected devices.

Approximate Hours

Item	Appx. Hours
Cl	12
LI	0
SW	2
SL	1
Total	15

Session Outcomes (SOs)	**(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 3.3 Protocols for connected devices. 3.4 SOAP, 3.5 REST, 3.6 HTTP Restful and 3.7 web Sockets. 3.8 Internet Connectivity Principles: 3.9 Internet Connectivity features 3.10 Internet based communication 3.11 IP addressing in IoT 3.12 Media Access Control	1. Designing of Web Connectivity 2. Communication Protocol

CO4. Familiarize and understand the basic Sensor data Communication Protocols.

Approximate Hours

Item	Appx Hours
Cl	10
LI	0
SW	2
SL	1
Total	13

Session Outcomes (SOs)	(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 Intro to Sensor Technology 4.2 Types of Sensors 4.3 Participatory Sensing 4.4 Industrial IoT and 4.5 Automotive IoT 4.6 Actuator 4.7 Sensor data Communication Protocols 4.8 Radio Frequency Identification Technology 4.9 Wireless Sensor Network Technology. 4.10 Examples of IoT	1. How Sensor works 2. Working of wireless sensor network

CO5. Develop the application skills regarding the Smart City Streetlights control & monitoring

Approximate Hours

Item	Appx Hours
Cl	8
LI	0
SW	2
SL	1
Total	11

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

SO5.1 Understand about the concept of IoT 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** 5.1 Specification- Requirement 5.2 Process, Model, service 5.3 Functional view 5.4 Operational View 5.5 IoT Privacy and security solutions 5.6 Raspberry Pi 5.7 Arduino devices. 5.8 IoT Case Studies: Smart City Streetlights control & monitoring.	1. IoT Designing 2. IoT privacy

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 IoT concept and its Architecture.	8	2	1	12
CO 2: Acquire the basic concept of Software defined networking and Machine-to-Machine (M2M).	7	2	1	13
CO 3: Exposed to various web communication Protocols for connected devices & Message communication Protocols for connected devices.	12	2	1	15
CO 4: Familiarize and understand the basic Sensor data Communication Protocols.	10	2	1	17
CO 5: Develop the application skills regarding the Smart City Streetlights control & monitoring	8	2	1	18
Total Hours	45	10	5	75

Suggestion for End Semester Assessment

Suggested Specification Table (ForESA)

CO	**Unit Titles**	**Marks Distribution**			**Total Marks**
		R	**U**	**A**	
CO-1	Acquire the knowledge of IoT concept and its Architecture.	01	01	03	05

CO-2	Acquire the basic concept of Software defined networking and Machine-to-Machine (M2M).	01	01	03	05
CO-3	Exposed to various web communication Protocols for connected devices & Message communication Protocols for connected devices.	03	03	01	07
CO-4	Familiarize and understand the basic Sensor data Communication Protocols.	02	03	01	06
CO-5	Develop the application skills regarding the Smart City Streetlights control & monitoring.	01	03	01	05
Total		08	11	09	28

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

The end of semester assessment for Internet of Things will be held with written examination of 50marks

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

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. 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	Universal Press	First Edition
2	"The Internet of Things: Connecting Objects"	Hakima Chaouchi	Wiley publication	First
3	"MySQL for The Internet of Things"	Charless Bell	A Press publication.	Second
5	Lecture note provided by Dept. of C A & I T And Science, AKS University, Satna .			

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CO, PO and PSO Mapping

Course: B. Tech. (AI-DS)
Course Code: OE001
Course Title: Internet of Things

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
	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-long learning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO 1: Acquire the knowledge of IoT concept and its Architecture.	2	2	3	1	1	1	1	1	1	1	1	2	2	2	2	3	
CO 2: Acquire the basic concept of Software defined networking and Machine-to-Machine (M2M).	2	3	1	1	2	2	1	1	1	1	1	1	2	2	3	2	
CO 3: Exposed to various web communication Protocols for connected devices & Message communication Protocols for connected devices.	3	2	2	2	2	2	1	1	1	1	1	2	2	3	1	1	
CO 4: Familiarize and understand the basic Sensor data Communication Protocols.	3	2	3	3	2	3	1	2	2	1	2	3	2	1	3	2	
CO 5: Develop the application skills regarding the Smart City Streetlights control & monitoring	3	2	3	2	3	2	1	2	1	1	2	3	3	3	2	1	

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: Acquire the knowledge of IoT concept and its Architecture.	SO1.1 SO1.2 SO1.3 SO1.4		Unit-1.0 Theoretical Framework of IoT 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	As Mentioned in Page no._____to _____
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 Software defined networking and Machine-to-Machine (M2M).	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2 Machine-to-Machine (M2M)2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7	
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 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,3.11,3.12	
PO:1,2,3,4,5,6, 7,8,9,10,11,12 PSO:1,2,3,4	CO4: Familiarize and understand the basic Sensor data Communication Protocols.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 : Sensor Technology 4.1,4.2,4.3,4.4,4.5,4.6,4.7,48,4.9,4.10	
PO:1,2,3,4,5,6, 7,8,9,10,11,12 PSO:1,2,3,4	CO 5: Develop the application skills regarding the Smart City Streetlights control & monitoring.	SO5.1 SO5.2 SO5.3 SO5.4		Unit5: IoT Design methodology 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	

A K S University

Faculty of Computer Application Science and Information Technology

Department of Computer Science

Bachelors in Technology [B.Tech.]

Artificial Intelligence and Data Science [AIDS]

(Revised as on 01 August 2023)

SEMESTER -III

Course Code: OE002

Course Title: Robotics

Pre-requisite: Strong foundation in mathematics (including algebra and calculus), proficiency in programming languages (e.g., Python, C++), and basic understanding of physics and mechanics are key prerequisites for studying robotics.

Rationale: Robotics can also help students develop life skills and social skills also help students prepare for a technological future.

Course Outcome:

CO1: Understand basics of Robotics.
CO2: Understand the Need of AI in Robotics.
CO3: Apply game playing in AI .
CO4: Apply Robotics fundamentals.
CO5: Apply Robotics and Its applications

.**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)	
OE	OE002	Robotics	3	0	1	1	5	3

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

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

Scheme of Assessment:

Theory

		Course Title	Scheme of Assessment (Marks)

			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ESA)
			Class/HomeAssignment5 number 3 marks each (CA)	Class Test 2 (2 best out Of 3) 10	Seminar one (Presentation) (SA)	Class Activity any	Class Attendance	Total Marks (CA+CT+SA+CAT		
OE	OE002	Robotics	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: Understand basics of Robotics.

Approximate Hours

Item	Appx. Hrs.
Cl	10
LI	0
SW	1
SL	1
Total	12

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

SO1.1 Understand about Introduction to Robotics Fundamentals of Robotics **SO1.2** Understand Robot Kinematics, Position Analysis **SO1.3** Understand Robot Programming languages & systems **SO1.4** Introduction, the three levels of robot programming **SO1.**5 requirements of a robot programming language **SO1.6** problem specular to robot programming languages **SO1.**7 Learn about the Programming. Testing & debugging & their Tools. .		**Unit-1.0 Introduction**: 1.1 Introduction to Robotics 1.2 Fundamentals of Robotics . 1.3 Robot Kinematics: 1.4 Position Analysis. 1.5 Dynamic Analysis and Forces 1.6 Robot Programming languages & 1.7 systems 1.8 Introduction, the three levels of robot programming 1.9 requirements of a robot programming language 1.10 problem specular to robot programming languages	1. Start with simple projects to apply theoretical knowledge. Build basic robot models using kits like Arduino or Raspberry Pi, gradually advancing to more complex projects . 2. Experiment with sensor integration, motor control, and programming to enhance your practical skills.

SW-1 Suggested Sessional Work (SW):

a. Assignments:
- Research and present an overview of the history and evolution of robotics.
- Explore various applications of robotics in different industries.

b. Mini Project:
Implement basic control algorithms for movement and obstacle detection

c. Other Activities (Specify):

CO2: Apply game playing in AI .

Approximate Hours

Item	Appx. Hrs.
Cl	8
LI	0
SW	1
SL	1
Total	7

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Understand about History, state of the art **SO2.2**Understand about Need of AI in Robotics. **SO2.3**Use of Thinking and acting humanly **SO2.4** Understand about intelligent agents **SO2.5**Understand about structure of agents	LI 2.1 writing and implementing code to control robot movements, respond to sensor inputs, and execute specific tasks, enhancing students' programming proficiency in languages like Python, C++, or specialized robotics languages.	**Unit-1.0 Need of AI in Robotics** 2.1 History, 2.2 state of the art 2.3 Need of AI in Robotics. 2.4 Thinking and acting humanly 2.5 intelligent agents -I 2.6 intelligent agents -II 2.7 structure of agents 2.8 various types of agents	1. learn about Need of AI in Robotics

SW-2 Suggested Sessional Work (SW):

a. Assignments:
- Design a simple electronic circuit for a robot using components like resistors, capacitors, and transistors.
- Explain the purpose and functionality of each component in the circuit.

b. Mini Project:
- Design a robot that follows a line on the ground using infrared sensors.

c. Other Activities (Specify):

CO3: Apply Robotics fundamentals.

Approximate Hours

Item	Appx. Hrs.
Cl	8
LI	0
SW	1
SL	1
Total	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Understand AI and game playing . **SO3.2** Understand plausible move generator **SO3.3**Use of static evaluation move generator **SO3.4** Understand about game playing strategies **SO3.5**Understand about Problems in game laying.		**Unit-3.0 Game Playing** : 3.1 AI and game playing-I 3.2 AI and game playing-II 3.3 plausible move generator. 3.4 static evaluation move generator 3.5 game playing strategies -I 3.6 game playing strategies -II 3.7 Problems in game playing-I 3.8 Problems in game playing-II	1. learning game playing strategies 2. AI and game playing

SW-1 Suggested Sessional Work (SW):

a. Assignments:
- Write a program to control the movement of a simulated robot in a 2D environment.
- Implement basic algorithms for obstacle avoidance and path planning.

b. Mini Project:
- Experiment with different line-following algorithms to optimize performance.

c. Other Activities (Specify):

CO4: Apply Robotics and Its applications

Approximate Hours

Item	Appx. Hrs.
Cl	7
LI	0
SW	1
SL	1
Total	9

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO4.1 Understand about Robot Classification **SO4.2** Understand about Robot Specification notation **SO4.3** Understand kinematic representations and transformations **SO4.4** learn dynamics techniques trajectory planning and control.	LI.4.1 Students experiment with designing and implementing control algorithms to regulate the behavior of robots, covering concepts such as feedback control, trajectory planning, and obstacle avoidance.	**Unit-4.0 Robotics fundamentals** 4.1 Robot Classification-I 4.2 Robot Classification-II 4.3 Robot Specification notation 4.4 kinematic representations and 4.5 transformations 4.6 dynamics techniques 4.7 trajectory planning and control.	1. learn about Robot Classification 2.learn about kinematic representations .

SW-1 Suggested Sessional Work (SW):

a. Assignments:

Choose a specific type of robotic hardware (e.g., wheeled robot, robotic arm) and analyze its components and structure.

b. Mini Project:

i. Construct a simple robotic arm with at least two degrees of freedom.

c. Other Activities (Specify):

CO5: At the end of this chapter the student will use Robotics and Its applications

. **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 DDD concept and Intelligent robots . **SO5.2**Understand about file Robot anatomy-Definition **SO5.** Understand about law of robotics **SO5.4** Understand about History and Terminology of Robotics-Accuracy **SO5.5**Understand repeatability of Robotics-Simple problems-Specifications of Robot-Speed of Robot		**Unit-5.0 Robotics and Its applications** 5.1 DDD concept and 5.2 Intelligent robots 5.3 Robot anatomy-Definition 5.4 law of robotics - I 5.5 law of robotics - II 5.6 History and Terminology of Robotics-Accuracy 5.7 repeatability of Robotics-	1.learn law of robotics 2. Pneumatic and Electric system

		5.8 Simple Problems	
		5.9 Specifications of Robot- 5.10 Speed of Robot 5.11 Robot joints and links-Robot classifications-Architectureofroboticsystems-RobotDrivesystems-Hydraulic 5.12 Pneumatic and Electric system	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Solve kinematic equations for a robotic arm or manipulator.

b. Mini Project:

i. Implement algorithms for identifying and sorting different colored objects.

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: Understand basics of Robotics.	10	1	1	12
CO2: Understand the Need of AI in Robotics.	8	1	1	10
CO3: Apply game playing in AI	8	1	1	10
CO4: Apply Robotics fundamentals.	7	1	1	9
CO5: Apply Robotics and Its applications	12	1	1	14
Total Hours	45	5	5	55

Suggestion for End Semester Assessment

A K S University

Faculty of Computer Application Science and Information Technology

Department of Computer Science

Bachelors in Technology [B.Tech.]

Artificial Intelligence and Data Science [AIDS]

(Revised as on 01 August 2023)

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
1	Introduction to Robotics.	03	04	03	10
2	Need of AI in Robotics.	05	03	02	10
3	game playing in AI .	05	02	03	10
4	Robotics fundamentals.	04	04	02	10
5	Robotics and Its applications production and quality of cement.	03	05	2	10
Total		20	15	15	50

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

Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition &Year
1	Robotics, Vision and Control: Fundamental Algorithms in MATLAB	Peter Corke	Springer	2011
2	Robotics: Everything You Need to Know About Robotics from Beginner to Expert	Peter Mc Kinnon	Create space Independent Publishing Platform	2016
3	Introduction to AI Robotics	Robin R. Murphy	MIT press	2001
4	Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using AI techniques	Francis X. Govers	Packet Publishers	2018

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COs, POs and PSOs Mapping

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

Course Code: OE002

Course Title: Robotics

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO1: Understand basics of Robotics.	1	1	2	2	3	2	3	1	2	1	3	2	2	3	3	1	2
CO2: Understand the Need of AI in Robotics.	1	1	2	2	1	2	3	1	1	1	2	2	2	2	2	1	3
CO3: Apply game playing in AI	2	2	1	1	1	2	2	1	1	2	1	2	1	1	2	2	2
CO4: Apply Robotics fundamentals.	3	2	2	2	3	2	3	1	2	1	2	3	3	3	3	2	2
CO5: Apply Robotics and Its applications	3	2	3	1	1	3	3	1	1	1	2	2	3	3	1	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO1: **Understand basics of** Robotics.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5 SO1.6 SO1.7		Unit-1 Introduction: 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 _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO2: Understand the Need of AI in Robotics.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5 SO2.6 SO2.7		Unit-2 Structured and semi-structured 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7,2.8	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO3: **Apply** game playing in AI	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 Transaction Management 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	CO4: Apply Robotics fundamentals.	SO4.1 SO4.2 SO4.3 SO4.4		Unit-4 Unstructured Data Management 4.1,4.2,4.3,4.4,4.5,4.6,4.7	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO5: Apply Robotics and Its applications	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit-5 Big Data Management 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

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (CSE) (AI/DS) Program

(Revised as on 01 August 2023)

Semester-IV

Course Code: **PC401**

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (CSE) (AI/DS) Program

(Revised as on 01 August 2023)

Course Title : Theory of computation

Pre- requisite: Basic knowledge of set theory and its properties.

Rationale: Students will understand fundamental mathematical and computational principles that are foundations of computer science. They should learn about abstract models of computation, finite representations for languages and gain formal understanding of algorithms and procedures.

Course Outcomes:

CO1: Understand models and abstractions: automata as a basic model of computation.**CS-**

CO2: Student will acquire to represent regular expression and Finite State Automata.

CO3: Student will acquire to represent CFL and Pushdown Automata.

CO4: Student will recall Turing machines and the concept of computability, including decidability and un-decidability.

CO5: Students will Link between languages, automata, and decision problems.

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)	
PC	PC401	Theory of computation	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 ofteacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Board of Study	Course Code	Course Name	Scheme of Assessmentnt (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment5 number 3	Class Test2 (2 bestout of	Seminar	Class Activ	Class Att	Total Marks (CA+CT+SA+CAT+ AT)		
PC	PC 401	Theory of Computation	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.

CO.1: Understand models and abstractions: automata as a basic model of computation.

Approximate Hours

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

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1: Recall the concepts of alphabet string and languages SO1.2:Recognize the automata and its types SO1.3: Identify formal languages SO1.4 Derive Inductive proofs SO1.5 Differentiate NFA and DFA		**Unit-1. Introduction of Computational Science** 1.1 Definition of Alphabet, Word/String, Language 1.2 Introduction to formal proof 1.3 Additional forms of proof, Inductiveproofs 1.4 Chomsky Hierarchy for Formal Languages and Automata 1.5 Finite Automata and its Type 1.6 Deterministic Finite Automata(DFA) 1.7 Non -Deterministic Finite Automata 1.8 Finite Automata with Epsilon transitions. 1.9 Conversion NFAto DFA 1.10 Conversion Epsilon NFA to NFA	1. Study the set theory basics and properties 2. Practice questions on FA

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Explain Chomsky Hierarchy with example.
ii. Practice question of DFA and NFA.
iii. Differentiate among NFA, DFA and epsilon NFA

b. Other Activities (Specify):

Seminar and Tutorial

CO.2: Student will acquire to represent regular expression and Finite State Automata.

Approximate Hours

Item	AppX Hrs
Cl	09
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO2.1. Discuss minimization of Finite automata **SO2.2** Acquire knowledge of Regular expression and Identities. **SO2.3** List closure properties of Regular Languages. **SO2.4** Convert Regular expression to FA and vice versa **SO2.5** Use of Pumping Lemma to prove language is not Regular		**Unit-2 Regular Expression** 2.1 Minimization of DFA: Equivalence class method 2.2 Myhill Nerode Minimization 2.3 Regular Expression: Rules and Identities. 2.4 Simplification of Regular Expression using Identities. 2.5 Regular Expression to FA 2.6 FA to Regular Expression Transformation 2.7 Arden's Theorem 2.8 Closure properties of Regular language 2.9 Pumping Lemma for Regular Language	1. Study of different minimization technique. 2. Application of Finite automata and Regular expression

SW-2 Suggested Sessional Work (SW):

a. Assignments:
i. Discuss Pumping Lemma with example.
ii. Discuss Minimization technique.

b. Other Activities (Specify):
Seminar and Tutorial

CO.3: Student will acquire to represent CFL and Pushdown Automata.

Approximate Hours

Item	Appx. Hrs.
Cl	13
LI	0

SW	2
SL	1
Total	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Design PDA for CFL. SO3.2 Differentiate DPDA and NPDA. SO3.3 Derive Parse Tress and identify Ambiguity in Grammar SO3.4 Use of Pumping Lemma to prove language is not Context Free. SO3.5 Equivalence of CFG to PDA and PDA to CFG		**Unit-3 : Context free Grammar** 3.1 Introduction Context free Grammar 3.2 Parse Trees: Let Most Derivation and Right Most Derivation 3.3 Ambiguities in Context Free Grammar 3.4 Simplification of Grammars:	i. Design PDA for different languages. ii. Applications of Derivation trees.
		3.5 Removal of Null Production 3.6 Removal of Unit Productions, Removal of Useless Symbols 3.7 Definition of the Pushdown automata 3.8 Languages accepted by Pushdown Automata 3.9 String/Language Acceptability by PDA 3.10 Comparison between Non-Deterministic PDA and Deterministic PDA 3.11 Equivalence of CFG to PDA 3.12 Equivalence of PDA to CFG 3.13 Pumping Lemma for CFL	

SW-3 Suggested Sessional Work (SW):

a. Assignments:

1) Design PDA for CFLs.
2) Convert CFG to PDA.
3) Differentiate DPDA and NPDA.

b. Other Activities (Specify):

Seminar and Tutorial

CS-401.4: Student will recall Turing machines and the concept of computability, including decidability and un-decidability.

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)**
SO4.1 Design LBA for the Languages **SO4.2** Design Turing Machine for the given Languages **SO4.3** Discuss Types of Turing Machine **SO4.4** Recognize Decidability and Undesirability and Halting problem of Turing Machine. **SO4.**5 Recall concept of Universal Turing Machine.		**Unit-4 : Linear Bounded Automata and Turing Machine** 4.1 Normal forms for CFG 4.2: CNF and GNF 4.3: Closure Properties of CFL 4.4: Turing Machines 4.5:Universal Turing Machine 4.6:Programming Techniques for TM 4.7: Variations of TM	i. Study different Types of Turing Machine ii. Study of different problems which are undecidable.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Design Turing Machine for the Languages.
ii. Discuss Different types of Turing Machine.

b. Other Activities (Specify):

Seminar and Tutorial

CO.5: Students will Link between languages, automata, and decision problems.

Approximate Hours

Item	Appx Hrs.
Cl	6
LI	0
SW	2
SL	1
Total	09

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1. Recall Halting problem of Turing Machine. SO5.2 Differentiate Recursive and Recursively enumerable language. SO5.3 Identify P class and NP class Problem. SO4. Explain post correspondence problem SO5.5 recognize decidable problems and un- decidable problem.		**Unit 5: Turing Machine** 5.1 : Halting problem of Turing Machine 5.2 Recursive language and recursively enumerable language 5.3 A language that is not Recursively Enumerable (RE) 5.4 An undecidable problem that is RE Undecidable problems about Turing Machine 5.5 Post's Correspondence Problem 5.6: P class and NP classes	1. Study of P and NP class problems 2. Identify Decidable problems

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i) Give some examples to explain P and NP class problem.
ii) Identify languages which are Recursive.
iii) Explain Halting problem in Turing Machine.

b. Other Activities (Specify):

Seminar and Tutorial

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: Understand models and abstractions: automata as a basic model of computation.	10	2	1	11
CO.2: Student will acquire to represent regular expression and Finite State Automata.	09	2	1	14

CO.3: Student will acquire to represent CFL and Pushdown Automata.	13	2	1	11
CO.4: Student will recall Turing machines and the concept of computability, including decidability and un-decidability.	07	2	1	10
CO.5: Students will Link between languages, automa7Hta, and decision problems.	6	2	1	14
Total Hours	46	10	5	61

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	CO.1: Understand models and abstractions: automata as a basic model of computation.	05	02	02	09
CO-2	CO.2: Student will acquire to represent regular expression and Finite State Automata.	02	03	05	10
CO-3	CO.3: Student will acquire to represent CFL and Pushdown Automata.	02	03	06	11
CO-4	CO.4: Student will recall Turing machines and the concept of computability, including decidability and un-decidability.	2	03	05	10
CO-5	CO.5: Students will Link between languages, automata, and decision problems.	-	05	05	10
Total		11	16	23	50

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

The end of semester assessment for Theory of Computation 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 Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	An Introduction to Formal Languages and Automata	Peter Linz	Jones & Bertlet	Sixth edition
2	Introduction to Automata Theory, Languages and Computation	Hopcroft and Ullman	Pearson	Third Edition
3	Theory of Computer Science: Automata, Languages and Computation	Mishra K.L.P	PHI	Third Edition, 2006
4	Lecture note provided by Dept. of CSE, AKS University, Satna .			

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- Mr. Vinay Kumar Dwivedi, Assistant Professor, Department of Computer Science and Engineering

Cos, POs and PSOs Mapping

Course Title: 4BTech (AI/DS)
Course Code: PC401
Course Title: Theory of Computation

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO.1: Understand models and abstractions: automata as a basic model of computation.	2	3	2	1	1	2	1	1	1	1	1	2	**2**	**2**	2	**1**	**2**
CO.2: Student will acquire to represent regular expression and Finite State Automata.	2	2	2	2	1	2	1	1	1	1	1	3	**2**	**3**	2	**1**	**3**
CO.3: Student will acquire to represent CFL and Pushdown Automata.	2	3	3	2	1	1	1	1	1	1	1	3	**2**	**3**	2	**2**	**2**
CO.4: Student will recall Turing machines and the concept of computability, including decidability and un-decidability.	2	2	2	2	1	2	1	1	1	1	1	3	**2**	**1**	2	**2**	**2**
CO.5: Students will Link between languages, automata, and decision problems.	2	3	3	3	2	2	1	1	1	1	3	3	**2**	**1**	2	**3**	**3**

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CS-401.1: Understand models and abstractions: automata as a basic model of computation.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**Unit-1. Introduction of Computational Science** 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 _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CS-401.2: Student will acquire to represent regular expression and Finite State Automata.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		**Unit-2 Regular Expression** 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	CS-401.3: Student will acquire to represent CFL and Pushdown Automata.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		**Unit-3 : Context free Grammar** 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	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CS-401.4: Student will recall Turing machines and the concept of computability, including decidability and un-decidability.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		**Unit-4 : Linear Bounded Automata and Turing Machine** 4.1,4.2,4.3,4.4,4.5,4.6,4.7	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CS-401.5: Students will Link between languages, automata, and decision problems.	SO5.1 SO5.2 SO5.3 SO5.4		**Unit 5: Turing Machine** 5.1,5.2,5.3,5.4,5.5,5.6	

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

Semester IV

Course Code: **PC402**

Course Title: **Software Engineering**

Pre-requisite: Basics knowledge of programming

Rationale: Software engineering is important because it helps create high-quality software that meets user needs and is easy to maintain.

Course Outcomes:

On successful completion of this course, the students will be able to:

PC402.l Students should be familiar with various phases of the software development process, including requirements analysis, design, implementation, testing, deployment, and maintenance.

PC402.2 Learn how to design software systems, considering factors such as modularity, scalability, and maintainability. Understand architectural patterns and their applications.

PC402.3 Develop strong programming skills in relevant languages and frameworks. This includes understanding data structures, algorithms, and design patterns.

PC402.4 Understand the challenges and strategies associated with maintaining and evolving software systems over time. Understand the importance of quality assurance in software development.

PC402.5 Acquire basic project management skills, including estimation, planning, and tracking progress.

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)	
PC	PC402	Software Engineering	3	2	2	1	8	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 teachers 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)		
PCC	PC402	SOFTWARE ENGINEERING	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PCC	PC402	SOFTWARE ENGINEERING	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.

PC402.l Students should be familiar with various phases of the software development process, including requirements analysis, design, implementation, testing, deployment, and maintenance.

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 Understand the requirement of software engineering. **SO1.2** Understanding standard for software process. **SO1.3** Understanding types of software development models. **SO1.4** Critically evaluate various types of software development models. **SO1.**5 Understand 4th generation models. .	LI1.1. Develop requirements specification for a given problem (The requirements specification should include both functional and non-functional requirements. For a set of about 20 sample problems LI1.2. TO design and implement Electronic Cash Counter system through Class Diagram LI1.3. To design and implement ATM System	**Unit-1.0 Introduction and Software Process Models** **(13 Lectures)** **1.1** Software, Software Engineering **1.2** Myths, Software Process, Work Products **1.3** Importance of Software Engineering **1.4** Standard for Software Process **1.5** Waterfall Model **1.6** Prototyping Model, Iterative Enhancement Model **1.7** Spiral Model **1.8** RAD model **1.9** 4th Generation models, Formal Methods **1.10** Agile development model.	1. Learning about various SDLC models.

	through Use case Diagram		

SW-1 Suggested Sessional Work (SW):

a. Assignments:
i. Critically evaluate spiral model.
ii. Explain Agile development model.

b. Mini Project:
Compare various software development models.

c. Other Activities (Specify):
Find out the characteristics of a good software.

PC402.2 Learn how to design software systems, considering factors such as modularity, scalability, and maintainability. Understand architectural patterns and their applications.

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 To Understand the need for software requirement specifications. **SO2.2** To learn about requirement verification and validation. **SO2.3** To understand the role of management in software development. **SO2.4** To understand project estimation techniques.	LI2.1. To design and implement ATM System through Sequence Diagram. LI2.2. To design and implement ATM System through Collaboration diagram.	**Unit-2 Requirement Engineering and Software Project Management (12 Lectures)** 2.1 Software Requirements, Types of Requirements 2.2 Requirement Engineering Cycle. 2.3 Requirements Specification document , Characteristics of Requirements 2.4 Requirement verification and validation 2.5 Role of Management in	1. Try to Implement project estimation techniques with an example.

SO2.5 To learn about software configuration management.	LI2.3. To design and implement ATM System through State Chart diagram	Software Development 2.6 Project Estimation Techniques, Staffing & Scheduling 2.7 Earned Value Analysis 2.8 Software Risks, Software Configuration Management 2.9 Software Process and Project metrics.	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Prepare a format of software requirement specification.
ii. Explain software process and project matrix.

b. Mini Project:

Estimate a project using COCOMO model.

PC402.3 Develop strong programming skills in relevant languages and frameworks. This includes understanding data structures, algorithms, and design patterns.

Approximate Hours

Item	AppX Hrs
Cl	7
LI	6
SW	2
SL	1
Total	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO3.1 Learning about software design concept. **SO3.2** Understand modular approach of designing. **SO3.3** Differentiate between coupling and cohesion. **SO3.4** Understand object-oriented approach of designing.	LI3.1. To design and implement ATM System through Activity Diagram. LI3.2. To design and implement Component diagram for	**Unit-3 Software Design and Coding** **(10 Lectures)** 3.1 Process, Data and Behavioural Modelling Essential Tags 3.2 Design Concepts, Modularity 3.3 Architectural design 3.4 Coupling and Cohesion 3.5 Top-down and bottom-up design	1. Learning various approaches of software design.

SO3.5 Use coding style and documentation.	ATM System LI3.3. To design and implement ATM System through Deployment diagram.	3.6 Object-oriented Analysis, Function-oriented and Object-Oriented Design approach 3.7 Software Design Document, Coding styles and documentation	

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Explain top-down and bottom-up approach of designing.

ii. Evaluate types of coupling.

b. Mini Project:

iii. Create an DFD for any restaurant.

c. Other Activities (Specify):

i. Design and Develop UML diagrams for any Software Project.

PC402.4 Understand the challenges and strategies associated with maintaining and evolving software systems over time. Understand the importance of quality assurance in software development.

Approximate Hours

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

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**

Understanding differenttypes of testing approach **SO4.2** Learn about different levels of testing. **SO4.3** Creating test cases for any algorithm. **SO4.4** Understanding the need for SQA. **SO4.5** Understand software quality factors.	LI4.1. To design and write the test cases for ATM System LI4.2. Develop test cases for unit testing and integration testing LI4.3. Develop test cases for various white box and black box testing techniques.	**Unit-4: Testing and Software Quality (15 Lectures)** 4.1 Testing principles & testing strategies 4.2 Black-box and White-box Testing Techniques 4.3 Levels of testing -unit, integration, system, regression 4.4 Test Plan, Test Cases Specification 4.5 Software debugging 4.6 Software Maintenance 4.7 Software Quality Assurance (SQA) 4.8 SQA tasks, Software amplification and removal 4.9 Formal Technical Reviews 4.10 Software Quality Factors 4.11 ISO 9126, SEI CMM, CMMI 4.12 Software Reliability, Software Availability	1. Differentiate between black box and white box testing. 2. Learn about software quality assurance.

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

a. Assignments:

i. Write down the types of software maintenance.

ii. Explain the working of SQA.

b. Mini Project:

i. Learn to use version control systems (e.g., Git) to manage source code changes collaboratively.

c. Other Activities (Specify):

Develop the ability to create clear and concise documentation for software projects, including technical specifications, user manuals, and system documentation.

PC402.5 Acquire basic project management skills, including estimation, planning, and tracking progress.

Approximate Hours

Item	AppX Hrs
Cl	7
LI	6
SW	2

SL	1
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand the scope of CASE tools. **SO5.2** Understand the need of CASE in SDLC. **SO5.3** Learn about web engineering. **SO5.4** Learn about reverse engineering **SO5.5** Understanding the challenges of software engineering.	LI5.1. Develop DFD model (level-0, level-1 DFD and Data dictionary) of a project LI5.2. : Implementation of COCOMO Model for cost estimation LI5.3. Implementation of CPM & PERT	**Unit-5: Computer Aided Software Engineering and Advanced Topics (10 Lectures)** 5.1 Computer Aided Software Engineering (CASE) and its Scope 5.2 CASE support in Software Life Cycle, Architecture of CASE Environment. 5.3 Upper CASE and Lower CASE, Exposure to CASE Tools 5.4 Software Process Improvement, Component Based Software Engineering 5.5 Web Engineering and Reverse Engineering	1. Learn CASE Tools.
		5.6 Software Engineering challenges of Big Data 5.7 Mobile Applications	

SW-5 Suggested Sessional Work (SW):

a. Assignments

i. Find out challenges in software engineering. How would you try to overcome these challenges?
ii. what is CASE TOOL? Which are the top three open source case tools in the market and their unique features?

b. Mini Project:

i. Implement CASE tools in your project.

c. Other Activities (Specify):

Explain reverse engineering.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
PC402.1 Students should be familiar with various phases of the software development process, including requirements analysis, design, implementation, testing, deployment, and maintenance.	10	6	2	1	16
PC402.2 Learn how to design software systems, considering factors such as modularity, scalability, and maintainability. Understand architectural patterns and their applications.	9	6	2	1	15
PC402.3 Develop strong programming skills in relevant languages and frameworks. This includes understanding data structures, algorithms, and design patterns.	7	6	2	1	13
PC402.4 Understand the challenges and strategies associated with maintaining and evolving software systems over time. Understand the importance of quality assurance in software development.	12	6	2	2	19
PC402.5 Acquire basic project management skills, including estimation, planning, and tracking progress.	7	6	2	1	13
Total Hours	45	30	10	6	91

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
PC402.1	Students should be familiar with various phases of the software development process, including requirements analysis, design, implementation, testing, deployment, and maintenance.	02	01	01	04

PC402.2	Learn how to design software systems, considering factors such as modularity, scalability, and maintainability. Understand architectural patterns and their applications.	02	04	02	08
PC402.3	Develop strong programming skills in relevant languages and frameworks. This includes understanding data structures, algorithms, and design patterns.	03	05	04	12
PC402.4	Understand the challenges and strategies associated with maintaining and evolving software systems over time. Understand the importance of quality assurance in software development.	02	08	05	15
PC402.5	Acquire basic project management skills, including estimation, planning, and tracking progress.	03	05	03	11
Total		12	23	15	50

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

The end of semester assessment for software engineering will be held with written examination of 50 marks

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

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit 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	Software Engineering-A Practitioners Approach	R. Pressman	McGraw Hill International edition	2004
2	Software Engineering	N.S. Gill	Khanna Publishing Co.	Delhi 2018
3	Software Engineering	Ian Sommerville	Addison-Wesley	2010
4	An Integrated Approach to Software Engineering	Pankaj Jalote	Narosa	2014
5	Fundamentals of Software Engineering	By Rajib Mall	PHI Learning Pvt. Ltd	2014

Curriculum Development Team

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CO, PO and PSO Mapping

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

Course Code: PC402

Course Title: Software Engineering

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
	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-long learning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO1	3	3	3	3	2	3	1	1	2	1	3	3	2	2	3	2	3
CO2	2	3	2	3	2	2	1	1	2	3	3	3	2	3	2	3	3
CO3	3	2	2	3	2	2	1	2	3	3	3	3	2	2	2	2	3
CO4	3	2	3	2	2	2	1	2	3	3	3	3	2	2	3	2	2
CO5	2	2	3	2	2	2	1	1	2	1	3	3	2	2	3	2	2

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: Students should be familiar with various phases of the software development process, including requirements analysis, design, implementation, testing, deployment, and maintenance.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	LI1.1,LI1.2,LI1.3	Unit-1.0 **Introduction and software process models** 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
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2: Learn how to design software systems, considering factors such as modularity, scalability, and maintainability. Understand architectural patterns and their applications.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LI2.1,LI2.2,LI2.3	Unit-2 **Requirement Engineering and Software Project Management** 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: Develop strong programming skills in relevant languages and frameworks. This includes understanding data structures, algorithms, and design patterns.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	LI3.1,LI3.2,LI3.3	Unit-3: **Software Design and Coding** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7	
PO1,2,3,4,5,6,7,8, 9,10,11,12 PSO 1,2, 3, 4, 5	CO4: Understand the challenges and strategies associated with maintaining and evolving software systems over time. Understand the importance of quality assurance in software development.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LI4.1,LI4.2,LI4.3	Unit-4: **Testing and Software Quality** 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 7,8,9,10,11,12PSO 1,2, 3, 4, 5	CO5: Acquire basic project management skills, including estimation, planning, and tracking progress.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	LI5.1,LI5.2,LI5.3	Unit-5: **Computer Aided Software Engineering and Advanced Topics** 5.1,5.2,5.3,5.4,5.5,5.6,5.7	

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

Semester-IV

Course Code: PC403

Course Title: Deep Learning

Pre-requisite: Student should have basic knowledge of python programming.

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

Course Outcomes:

PC-403.1: Students should be familiar with various characteristics of the deep learning.
PC-403.2: Learn how activation function works with different parameters.
PC-403.3: Create Autoencoder/Decoder and understand the mechanism of regularization and normalization.
PC-403.4: Develop convolutional neural network (CNN) and recurrent neural network (RNN).
PC-403.5: Apply pattern recognition and classification using artificial neural network.

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)	
PCC	PC403	Deep Learning	3	2	2	1	8	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 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.

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

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)		
PC	PC403	Deep Learning	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT		
PC	PC403	Deep Learning	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.

PC-403.1: Students should be familiar with various characteristics of the deep learning.

Approximate Hours

Item	Appx. Hrs.
CI	7
LI	4
SW	2
SL	1
Total	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understanding the basics of neuron. **SO1.2** Understanding various components of perceptron. **SO1.3** Understanding multilayer perceptron. **SO1.4** Understanding feedforward nature of neural network. **SO1.5** Understanding back propagation feature of neural network.	**LI.1.1.** Write a program for Multilayer Perceptron (MLP) Model. **LI.1.2.** Write a program for Feed Forward Neural Network.	**Unit-1.0 Introduction to Deep Learning** 1.1 History of Deep Learning, 1.2 McCulloch Pitts Neuron, 1.3 Multilayer Perceptrons (MLPs), 1.4 Representation Power of MLPs, 1.5 Sigmoid Neurons, 1.6 Feed Forward Neural Networks, 1.7 Back propagation	1. Learning basics of neural network and activation function.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Sigmoid Neurons
2. McCulloch Pitts Neuron

b. Mini Project:

Feed Forward Neural Networks

c. Other Activities (Specify):

NA

PC-403.2: Learn how activation function works with different parameters.

Approximate Hours

Item	Appx. Hrs.
CI	12
LI	10

SW	2
SL	1
Total	25

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Understanding basics of activation functions. **SO2.2** Understanding different variants of activation functions. **SO2.3** Understanding principal component analysis and its interpretation. **SO2.4** Understanding parameters and hyperparameters in neural network.	**LI.2.1.** Write a program for ReLU activation function. **LI.2.2.** Write a program for Leaky ReLU activation function. **LI.2.3.** Write a program for Tanh activation function **LI.2.4.** Write a program for Softmax activation function **LI.2.5.** Write a program for Sigmoid activation function	**Unit-2.0 Activation functions and parameters** 2.1 Linear Activation Function 2.2 Non-Linear Activation Function 2.3 RELU Function 2.4 Sigmoid Function 2.5 Gradient Descent (GD), 2.6 Momentum Based GD, 2.7 Nesterov Accelerated GD, 2.8 Stochastic GD, 2.9 Principal Component Analysis 2.10 PCA Interpretations, 2.11 Singular Value Decomposition, 2.12 Parameters v/s Hyper-parameters	1. Learning various parameters and hyperparameter of activation function.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Gradient Descent (GD)
2. Momentum Based (GD)

b. Mini Project:

Principal Component Analysis and its interpretations.

c. Other Activities (Specify):

NA

PC-403.3: Create Autoencoder/Decoder and understand the mechanism of regularization and normalization.

Approximate Hours

Item	Appx. Hrs.
CI	10
LI	8
SW	2
SL	1
Total	21

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Understanding basics of auto encoders. **SO3.2** Understanding different variants of auto encoder. **SO3.3** Understanding encoder decoder model. **SO3.4** Understanding basic concepts of batch normalization.	**LI.3.1.** Write a Program for demonstrating Regularization. **LI.3.2.** Write a program for implementing Sparse Auto Encoder. **LI.3.3.** Write a program for demonstrating Batch Normalization. **LI.3.4.** Write a program for Denoising Auto Encoder.	**Unit-3.0 Auto-encoders & Regularization** 3.1 Auto encoders and relation to PCA, 3.2 Regularization: Regularization in auto encoders, 3.3 Denoising auto encoders, 3.4 Sparse auto encoders, 3.5 Bias Variance Tradeoff, 3.6 L2 regularization, Early stopping, 3.7 Dataset augmentation, Batch Normalization 3.8 Encoder Decoder Models, 3.9 Attention Mechanism, 3.10 Attention over images,	1. Learning regularization and normalization in auto-encoder.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

1. Denoising auto encoders
2. Sparse auto encoders

b. Mini Project:

Encoder Decoder Models

c. Other Activities (Specify):

NA

PC-403.4: Develop convolutional neural network (CNN) and recurrent neural network (RNN).

Approximate Hours

Item	Appx. Hrs.
CI	10

LI	4
SW	2
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Understanding basics of convolutional neural network. **SO4.2** Understanding different variants of convolutional neural network. **SO4.3** Understanding basics of recurrent neural network. **SO4.4** Understanding different variants of recurrent neural network.	**LI.4.1.** Write a program for implementing Convolutional Neural Network. **LI.4.2.** Write a program for Implementing Recurrent Neural Network.	**Unit-4.0 Deep Learning Models** 4.1 Introduction to CNNs, 4.2 Architecture, 4.3 Convolution/Pooling Layers, 4.4 CNN Applications, 4.5 LeNet, AlexNet, ZF-Net, 4.6 VGGNet, GoogLeNet, ResNet. 4.7 Introduction to RNNs, 4.8 Back propagation through time (BPTT), 4.9 Vanishing and Exploding Gradients, 4.10 Truncated BPTT, GRU, LSTMs	1. Learning convolutional neural and recurrent neural network.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

1. Introduction to CNNs
2. Introduction to RNNs

b. Mini Project:

Back propagation through time (BPTT)

c. Other Activities (Specify):

NA.

PC-403.5: **Apply pattern recognition and classification using artificial neural network.**

Approximate Hours

Item	Appx. Hrs.
CI	6
LI	4
SW	2

SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 Understanding basics of image processing through deep learning models. **SO5.2** Understanding the procedure and significance of natural language processing. **SO5.3** Understanding the development of speech recognition system. **SO5.4** Understanding video processing system.	**LI.5.1.** Write a program to count frequency 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?	**Unit-5.0 Deep Learning Applications** 5.1 Image Processing, 5.2 Natural Language Processing, 5.3 Speech Recognition, 5.4 Video Analytics 5.5 Data Visualization 5.6 Pattern Recognition	1. Learning core applications of deep learning algorithms.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

1. Image Processing
2. Speech Recognition

b. Mini Project:

Natural Language Processing

c. Other Activities (Specify):

NA.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	LI (Laboratory Instruction)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
PC-403.1**:** At the end of this chapter the student will be familiar with various characteristics of the deep learning.	7	4	2	1	14

PC-403.2**:** At the end of this chapter the student will use	12	10	2	1	25
activation function works with different parameters.					
PC-403.3: At the end of this chapter the student will create Autoencoder/Decoder and understand the mechanism of regularization and normalization.	10	8	2	1	21
PC-403.4: At the end of this chapter the student will develop convolutional neural network (CNN) and recurrent neural network (RNN).	10	4	2	1	17
PC-403.5: At the end of this chapter the student will do pattern recognition and classification using artificial neural network.	6	4	2	1	13
Total Hours	45	30	10	5	90

Suggestion for End Semester Assessment

Suggested Specification Table (ForESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
PC-403.1	Students should be familiar with various characteristics of the deep learning.	02	05	01	08
PC-403.2	Learn how activation function works with different parameters.	02	03	05	10
PC-403.3	Create Autoencoder/Decoder and understand the mechanism of regularization and normalization.	02	03	07	12
PC-403.4	Develop convolutional neural network (CNN) and recurrent neural network (RNN).	1	3	7	10

PC-403.5	Apply pattern recognition and classification using artificial neural network.	1	05	05	10
Total		13	26	13	50

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

The end of semester assessment for Deep Learning will be held with written examination of 50 marks.

Suggested Learning Resources:

a. Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Deep Learning	Ian Goodfellow	MIT press	2016, 4th Edition
2	Learning deep architectures for AI.	Bengio, Yoshua	Now Publishers	2009, 3rd Edition
3	Deep Learning	Rajiv Chopra	Khanna Book Publishing	2020, 5th Edition

Curriculum Development Team

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COs, POs and PSOs Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]
Course Code : PC-403
Course Title: Deep Learning

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO 1: Students should be familiar with various characteristics of the deep learning.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1	2
CO 2: Learn how activation function works with different parameters.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1	3
CO3: Create Autoencoder / Decoder and understand the mechanism of regularization and normalization.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2	2
CO 4: Develop convolutional neural network (CNN) and recurrent neural network (RNN).	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2	2
CO 5: Apply pattern recognition and classification using artificial neural network.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 1: Students should be familiar with various characteristics of the deep learning.	SO1.1 SO1.2 SO1.3 SO1.4	LI.1.1, LI1.2	Unit-1 Introduction to Deep Learning 1.1,1.2,1.3,1.4,1.5,1.6,1.7	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2: Learn how activation function works with different parameters.	SO2.1 SO2.2 SO2.3 SO2.4	LI.2.1, LI2.2, LI2.3, LI.2.4, LI.2.5	Unit-2 Activation functions and parameters 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 PSO 1,2, 3, 4, 5	CO3: Create Autoencoder / Decoder and understand the mechanism of regularization and normalization.	SO3.1 SO3.2 SO3.3 SO3.4	LI3.1, LI3.2, LI3.3, LI.3.4	Unit-3 Auto-encoders & Regularization 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: Develop convolutional neural network (CNN) and recurrent neural network (RNN).	SO4.1 SO4.2 SO4.3 SO4.4	LI4.1, LI.4.2	Unit-4 Deep Learning Models 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: Apply pattern recognition and classification using artificial neural network.	SO5.1 SO5.2 SO5.3 SO5.4	LI.5.1, LI5.2	Unit-5 Deep Learning Applications 5.1,5.2,5.3,5.4,5.5,5.6	

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

Semester-IV

Course Code: PC404

Course Title: Operating System

Pre-requisite: Student should have basic knowledge of Computer fundamentals and programming.

Rationale: Operating System manages the computer's memory and processes, as well as all of its software and hardware. It also allows you to communicate with the computer without knowing how to speak the computer's language.

Course Outcome:

PC404.1. Understand the basics of an operating systems and its major components
PC404.2. Create and/or modify concurrent programs
PC404.3. Understand Memory Management and Data Management
PC404.4. Apply security as well as recovery features in the design of algorithm
PC404.5. Understand and implement shell programming

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)	
PC	PC404	Operating System	3	2	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 Test2 (2bestout of3) 10 marks each(CT)	Seminar one (SA)	Class Activity anyone (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	**(ESA)**	(PRA+ESA)
PC	PC404	Operating System	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 (ESA)	Total Marks (PRA+ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PC	PC404	Operating System	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.

PC404.1. Understand the basics of an operating systems and its major components.

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

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand Computer and Operating system **SO1.2** Learn about the Batch system, multiprogramming, multiprocessing operating system **SO1.3** Understand Multi user, time sharing, personal system **SO1.4** Learn about Parallel system, real time system, simple monitors. **SO1.5** Understand system architecture and its components **SO1.6** Understand Operating system services, system calls, system programs, system structure **SO1.7** Understand the approaches to OS design and implementation: Microkernel, Layered, Kernel Approach	LI1.1. Write a program (using fork() and/or exec() commands) where parent and Child executes a) same program, same code. b) same program, different code. c) before terminating, the parent waits for the child to finish its task. LI1.2. 2. Write a program to report the behavior of the Linux kernel	**Module 1: Concepts of Operating System** 1.1 Computer system overview, concept of an operating system 1.2 Batch system, multiprogramming, multiprocessing 1.3 Multi user, time sharing, personal system 1.4 Parallel system, real time system, simple monitors 1.5 general system architecture, System components 1.6 Operating system services, system calls,system programs, system structure 1.7 Approaches to OS design and	1. Study about different types of Operating Systems.

	including kernel Version, CPU type, and model. (CPU information) LI1.3. 3. Write a program to print file details including owner access permissions, File access time, where	1.8 implementation: Microkernel, Layered, 1.9 Kernel Approach	
	the file name is given as an argument.		

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Explain Batch system, Multiprogramming, Multiprocessing, Multi user, Time sharing operating system.

ii. Describe System architecture and its components.

PC404.2. Create and/or modify concurrent programs

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Learn about the concept of process, process states, process state transitions **SO2.2** Understand the Process control block, operations on processes **SO2.3** Learn about Threads, concurrent processes, mutual exclusion and synchronization **SO2.4** Understand the principles of deadlocks, integrated deadlocks strategy **SO2.5** Learn about Scheduling levels, scheduling criteria **SO2.6** Learn about inter process synchronization, Inter process communication Socket Programming **SO2.7** Learn about Linux, IPC Mechanism, Remote procedure calls **SO2.8** Learn about RPC exception handling,security issues	LI2.1. Write a program to report the behavior of the Linux kernel including information on configured memory, amount of free and used memory. (memory information) LI2.2. Write a program to copy files using system calls. LI2.3. Writea program to implement the FCFS scheduling algorithm.	**Module 2: Processes and Threads** 2.1 Concept of process, process states, process state transitions 2.2 Process control block, operations on processes 2.3 Threads, concurrent processes, mutual exclusion and synchronization 2.4 Principles of deadlocks, integrated deadlocks strategy 2.5 Scheduling levels, scheduling criteria 2.6 Inter process synchronization, Inter process communication 2.7 Linux, IPC Mechanism, Remote procedure calls 2.8 RPC exception handling, 2.9 security issues	Study about processes and threads

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Draw and describe Process Control Block
ii Explain concurrent process.

PC404.3. Understand Memory Management and Data Management

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

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Learn about Logical and physical address space **SO3.2** Understand Storage allocation and management techniques **SO3.3** Learn about Swapping concepts of multi programming, paging **SO3.4** Learn about Segmentation, virtual storage management strategies **SO3.5** Learn about Demand paging, page replacement algorithm **SO3.6** Learn about Thrashing, File organization, record blocking, access method **SO3.7** Learn about Directory structure, protection file system structure, allocation methods	LI3.1. Write a program to implement the Round Robin scheduling algorithm. LI3.2. 8 Write a program to implement the SJF scheduling algorithm. LI3.3. 9 Write a program to implement a non-preemptive priority-based scheduling Algorithm.	**Module-3.0 Memory Management and Data Management** 3.1. Logical and physical address space 3.2. Storage allocation and management techniques 3.3. Swappingconcepts of multi programming, paging 3.4. Segmentation, virtual storage management strategies 3.5. Demand paging, page replacement algorithm 3.6. Thrashing, File organization, record blocking,	Study about memory allocation.

SO3.8 Learn about Free space management, directory implementation, disk structure, disk scheduling **SO3.9** Learn about Disk management, buffering, swap space management, RAID levels		access method 3.7. Directory structure, protection file system structure, allocation methods 3.8. Free space management, directory implementation, disk structure, disk scheduling 3.9. Disk management, buffering, swap space management, RAID levels	

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Describe Page replacement algorithm.

ii. Differentiate between Logical and Physical address space.

PC404.4. Apply security as well as recovery features in the design of algorithm

Item	AppX Hrs
Cl	9
LI	6
SW	2
SL	2
Total	18

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO4.1 Learn about types of Threats in OS **SO4.2** Learn about Basic OS	LI4.1. Write a program to implement a	**Module-4.0 OS Security**	1. Study about latest malwares
Security Mechanisms	pre-emptive	4.1 Types of Threats in OS	

SO4.3 Understanding the Threats: Malware Taxonomy: Viruses, Worms, Rootkits **SO4.4** Learn about Defense: An Overview, Logging, Auditing, and Recovery **SO4.5** learn about OS-level Memory Protection	priority-based Scheduling Algorithm. LI4.2. 11 Write a program to calculate the sum of n numbers using the thread library. LI4.3. 12 Write a program to implement first-fit, best-fit, and worst-fit allocation strategies	4.2 Basic OS Security Mechanisms 4.3 Understanding the Threats: Malware Taxonomy: 4.4 Viruses, Worms, 4.5 Rootkits 4.6 Defense: An Overview, Logging, 4.7 Auditing, and Recovery 4.8 OS-level 4.9 Memory Protection	

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Write short note on OS-level Memory Protection.

ii. Differentiate between Viruses, Worms, Rootkits.

PC404.5. Understand and implement shell programming

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

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

5.1 Introduction to the Linux/Unix OS design and architecture **SO5.2** Understand Unix shell, Unix operating system services, user perspective **SO5.3** Learn about Representation of files in Unix system processes and their structure, input-outputsystem **SO5.4** Understand Memory management in Unix **SO5.5** Understand Processes: fork, wait, exec, exit, kill, getpid, brk, nice, sleep,trace **SO5.6** Understand Files: open, close, read, write, lseek, stat, sync **SO5.7** Understand Directories: mkdir, rmdir, link, unlink, mount,umount users + **SO5.8** Understand Security: chown, chmod, getuid, setuid **SO5.9** Understand Inter process communication: signals, pipe, Networking: socket, accept, snd, recv, connect	LI5.1. To study of Basic UNIX Commands and various UNIX editors such as vi, ed, ex and EMACS LI5.2. To write C Programs using the following system calls of UNIX operating system fork, exec,getpid, exit, wait, close, stat, opendir, readdir. LI5.3. To write C programs to simulate UNIX commands like cp, ls, grep	**Module -5.0 Case Studies and OS Abstractions** 5.1 Linux/Unix OS design and architecture 5.2 Unix shell, Unix operating system services, user perspective 5.3 Representation of files in Unix system processes and their structure, input-output system 5.4 Memory management in Unix 5.5 Processes: fork, wait, exec, exit, kill, getpid, brk, nice, sleep,trace 5.6 Files: open, close, read, write, lseek, stat, sync 5.7 Directories: mkdir, rmdir, link, unlink, mount,umount users + 5.8 Security: chown, chmod, getuid, setuid 5.9 Inter process communication: signals, pipe, Networking: socket, accept, snd, recv, connect	Study about Linux/Unix OS design and architecture

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Describe Linux/Unix OS design and architecture.

ii. Elaborate Memory management in Unix.

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)
PC404.1. Understand the basics of an operating systems and its major components	9	6	2	2	11
PC404.2. Create and/or modify concurrent programs	9	6	2	2	12
PC404.3. Understand Memory Management and Data Management	9	6	2	2	13
PC404.4. Apply security as well as recovery features in the design of algorithm	9	6	2	2	11
PC404.5. Understand and implement shell programming	9	6	2	2	13
Total Hours	45	30	10	10	60

Suggestion for End Semester Assessment-

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
PC404.1	Understand the basics of an operating systems and its major components	03	04	03	10
PC404.2	Create and/or modify concurrent programs	05	03	02	10
PC404.3	Understand Memory Management and	05	03	02	10
	Data Management				
PC404.4	Apply security as well as recovery features in the design of algorithm	04	05	01	10
PC404.5	Understand and implement shell programming	03	05	2	10
Total		20	17	13	50

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

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

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. 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	Operating system	Galvin & Silberschatz	John Willey	7th Edition, 2004
2	Operating Systems-A Concept Based Approach	Dhamdhare	TMH	2006
3	Operating systems Internals and design principles	Willi am Stall ings	Pearson Education	2012
4	Operating Systems –A Design Oriented Approach	Crowley	TMH	2001
5	Operating systems Design and Implementation	Andrew S. Tanenbaum	Pearson Education	2009

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COs, POs and PSOs Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]
Course Code: PC404
Course Title: Operating System

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

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO 1:** Understand the basics of an operating systems and its major components	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5 SO1.6 SO1.7		Module-1 Concepts of Operating System 1.1,1.2,1.3,1.4,1.5,1.6,1.7	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO 2 :** Create and/or modify concurrent programs	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5 SO2.6 SO2.7 SO2.8		Unit-2 Datatypes and Operators, Variables, Sequences and Iteration 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7,2.8,	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO 3:** Understand Memory Management and Data Management	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5 SO3.6 SO3.7 SO3.8 SO3.9		Unit-3 Conditional Statements, Loops, Arrays and Strings, User Defined Data Types 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,	

PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO 4:** Apply security as well as recovery features in the design of algorithm	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 Dictionaries and Dictionary Accumulation, Functions/Methods: 4.1,4.2,4.3,4.4,4.5	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO 5:** Understand and implement shell programming	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5 SO5.6 SO5.7 SO5.8 SO5.9		Unit-5 File Handling and Memory Management: 5.1,5.2,5.3,5.4,5.5,5.6,5.6,5.7,5.8,5.9	

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

Semester-IV

Course Code:	HS401
Course Title :	Personality Development through life enlightenment skills
Pre- requisite:	Student should have basic knowledge of PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
Rationale:	This course will help students both in their personal and desired professional life. The other purposes of personality development through life enlightenment skills.

Course Outcomes:

CO.1: A student will be able to describe the Introduction to Holistic development of personality
CO.2: A student will be able to discuss the introduction Approach to day-to-day work and duties
CO.3: A student will be able to interpret Statements of basic knowledge.

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)	
HS	HS401	Personality Development through life enlightenment skills	3	0	1	1	5	3

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

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

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

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 number3 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)		
HS	**HS401**	Personality Development through life enlightenment skills	10	10	10	10	10	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.

CO. 1: A student will be able to describe the Introduction to Holistic development of personality

Approximate Hours

Item	Appx Hrs.
Cl	15
LI	0
SW	1
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)

SO1.1 Student will able to Understand the wisdom **SO1.2** Student will able to Describe the concept of pride & heroism **SO1.3** Student will able to Describe virtue	.	**Unit-1.0** Introduction to **Holistic Development of personality** 1.1 Introduction to Verses- 19,20,21,22 (wisdom) 1.2 Introduction to Verses- 19,20,21,22 (wisdom) 1.3 Introduction to Verses- 19,20,21,22 (wisdom) 1.4 Introduction to Verses- 29,31,32 (pride & heroism) 1.5 Introduction to Verses- 29,31,32 (pride & heroism) 1.6 Introduction to Verses- 29,31,32 (pride & heroism) 1.7 Introduction to Verses- 26,28,63,65 (virtue) 1.8 Introduction to Verses- 26,28,63,65 (virtue) 1.9 Introduction to Verses- 26,28,63,65 (virtue) 1.10 Introduction to Verses- 52,53,59 1.11 Introduction to Verses- 52,53,59 1.12 Introduction to Verses- 52,53,59 1.13 Introduction to Verses- 71,73,75,78 1.14 Introduction to Verses-	1. Introduction to Holistic Development of personality 2. The concept of wisdom

		71,73,75,78 1.15 Introduction to Verses- 71,73,75,78	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Concept of Holistic Development of personality

b. Mini Project:

i. Flow diagram of Twenty-five entities of personality development

c. Other Activities (Specify): reed the all concepts of personality development

C0 101.2: A student will be able to discuss the introduction Approach to day-to-day work and duties

Approximate Hours

Item	Appx Hrs.
Cl	15
LI	0
SW	1
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Student will able to Understand the introduction Approach to day-to-day work and duties SO2.2 Student will able to Understand the Concept of karma yoga SO2.3 Student will able to understand the Values and ethics in gita **SO2.4** Student will able to understand the Self control **SO2.**5 Student will able to lean about the result of works	.	Unit-2 introduction Approach to day to day work and duties 2.1 Introduction of Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48 2.2 Introduction of Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48 2.3 Introduction of Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48 2.4 Introduction of Shrimad Bhagwad Geeta : Chapter 2-Verses 41,	1- introduction Approach to day-to-day work and duties 2- karma yoga

		47,48 2.5 introduction of Chapter 3-Verses 13, 21, 27, 35, 2.6 introduction of Chapter 3-Verses 13, 21, 27, 35, 2.7 introduction of Chapter 3-Verses 13, 21, 27, 35, 2.8 introduction of Chapter 3-Verses 13, 21, 27, 35, 2.9 introduction of Verses 5,13,17, 23, 35 2.10 introduction of Verses 5,13,17, 23, 35 2.11 introduction of Verses 5,13,17, 23, 35 2.12 introduction of Verses 5,13,17, 23, 35 2.13 introduction of Chapter 18-Verses 45, 46, 48. 2.14 introduction of Chapter 18-Verses 45, 46, 48. 2.15 introduction of Chapter 18-Verses 45, 46, 48.	

SW-2 Suggested Sessional Work (SW):

a. Assignments:
   i. the Concept Approach to day-to-day work and duties
   ii. Karma yoga

CT 101.3: A student will be able to interpret Statements of basic knowledge

Approximate Hours

Item	Appx Hrs.
Cl	15
LI	0
SW	1
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Student will able to understand the Statements of basic knowledge **SO3.2** A student will be able to explain the control mind persons sthitapragya **SO3.3** A Student will be able to Understand the Concept of Bhakti yoga **SO3.4** A student will be able to explain the Personality of Role model **So3.4** A student will be able to explain the gyan yog SO4.5 A student will be able to explain the result of gyan yoga	.	**Unit-3 : introduction of Statements of basic knowledge** **3.**1 Introduction Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 **3.**2 Introduction Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 **3.**3 Introduction Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 **3.**4 Introduction Chapter 12 -Verses 13, 14, 15, 16,17, 18 3.5 Introduction Chapter 12 -Verses 13, 14, 15, 16,17, 18 3.6 Introduction Chapter 12 -Verses 13, 14, 15, 16,17, 18 3.7 • Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, 3.8 • Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, 3.9 • Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, 3.10 Chapter 4-Verses 18, 38,39 3.11 Chapter 4-Verses 18,	1- Concept of Bhakti yoga 2- Sthitapragya

		38,39 3.12 Chapter 4-Verses 18, 38,39 3.13 Chapter18 – Verses 37,38,63 3.14 Chapter18 – Verses 37,38,63 3.15 Chapter18 – Verses 37,38,63	

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Introduction to Sthiti pragya
ii. Concept of Bhakti Yog

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
C0 101.1: A student will be able to describe the Introduction to Holistic development of personality	15	1	1	17
C0 101.2: A student will be able to discuss the introduction Approach to day-to-day work and duties	15	1	1	17
C0 101.3: A student will be able to interpret Statements of basic knowledge	15	1	1	17
Total Hours	45	03	03	51

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Neetisatakam-Holistic development of personality	17	16	00	33
CO-2	Approach to day-to-day work and duties.	17	16	00	33
CO-3	Statements of basic knowledge.	17	17	00	34

Total	51	49	00	100

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

The end of semester assessment for Personality Development through life enlightenment skills will be held with writtenexamination of 50 marks

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

Suggested Instructional/Implementation Strategies:

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

COs, POs and PSOs Mapping

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

Course Code : HS401

Course Title: Personality Development through life enlightenment skills

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO1 : A student will be able to describe the Introduction to Holistic development of personality	1	2	2	2	1	2	2	3	2	3	1	3	2	3	3	1	2
CO 2 : A student will be able to discuss the introduction Approach to day to day work and duties	1	1	2	2	2	2	2	3	2	3	1	3	2	2	2	1	3
CO3 : 101.3: A student will be able to interpret Statements of basic knowledge	1	1	1	1	1	1	1	3	2	1	1	3	1	1	2	2	2

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning (SL)
PO 1,2,3,4,5,6, 7,8,9,10,11,12,13, 14,15	CO-1:A student will be able to describe the Introduction to Holistic development of personality	SO1.1 SO1.2 SO1.3 SO1.4		Unit-1.0 Neetisatakam-Holistic development of personality 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11,1.12,1.13,1.14,1.15	As mentioned in page number
PO 1,2,3,4,5,6, 7,8,9,10,11,12,13, 14,15	CO 2 :A student will be able to discuss the introduction Approach to day-to-day work and duties	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2 Approach to day-to-day work and duties. 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,	
PO 1,2,3,4,5,6, 7,8,9,10,11,12,13,`14, 15,	CO3 :A student will be able to interpret Statements of basic knowledge.	SO3.1 SO3.2 SO3.3 SO3.4		Unit-3 : Statements of basic knowledge. 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	

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

Semester-IV

Course Code: AU202

Course Title: Environmental Science

Pre- requisite: To study this course, the student must have a knowledge about the environmental components, pollution, biodiversity, and ecosystem at senior secondary.

Rationale: The students studying Environmental Science should possess foundational understanding about environment and its components. They should also know the importance of ecosystems in our surroundings.

Course Outcomes:

CO1: To understand various aspects of life forms, ecological processes, and theimpacts on them by the human during Anthropocene era.
CO2: To build capabilities to identify relevant environmental issues, analyze thevarious underlying causes, evaluate the practices and policies, and develop framework to make inform decisions.
CO3: To develop empathy for all life forms, awareness, and responsibility towards environmental protection and nature preservation.
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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)	
AU	AU202	Environmental Science	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.

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Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

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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
			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)
AU	AU 202	Environmental Science	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: To understand various aspects of life forms, ecological processes, and the impacts on them by the human during Anthropocene era.

Approximate Hours

Item	AppX Hrs.
Cl	15
LI	0
SW	2
SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)

SO1.1 Know multidisciplinary nature of environmental science. SO1.2 Learn about the natural resources. SO1.3 Know the problems associated with land resource. SO1.4 Learn the conservation of resources. SO1.5 Know alternative energy resources.	.	**Unit-1 Environment and Natural Resources:** 1.1 The Multidisciplinary nature of environmental studies. 1.2 Scope and 1.3 Importance of Environmental studies 1.4 Components of Environment: 1.5 Atmosphere, 1.6 Hydrosphere, 1.7 Lithosphere, and 1.8 Biosphere. 1.9 Brief account of Natural Resources and 1.10 associated problems 1.11 Land Resource 1.12 Water Resource 1.13 Energy Resource 1.14 Concept of Sustainability and 1.15 Sustainable Development	i. What is environmental Science? ii. What are resources?

SW-1 Suggested Sessional Work (SW):

a. Assignments:

- **i.** Write the definition and causes of soil erosion.
- **ii.** Define desertification and write its causes.
- **iii.** Describe structure of atmosphere.
- **iv.** Explain lithosphere.

CO2: To build capabilities to identify relevant environmental issues, analyze the various underlying causes, evaluate the practices and policies, and develop framework to make inform decisions.

Approximate Hours

Item	AppX Hrs
Cl	15
LI	0
SW	2

SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Understand the concept of ecosystem. **SO2.2** Learn the structure of ecosystem. **SO2.3** Know the function of ecosystem. **SO2.4** Describe the structure of forest ecosystem. **SO2.**5 Learn about biodiversity and its conservation.		**Unit-2 Biomes, Ecosystem and Biodiversity** 2.1 Introduction 2.2 Major Biomes: Tropical, 2.3 Temperate, 2.4 Forest, 2.5 Grassland, 2.6 Desert, 2.7 Tundra, 2.8 Wetland, 2.9 Estuarine and 2.10 Marine 2.11 Ecosystem: Structure 2.12 Ecosystem: Function and 2.13 Ecosystem: types 2.14 their Preservation & Restoration 2.15 Biodiversity and its conservation practices.	i. What is biotic and abiotic components of environment? ii. What are interactions?

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. What do you mean by ecosystem? Describe the structure of ecosystem.
ii. Give a brief classification of ecosystem.
iii. Write the function of an ecosystem.
iv. Define biodiversity write strategies of biodiversity conservation.

b. Mini Project:

Visit to various ecosystem and study biotic and abiotic ecosystem.

CO3: To develop empathy for all life forms, awareness, and responsibility towards environmental protection and nature preservation.

Approximate Hours

Item	AppX Hrs
Cl	15
LI	0
SW	2

SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1. Learn about pollution and its sources. **SO3.2** Know the sources of different pollutant. **SO3.3** Understand the law & legislation related to environment. **SO3.4** Learn the control of pollution. **SO3.**5 Describe the role of information technology in environment and human health.		**Unit-3: Environmental Pollution, Management and Social Issues**: 3.1 Introduction 3.2 Pollution: Types, 3.3 Control measures, 3.4 Management and 3.5 associated problems. 3.6 Environmental Law and Legislation: 3.7 Protection and conservation Acts. 3.8 International Agreement & Program 3.9 Environmental Movements, 3.10 communication and 3.11 public awareness Program. 3.12 National and 3.13 International organizations related to environment conservation and monitoring. 3.14 Role of information technology in environment and 3.15 human health.	i. What is pollution basic introduction? ii. What is pollutant?

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Write an essay on air pollution.
ii. What do you mean by acid rain write its causes and effects.
iii. Describe the effects of water pollution.
iv. How soil pollution can be control?
v. Describe the role of information technology in environment and human health.
vi. Mention some national and international organizations related to environment conservation and monitoring.

b. Other Activities (Specify):

Visit to different polluted sites and study the source of pollution and their effects.

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: To understand variousaspects of life forms, ecological processes, and the impacts on them by the human during Anthropocene era.	15	2	1	18
CO2: To build capabilities to identify relevant environmental issues, analyze the various underlying causes, evaluate the practices and policies, and develop framework to make inform decisions.	15	2	1	18
CO3: To develop empathy for all life forms, awareness, and responsibility towards environmental protection and nature preservation.	15	2	1	18
Total Hours	45	6	6	54

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Environment and Natural Resources:**	03	01	01	05
CO-2	**Biomes, Ecosystem and Biodiversity**	02	06	02	10
CO-3	**Environmental Pollution, Management and** Social **Issues**	03	07	05	15
Total		11	26	13	50

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

The end of semester assessment for Fundamental of Environmental Science will be held with written examination of 50 marks

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

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. 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	Ecology; Environment Science and Conservation	Singh; J.S., Singh S.P. and Gupta, S. R	S. Chand publishing, New Delhi.	2018
2	Perspectives in Environmental Studies	Kaushik, Anubha, Kaushik, C.P.	New age International Publishers	2018
3	A Textbook of Environmental Studies	Asthana, D. K Asthana Meera	S. C1iand.Publishing, New Delhi	2007
4	Environmental Law and Policy in India: Cases, Material & Status	Divan, S. and Rosenkranz, A	Oxford University Press, India	2002

COs, POs and PSOs Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]
Course Code : AU202
Course Title: Environmental Science

Course Outcomes	Program Outcomes											Program Specific Outcome				
	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	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-long learning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO 1: : To understand various aspects of life forms, ecological processes, and the impacts on them by the human during Anthropocene era	1	2	2	3	2	3	2	2	1	3	3	2	3	3	1	2
CO 2 : To build capabilities to identify relevant environmental issues, analyze the various underlying causes, evaluate the practices and policies, and develop framework to make inform decisions	1	2	2	1	2	3	2	1	1	2	3	2	2	2	1	3
CO 3: To develop empathy for all life forms, awareness, and responsibility towards environmental protection and nature preservation.	2	1	1	1	2	3	2	1	2	1	3	1	1	2	2	2

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO.1:** To understand various aspects of life forms, ecological processes, and the impacts on them by the human during Anthropocene era.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**Unit-1 Environment and Natural Resources:** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11,1.12,1.13,1.14,1.15	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO.2:** To build capabilities to identify relevant environmental issues, analyze the various underlying causes, evaluate the practices and policies, and develop framework to make inform decisions.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		**Unit-2 Biomes, Ecosystem and Biodiversity** 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	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO.3:** To develop empathy for all life forms, awareness, and responsibility towards environmental protection and nature preservation.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		**Unit-3: Environmental Pollution, Management and Social Issues**: 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	

Semester - V

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

SEMESTER V

Course Code: **PC501**

Course Title: **Data and Visual Analytics in AI**

Pre- requisite: Student should have knowledge of analyzing and visualizing big data to provide organizations with insights for data-driven decision making. Python programming and data visualization are required

Rationale: Visualization is central to advanced analytics for similar reasons. When a data scientist is writing advanced predictive analytics or machine learning (ML) algorithms, it becomes important to visualize the outputs to monitor results and ensure that models are performing as intended. This is because visualizations of complex algorithms are generally easier to interpret than numerical outputs.

Course Outcomes:

PC501.1: Understand the basics of graphics and data visualization.
PC501.2: Understand graphics pipeline and graphical perception.
PC501.3: Understand graphical designing.
PC501.4: Design and implement multidimensional data.
PC501.5: Design collaborative visual 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)	
PC	PC501	Data and Visual Analytics in AI	3	2	1	1	7	4

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

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

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

SL: Self Learning,

C: Credits.

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

Scheme of Assessment:

Theory

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)
PC	**PC501**	**Data and Visual Analytics in AI**	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PC	PC501	Data and Visual Analytics in AI	35	5	5	5	50	50	100

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

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.

PC501.1: Understand the basics of graphics and data visualization.

Approximate Hours

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)
SO1.1 Understand about data for graphics **SO1.2** Understand about Design principles **SO1.3** Understand about Value for visualization **SO1.4** Understand about Categorical, time series **SO1.5** Understand about statistical data graphics **SO1.6** Use of Visualization Tools	LI1.1 Loading different types of datasets using Python. LI1.2 Write a program to create a data frame from dictionary. LI1.3 Write a script to handle missing values using the suitable methods.	**Unit 1.0 Introduction (9 Lectures)** 1.1 Data for Graphics. 1.2 Design principles 1.3 Value for visualization 1.4 Categorical 1.5 Time series 1.6 statistical data graphics I 1.7 statistical data graphics II 1.8 Introduction to Visualization Tools I 1.9 Introduction to Visualization Tools II	1. Learn about design principles and visualization tools

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Discuss about designing principles for data analytics.

ii. Explain categorical Data with examples.

iii. Discuss about various data visualization tools.

PC501.2 Understand graphics pipeline and graphical perception

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

Approximate Hours

Item	AppX. Hrs
Cl	10
LI	6
SW	2
SL	1
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understand Graphics pipeline. **SO2.2** Able to understand Primitives: vertices, edges, triangles **SO2.3** Able to understand Model transforms: translations **SO2.4** Understand about rotations, scaling, View transform **SO2.5** Use of Perspective transform, window transform	LI2.1 Create a Python script for visualizing the given data. LI2.2 Write a script to filter the data. LI2.3 Write a Python module to implement Linear Regression model.	**Unit 2.0 Graphics Pipeline and Aesthetics and Perception (10 Lectures)** 2.1 Primitives: vertices edges and triangles 2.2 Model transforms 2.3 Translations 2.4 Rotations 2.5 scaling 2.6 View transform, Perspective transform, window transform 2.7 Graphical Perception Theory 2.8 Experimentation, and the Application 2.9 Graphical Integrity, Layering and Separation 2.10 Color and Information, Using Space	SL1. Learn about Model transforms: translations, rotations and scaling.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Explain Perspective transform and window transform.

b. Mini Project:

i. Suppose we want to design a database related to your university to help the different departments in the faculty to follow the transactions and processes of textbooks distributed to the students. Complete an information level design for a database that must satisfy the following constraints and requirements:

- Each student can be enrolled in many courses.
- A given course is proposed by one department, but one department can propose many courses.
- Any course is given by one lecturer.
- Each lecturer belongs to one department.
- At the beginning of the semester, each department sends to the "book unit" a document containing the list of requested books.
- Any student receives one book for each course in which he is enrolled.

Based on the previous requirements, do the following:

A. Define the Layering and Separation.

B. Explain the Color and Information.

C. Write Python script for implementing Model transforms.

c. Other Activities (Specify):

Write Python Script for Layering and Separation.

PC501.3. Understand graphical designing.

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Understand about Visual Display of Quantitative Information **SO3.2** Understand Basic Data-Ink Maximization. **SO3.3** Use Graphical Design **SO3.4** Use of Exploratory Data Analysis **SO3.5** Implementation Heat Map	LI 3.1 Write Python script implementing Machine Learning with Scikit Learn LI3.2 Write a script to implement of Logistic regression. LI3.3 Write a program to implement Decision tree for classification.	**Unit-3.0 Visualization Design (9 Lectures)** 1.1 Visual Display of Quantitative Information I 1.2 Visual Display of Quantitative Information II 1.3 Data-Ink Maximization I 1.4 Data-Ink Maximization II 1.5 Graphical Design I 1.6 Graphical Design II 1.7 Exploratory Data Analysis. 1.8 Heat Map I 1.9 Heat Map II	1. Write Python script for generating heat map.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. What is Data-Ink Maximization.

ii. Explain Visual Display of Quantitative Information.

b. Mini Project:

i. Explain Exploratory Data Analysis.

c. Other Activities (Specify):

Explain Graphical Design.

PC501.4 Design and implement multidimensional data.

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand about Query, Analysis and Visualization of Multi-Dimensional Relational Databases SO4.2 Understand Interactive Exploration, tSNE SO4.3 Understand about Interactive Dynamics for Visual Analysis, Visual Queries SO4.4 Understand about Finding Patterns in Time Series Data SO4.5 Apply Trend visualization, Animation, Dashboard, Visual Storytelling	LI4.1. Write Python script to Create Visualization of Multi-Dimensional Relational Databases. LI4.2 Write a Python module to implement of Naive Bayes classifier algorithm. LI4.3 Write a Python script to implement PCA for dimensionality reduction.	**Unit-4.0 Multidimensional Data and Interaction (9 Lectures)** 4.1 Query, Analysis and Visualization of Multi-Dimensional Relational Databases. 4.2 Interactive Exploration, tSNE I 4.3 Interactive Exploration, tSNE II 4.4 Interactive Dynamics for Visual Analysis I 4.5 Interactive Dynamics for Visual Analysis II 4.6 Visual Queries, Finding Patterns in Time Series Data I 4.7 Visual Queries, Finding Patterns in Time Series Data II 4.8 Trend visualization, Animation, Dashboard, Visual Storytelling I 4.9 Trend visualization, Animation, Dashboard, Visual Storytelling II	1. Study about Interactive Dynamics for Visual Analysis 2. Explain About Trend visualization, Animation, Dashboard

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Explain about Visual Queries.

b. Mini Project:

i. Write Python script for Finding Patterns in Time Series Data.

c. Other Activities (Specify):

Explain the Animation, Dashboard, Visual Storytelling.

PC501.5: Design collaborative visual analytics.

Approximate Hours

Item	AppX Hrs
Cl	8
LI	6
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand about Graph Visualization and Navigation **SO5.2** Understand about Online Social Networks **SO5.3** Learn about Social Data Analysis **SO5.4** Understand about Collaborative Visual Analytics **SO5.**4 Understand about Text, Map, Geospatial data	LI5.1 Write a Python script to implement Implementing K-means Clustering. LI5.2 Write a Python script to implement Implementing Hierarchical Clustering. LI5.3 Write a Python script to implement Random Forest.	**Unit 5.0 Collaboration (8 Lectures)** 5.1 Graph Visualization and Navigation. I 5.2 Graph Visualization and Navigation. II 5.3 Online Social Networks 5.4 Social Data Analysis. I 5.5 Social Data Analysis. II 5.6 Collaborative Visual Analytics 5.7 Text, Map, Geospatial data. I 5.8 Text, Map, Geospatial data. II	1. Write Python script to implement Map using Geospatial data

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. What is Graph Visualization and Navigation?

ii. Explain about Social Data Analysis.

b. Mini Project:

i. A survey of Online Social Networks.

c. Other Activities (Specify):
The Impact of Collaborative Visual Analytics.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
PC501.1. Introduction	9	6	1	16
PC501.2. Graphics Pipeline and Aesthetics and Perception	10	6	1	17
PC501.3. Visualization Design	9	6	1	16
PC501.4. Multidimensional Data and Interaction.	9	6	1	16
PC501.5. Collaboration	8	6	1	15
Total Hours	45	30	5	80

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
PC501.1	Introduction	03	04	03	10
PC501.2	Graphics Pipeline and Aesthetics and Perception	05	03	02	10
PC501.3	Visualization Design	05	03	02	10
PC501.4	Multidimensional Data and Interaction	04	05	01	10
PC501.5	Collaboration	03	05	2	10
Total		20	17	13	50

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

The end of semester assessment for Data and Visual Analytics in **AI** 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 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:

A. Books:

S. No.	Title	Author	Publisher	Edition & Year
1	The Visual Display of Quantitative Information	E. Tufte	Graphics Press	2nd Edition, 2001
2	Beginner's Guide for Data Analysis using R Programming	Jeeva Jose	Khanna Publishing	2019
3	Data Visualization Handbook	J. Koponen, J. Hildén	CRC Press	2019
4	The Book of Trees: Visualizing Branches of Knowledge	M. Lima	Princeton Architectural Press	2014
5	Handbook of Graph Drawing and Visualization	R. Tamassia	CRC Press	2013
6	Interactive Data Visualization for the Web	S. Murray	O'Reilly	2nd Edition, 2017

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

Curriculum Development Team

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CO, PO and PSO Mapping

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

Course Code: PC501

Course Title: Data and Visual Analytics in AI

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
	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-long learning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies
CO 1	3	2	3	2	3	3	1	1	1	1	1	3	2	2	3	2	3
CO2	3	3	2	3	3	2	1	2	1	1	1	3	2	3	2	1	3
CO3	3	2	3	3	3	2	1	2	1	1	1	3	2	3	2	2	3
CO4	3	2	3	2	3	2	1	3	1	1	1	3	2	2	3	2	2
CO5	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	3	2

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 the basics of graphics and data visualization.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5 SO1.6	LI1.1, LI1.2, LI1.3	Unit-1.0 **Introduction** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	As Mentioned in Page no. ___to _
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO2: Understand graphics pipeline and graphical perception.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LI2.1, LI2.2, LI2.3	Unit-2 **Graphics Pipeline and Aesthetics and Perception** 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: Understand graphical designing.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	LI3.1, LI3.2, LI3.3	Unit-3: **Visualization Design**. 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	CO4: Design and implement multidimensional data.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LI4.1, LI4.2, LI4.3	Unit-4: **Multidimensional Data and Interaction** 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: Design collaborative visual analytics.	SO5.1 SO5.2 SO5.3 SO5.4	LI5.1, LI5.2, LI5.3	Unit5: **Collaboration.** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,	

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

SEMESTER V

Course Code: **PC503**

Course Title : **Natural Language Processing**

Pre- requisite: To study this Course, a student must have basic knowledge of Soft Computing

Rationale: Natural language processing helps computers communicate with humans in their own language and scales other language-related tasks

Course Outcomes:

PC503.1 Understand language and the tools that are available to efficiently study and analyze large collections of text.

PC503.2 Analyze and discuss the effects of electronic communication on our language

PC503.3 Learn natural language processing with manual and automated approaches.

PC503.4 Learn computational frameworks for natural language processing.

PC503.5 Learn Information retrieval and lexical resources

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 (PC)	PC503	**Natural Language Processing**	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 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)		
PCC	**PC503**	Natural Language Processing	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PC	**PC503**	Natural Language Processing	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.

PC503.1 : Understand language and the tools that are available to efficiently study and analyze large collections of text.

Approximate Hours

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

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1 Understand the framework for natural language **SO1.2** Explain description of English or an Indian language in the frame work **SO1.3** Discuss Finitestate automata **SO1.4** Learn 5 different analysis levels used for NLP **SO1.**5 Understand the Applications	1. Implement a simple computational framework that can process basic English sentences. Use a predefined lexicon and grammar rules to parse sentences and output their syntactic structures. 2. Design and implement a finite state automaton that recognizes a set of valid words in English. Test the FSA with a list of words and non-	**Unit-1 Introduction (8 Lectures)** 1.1 A computational framework for natural language 1.2 description of English or an Indian language in the frame work 1.3 lexicon, algorithms and data structures for implementation of the framework 1.4 Finitestate automata 1.5 different analysis levels used for NLP 1.6 morphological, syntactic, semantic 1.7 pragmatic, Recursive and augmented transition networks 1.8 Applications like machine translations	**1.** Explain the framework of natural language 2. Explain Finitestate automata

	words to verify its accuracy. 3. reate a recursive transition network (RTN) for a simple subset of English grammar.		

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Explain the algorithms and data structures for implementation of the framework
ii. Applications of NPL

b. Other Activities (Specify): Seminar

PC503.2: Analyze and discuss the effects of electronic communication on our language

.

Approximate Hours

Item	AppXHrs
Cl	10
LI	6
SW	1
SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 To Understand Regular Expressions, Finite-State Automata **SO2.2** To learn Morphological Parsing **SO2.3** To lean Part-of Speech Tagging **SO2.4** Explain Context-free Grammar **SO2.5** Explain RTN, ATN	1. Implement a simple regular expression engine to recognize patterns in text. Use it to find and extract specific patterns such as dates, email addresses, or phone numbers from a given text corpus.	**Unit2: Word level and syntactic analysis (9 Lectures)** 2. Regular Expressions, Finite-State Automata 2.2 Morphological Parsing, Spelling Error Detection and correction 2.3 Words and Word classes 2.4 Part-of Speech Tagging 2.5 Syntactic Analysis:	1.Explain Regular Expressions, Finite-State Automata 2. Explain the concept of Context-free Grammar

	2. Develop a morphological parser that can analyze and generate the morphological structure of words. Implement a spelling error detection and correction system using edit distance or other algorithms. Test it with a list of common misspellings. 3. Create a program that classifies words into different word classes (e.g., nouns, verbs, adjectives) based on predefined rules or patterns. Test the classifier with a sample text.	Context-free Grammar, Constituency 2.6 Parsing-Probabilistic Parsing. 2.7 Machine- readable dictionaries. 2.8 lexical databases 2.9 RTN 2.10 ATN	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

iii. Morphological Parsing, Spelling Error Detection and correction

iv. Syntactic Analysis

PC503.3: Learn natural language processing with manual and automated approaches.

Approximate Hours

Item	AppX Hrs
Cl	10
LI	6
SW	1
SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction(LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 To Understand Lexical Semantics **SO3.2** To learn Word Sense Disambiguation **SO3.3** To understand cohesion **SO3.4** Explain Knowledge Representation. **SO3.5** learn about reasoning	1. Implement a system that represents the meaning of sentences using a formal representation (e.g., semantic networks or predicate logic). Demonstrate how different sentences can be represented and how the system handles synonyms and antonyms. 2. Develop a lexical semantic analyzer that can identify and represent the relationships between words, such as synonyms, antonyms, hypernyms, and hyponyms. Use WordNet or a similar lexical database to support your analysis. 3. Create a program to identify and analyze lexical and syntactic ambiguities in sentences. Provide examples of ambiguous sentences and demonstrate how the program detects and represents the	**Unit3: Semantic analysis (7 Lectures)** 3.1Meaning Representation, 3.2 Lexical Semantics 3.3 Ambiguity 3.4 Word Sense 3.5 Disambiguation 3.6 Discourse Processing: cohesion 3.7 Reference Resolution 3.8 Discourse Coherence and Structure 3.9 Knowledge Representation 3.10 reasoning	1. Differentiate Ambiguation & Disambiguation 2. Explain Coherence

	different possible interpretations.		

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
v. Explain reasoning
vi. Explain cohesion
vii. Explain Lexical Semantics

PC503.4 : Learn computational frameworks for natural language processing.

Approximate Hours

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

Session Outcomes (SOs)	**Laboratory Instruction(LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO4.1 Explain Architecture of NLG Systems **SO4.2** Understanding theApplication of NLG **SO4.3** To learn Characteristicsof Indian Languages **SO4.4** To lean about Machine Translation Approaches **SO4.5** Discuss Translation involving Indian Languages	1. Design and implement a simple NLG system that generates natural language descriptions from structured data (e.g., weather data, sports scores). Outline and explain the different components of the architecture you have used. 2. Create an application that uses NLG to generate personalized emails or reports based on user data. For instance, generate a personalized weather report or a performance summary for	**Unit-4 : Natural language generation** **(8 Lectures)** **4.1** Architecture of NLG Systems **4.2** Tasks and Representations **4.3** Application of NLG **4.4** Machine Translation **4.5** Problems in Machine Translation **4.6** Characteristics of Indian Languages **4.7** Machine Translation Approaches **4.8** Translation involving Indian Languages	**1.** Machine Translation Approaches **2.** Application of NLG

	students based on their grades. 3. Implement a basic machine translation system that translates sentences from one language to another using a rule-based or statistical approach. Evaluate the quality of the translations using metrics like BLEU or METEOR.		

SW-4 Suggested Sessional Work (SW):

a. Assignments:

Viii. Explain the Architecture of NLG Systems

ix. Explain the Characteristics of Indian Languages

b. Other Activities (Specify): Seminar

PC503.5 : Learn Information retrieval and lexical resources problem.

Approximate Hours

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

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

SO5.1 To Understand Information retrieval **SO5.2** Explain features of Information Retrieval Systems **SO5.3** learn Classical, Non-classical models **SO5.4** Learn valuation Lexical Resources **SO5.5** POS Tagger	1. Design and implement a simple information retrieval (IR) system that indexes a collection of documents and allows for efficient querying. Highlight and explain the key design features such as indexing, ranking, and retrieval performance. 2. Implement a classical IR model such as the Vector Space Model (VSM) or Boolean Model. Use a document collection to index and retrieve documents based on user queries. Evaluate the system using precision, recall, and F1-score. 3. Implement a part-of-speech (POS) tagger using a supervised learning approach. Train the tagger on a labeled corpus and evaluate its accuracy on a test set. Use the POS tagger to preprocess text data for an IR system.	**Unit 5: Information retrieval and lexical resources (9 Lectures)** 5.1 Design features of Information Retrieval Systems 5.2 Classical 5.3 Non-classical 5.4 Alternative Models of Information Retrieval 5.5 valuation Lexical Resources 5.6 World Net 5.7 Frame Net 5.8 Stemmers 5.9 POS Tagger	1. Differentiate various models of information retrieval system 2. Define Frame Ne

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**

x. Explain World Net, Frame Net

xi. Stemmers

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW +Sl)

CO1: Understand language and thetools that are available to efficiently study and analyse large collections of text	08	6	02	02	12
CO2: Analyze and discuss the effects of electronic communication on ourlanguage	10	6	02	02	14
CO3: Learn natural language processing with manual and automated approaches	10	6	02	02	14
CO4: Learn computational frameworks for natural language processing.	8	6	01	02	11
CO5: Learn Information retrieval andlexical resources	9	6	01	01	11
Total Hours	45	30	08	09	62

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Understand language	03	02	03	08
CO-2	Analyze and discuss the effects of electronic communication on our language	03	01	05	09
CO-3	Learn natural language processing	03	07	02	12
CO-4	Learn frameworks for natural language processing	03	05	05	13
CO-5	Information retrieval	03	02	03	08
Total		15	17	18	50

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

The end of semester assessment for Natural Language Processing will be held with written examination of 50 marks

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

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit any software company where NPL is implemented
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	Natural Language understanding	James Allen	Pearson Education, 2002	2002
2	NLP: A Paninian Perspective	Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal	Prentice Hall, 2016	2016
3	An Introduction to Natural Language Processing	Daniel Jurafsky and James H. Martin	Pearson Education, 2006	2006

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Natural Language Processing	Prof. Pawan Goyal	IIT Kharagpur
2.	Natural Language Processing	Prof. Pushpak Bhattacharya	IIT Bombay

Curriculum Development Team

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5. Mr. Lokendra Gaur, Assistant Professor, Department of Computer Science and Engineering.
6. Mr. Vinay Kumar Dwivedi, Assistant Professor, Department of Computer Science and Engineering.
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8. Ms. Pushpa Kushwaha, Assistant Professor, Department of Computer Science and Engineering.
9. Ms. Arpana Tripathi, Assistant Professor, Department of Computer Science and Engineering.

CO, PO and PSO Mapping

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

Course Code: PC503

Course Title: Natural Language Processing

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
	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-long learning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies
CO1	3	2	3	2	2	3	1	1	1	1	1	3	2	2	3	2	3
CO2	3	3	2	2	3	2	1	2	1	1	1	3	2	3	2	1	3
CO3	3	2	3	3	3	2	1	2	1	1	1	3	2	3	2	2	3
CO4	2	3	3	3	3	2	1	3	1	1	1	3	2	2	3	2	2
CO5	2	2	3	3	2	2	1	1	1	1	1	3	2	2	3	3	2

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 language and the tools that are available to efficiently study and analyze large collections of text.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 **Introduction** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	As Mentioned in Page no. ___to _
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO2: Analyze and discuss the effects of electronic communication on our language.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2 **Word level and syntactic analysis** 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: Learn natural language processing with manual and automated approaches.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3**: Semantic analysis**. 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO: 1,2,3,4	CO4: Learn computational frameworks for natural language processing.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4: **Natural language generation** 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	CO 5: Learn Information retrieval and lexical resources.	SO5.1 SO5.2 SO5.3 SO5.4		Unit5: **Information retrieval and lexical resources.** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

SEMESTER- V

Course Code: PC504

Course Title : **ADVANCED MACHINE LEARNING**

Pre-requisite: Student should have advance knowledge of machine learning.

Rationale: It enables leaders to make decisions based on more helpful information and analyze problems in new ways, making it the best ally for humans now and in the future.

Course Outcomes:

PC504.1: To introduce advanced concepts and methods of machine learning.
PC504.2: To develop an understanding of the role of machine learning in massive scale automation.
PC504.3: To design and implement various machine learning algorithms in a range of real-world applications.
PC504.4: To understand the computational complexity.
PC504: 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)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PC)	PC504	Advanced Machine Learning	3	2	2	1	8	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 teachers

A K S University

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(Revised as on 01 August 2023)

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)		
ES	PC504	Advanced Machine Learning	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PC	PC504	Advanced Machine Learning	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.

PC504.1: To introduce advanced concepts and methods of machine learning.

Approximate Hours

Item	Appx. Hrs.
Cl	7
LI	4
SW	2
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1. Understand concepts and methods of machine learning. **SO1.2.** To learn various functions of machine learning. **SO1.3.** Compare various algorithms. **SO1.4.** Leaning Random Initialization techniques for machine learning.	**LI.1.1.** Classification and regression algorithms. **LI.1.2.** Implementation of ANN	**Unit-1** **Artificial Neural Network** **1.1** Introduction to ANN. **1.2** Perceptron. **1.3** Cost Function. **1.4** Gradient Checking **1.5** multi-layer perceptron. **1.6** backpropagation algorithm. **1.7** Random Initialization	1. Different types of techniques for machine learning. 2. Learn about various algorithms used for machine learning.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Create algorithms for some real-life problems.
2. Create flowcharts for problems.

b. Mini Project:

NA

c. Other Activities (Specify):

NA

PC504.2: To develop an understanding of the role of machine learning in massive scale automation.

Approximate Hours

Item	Appx. Hrs.
Cl	12
LI	2
SW	2
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1. To Learn Bayesian. **SO2.2.** To Learn Probability theory **SO2.3.** Apply Naive Bayes learning algorithm	**LI.2.1.** K-Means Clustering.	**Unit-2** Bayesian Learning 2.1. Probability theory 2.2. Bayes rule 2.3. Naive Bayes learning algorithm 2.4. Bayes nets	1. Learn Bayesian. 2. Probability theory

SW-2 Suggested Sessional Work(SW):

a. Assignments:

1. Compare various existing systems.
2. Apply Naïve Bayes algorithm.

b. Mini Project:

NA

c. Other Activities(Specify):

NA

PC504.3: Gain an understanding of the various types of Conditional Statements, Loops, Arrays and Strings.

Approximate Hours

Item	Appx. Hrs.
Cl	10
LI	2
SW	2
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1. To Understand the decision tree. **SO2.2.** Applying searching on trees. **SO2.3.** Apply recursive induction. **SO2.4.** Calculate the computational complexity.	**LI.3.1.** Artificial Neural Network (with back-propagation).	**Unit-3 :** Decision Trees 3.1 Representing concepts as decision trees. 3.2 Recursive induction of decision trees. 3.3 Entropy and information gain. 3.4 Searching for simple trees. 3.5 computational complexity. 3.6 Overfitting. 3.7 Noisy data. 3.8 Pruning.	i. Various searching techniques on tree. ii. Calculate computational complexity.

SW-3 Suggested Sessional Work(SW):

a. Assignments:

1. Compare various searching techniques with complexity.
2. Use of recursive induction.

b. Mini Project:

NA

c. Other Activities(Specify):

NA

PC504.4: To understand the computational complexity.

Approximate Hours

Item	Appx. Hrs.
Cl	10
LI	2
SW	2
SL	1
Total	15

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

SO2.1. Understand the concepts of Reinforcement Learning **SO2.2.** Learn function approximation **SO2.3.**	**LI.4.1.** Decision Trees.	**Unit-4 :** Reinforcement Learning 4.1 Reinforcement earning through feedback network 4.2 function approximation	i. Reinforcement earning through feedback network ii. function approximation

SW-4 Suggested Sessional Work(SW):

a. Assignments:
1. Reinforcement earning through feedback network

b. Mini Project:
NA

c. Other Activities(Specify):
NA.

PC504.5: Comprehend the functions of different File Handling and Memory Management.

Approximate Hours

Item	Appx. Hrs.
Cl	6
LI	2
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Understanding Bagging **SO2.2** Boosting **SO2.3** learning with ensembles **SO2.4** Random Forest	**LI.5.1.** Random Forest.	**Unit 5:** Ensemble Methods 5.1 Bagging. 5.2 Boosting. 5.3 Stacking. 5.4 learning with ensembles. 5.5 Random Forest.	1. learning with ensembles. 2. Random Forest

SW-5 Suggested Sessional Work (SW):

a. Assignments:
Random Forest.

b. Mini Project:
NA

c. Other Activities(Specify):

NA.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	LI (Laboratory Instruction)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
PC504.1: To introduce advanced concepts and methods of machine learning.	7	4	2	1	14
PC504.2**:** To develop an understanding of the role of machine learning in massive scale automation.	12	4	2	1	17
PC504.3: To design and implement various machine learning algorithms in a range of real-world applications.	10	2	2	1	15
PC504.4: To understand the computational complexity.	10	2	2	1	15
PC504.5: Understand real world problems and developing computer solutions for those.	6	2	2	1	11
Total Hours	45	14	10	5	72

Suggestion for End Semester Assessment

Suggested Specification Table(ForESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
PC504.1	To introduce advanced concepts and methods of machine learning.	02	05	01	08

PC504.2	To develop an understanding of the role of machine learning in massive scale automation.	02	03	05	10
PC504.3	To design and implement various machine learning algorithms in a range of real-world applications.	02	03	07	12
PC504.4	To understand the computational complexity.	1	3	7	10
PC504.5	Understand real world problems and developing computer solutions for those.	1	05	05	10
Total		13	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	Machine Learning	Tom Mitchell	McGraw Hill	1997
2	Introduction to Machine Learning	Jeeva Jose	Khanna Publishing House	2020
3	Machine Learning	Rajiv Chopra	O'Reilly Media	2021

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COs, POs and PSOs Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]
Course Code : PC504
Course Title: Advanced Machine Learning

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
PC504.1: To introduce advanced concepts and methods of machine learning.	2	3	3	2	1	2	1	1	1	1	1	2	**2**	**3**	**1**	**2**	**2**
PC504.2**:** To develop an understanding of the role of machine learning in massive scale automation.	2	2	3	3	1	2	1	1	1	1	1	3	**2**	**2**	**2**	**2**	**2**
PC504.3: To design and implement various machine learning algorithms in a range of real-world applications.	2	3	3	2	1	1	1	1	1	1	1	3	**1**	**1**	**2**	**2**	**2**
PC504.4: To understand the computational complexity.	2	2	3	3	1	2	1	1	1	1	1	3	**2**	**3**	**1**	**2**	**2**
PC504.5: Understand real world problems and developing computer solutions for those.	2	3	3	3	2	2	1	1	1	1	3	3	**2**	**3**	**1**	**1**	**2**

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	PC504.1: To introduce advanced concepts and methods of machine learning.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	Unit-1 Introduction 1.1,1.2,1.3,1.4,1.5,1.6,1.7	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	PC504.2**:** To develop an understanding of the role of machine learning in massive scale automation.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	**Unit-2** To develop an understanding of the role of machine learning in massive scale 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	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	PC504.3: To design and implement various machine learning algorithms in a range of real-world applications.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	Unit-3 **:** To design and implement various machine learning algorithms in a range of real-world applications 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	PC504.4: To understand the computational complexity.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	Unit-4: To understand the computational complexity. 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	PC504.5: Understand real world problems and developing computer solutions for those.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	Unit-5 Understand real world problems and developing computer solutions for those. 5.1,5.2,5.3,5.4,5.5,5.6	

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

Semester V

Course Code: **PC502**

Course Title: **Optimization Techniques in Machine learning**

Pre- requisite: Data Structures and Data Management or Data Structures

Rationale: The aim of the course is to improve the accuracy of predictions of machine learning with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach. It explores the essential theory behind methodologies for developing systems that demonstrate intelligent behavior including dealing with uncertainty, learning from experience and following problem-solving strategies found in nature with accuracy.

Course Outcomes:

PC502.1: Demonstrate knowledge of the fundamental principles of Optimization.
PC502.2: Apply Machine Learning Strategy.
PC502.3: Use of Machine Learning.
PC502.4: Familiarize machine learning in Production and planning.
PC5025: Comprehend the use of care and feeding of Machine Learning.

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 (PC)	PC502	Optimization Techniques in Machine learning	4	0	1	1	5	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 (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)		
PC	PC502	**Optimization Techniques in Machine Learning.**	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.

PC502.1: Demonstrate knowledge of the fundamental principles of Optimization

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)
SO1.1 Understand the concept of Optimization **SO1.2** Compare types of Optimization. **SO1.3** Apply types of Optimization.	.	**Unit-1.0 Introduction. (10 Lectures)** 1.1 Demonstrate knowledge of the fundamental principles of Optimization 1.2 Solution of LPP 1.3 Simplex method I 1.4 Simplex method II 1.5 Simplex method III 1.6 Basic Calculus for optimization I 1.7 Limits I 1.8 Limits II 1.9 multivariate functions I 1.10 multivariate functions II	1. Search devices using optimized machine learning. 2. Numerical based on simplex method.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Numerical based on Simplex method.
ii. Numerical based on Calculus.
iii. Numerical based on Linear approximations.

PC502.2: Apply Machine Learning Strategy

Approximate Hours

Item	AppX Hrs
Cl	11
LI	0

SW	2
SL	2
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Understand the concept of ML readiness. **SO2.2** Use the risk mitigation. **SO2.3** Demonstrate the use of experimental mindset.	.	**Unit-2.0 Apply Machine Learning Strategy (11 Lectures)** 2.1. Machine Learning Strategy I 2.2. Machine Learning Strategy II 2.3. ML readiness I 2.4. ML readiness II 2.5. Risk mitigation I 2.6. Risk mitigation II 2.7. Risk mitigation III 2.8. Experimental mindset 2.9. Build/buy/partner 2.10. setting up a team, 2.11. Understanding and communicating change	1. How Ml readiness is used to solve real life problems. 2. Applications of the experimental mindset.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

iv. Numerical based on Fuzzy logic.
v. Numerical based on Membership Function.
vi. Numerical based on Genetic algorithm.

PC502.3: Use various AI algorithms.

Approximate Hours

Item	AppX Hrs
Cl	11
LI	0

SW	2
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Understand the concept of graph and search tree **SO3.2** Use various search algorithms **SO3.3** Apply various search algorithms	.	**Unit-3.0** Search Methods **(11 Lectures)** 3.1. Basic concepts of graph 3.2. Basic concepts of search tree. 3.3. breadth-first search 3.4. depth-first search 3.5. iterative deepening search 3.6. Heuristic search methods 3.7. best-first search 3.8. admissible evaluation functions 3.9. hill-climbing search 3.10. Optimization 3.11. Search such as stochastic annealing and genetic algorithm.	1. Compare and analyze all search algorithm.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

vii. Numerical based on Fuzzy logic.
viii. Numerical based on Membership Function.
ix. Numerical based on Genetic algorithm.

PC502.4: Familiarize knowledge representation in intelligent system.

Approximate Hours

Item	AppX Hrs
Cl	15
LI	0
SW	2
SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand the concept of knowledge representation **SO4.2** Use of frames and scripts **SO4.3** Apply formal logic and inference	.	**Unit-4.0 Knowledge representation and logical inference** **(15 Lectures)** 4.1. Issues in knowledge representation 4.2. Structured representation: frames 4.3. Example of FRAMES 4.4. Example of FRAMES 4.5. Example of FRAMES 4.6. Scripts 4.7. Example of Scripts 4.8. Example of Scripts 4.9. Example of Scripts 4.10. semantic networks 4.11. conceptual graphs 4.12. Formal logic and logical inference 4.13. Formal logic and logical inference 4.14. Knowledge-based systems structures 4.15. its basic components	1. Compare and analyze all search algorithm.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Questions based on frames.
ii. Questions based on scripts.
iii. Questions based on formal logic.

PC502.5: Comprehend the use of learning system.

Approximate Hours

Item	AppX Hrs
Cl	13
LI	00
SW	02
SL	01
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand the concept of Reasoning under uncertainty **SO5.2** Demonstrate the use of learning techniques	.	**Unit-5.0 Learning Techniques** **(13 Lectures)** 5.1. Reasoning under uncertainty. 5.2. Learning Techniques on uncertainty reasoning 5.3. Bayesian reasoning I 5.4. Bayesian reasoning II 5.5. Certainty factors I 5.6. Certainty factors II 5.7. Dempster-Shafer Theory of Evidential reasoning 5.8. A study of different learning and evolutionary algorithms 5.9. A study of different learning and evolutionary algorithms 5.10. Statistical learning I 5.11. Statistical learning II 5.12. Induction learning I 5.13. Induction learning II	1. Compare and analyze all learning techniques.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Different types of learning techniques.

ii. Use of Dempster-Shafer Theory of Evidential reasoning

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
PC502.1: Demonstrate knowledge of the fundamental principles of neural network.	10	02	02	14
PC502.2: Apply Fuzzy Logic.	11	02	02	15
PC502.3: Use various AI algorithms	11	02	01	14

PC502.4: Familiarize knowledge representation in intelligent system	15	02	01	18
PC502-5: Comprehend the use of learning system.	13	02	01	16
Total Hours	60	10	7	77

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Biological foundations to intelligent systems I.	03	02	03	08
CO-2	Biological foundations to intelligent systems II.	03	01	05	09
CO-3	Search Methods	03	07	02	12
CO-4	Knowledge representation and logical inference.	03	05	05	13
CO-5	Learning Techniques.	03	02	03	08
Total		15	17	18	50

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

The end of semester assessment for Optimization Techniques in Machine learning 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 any company where AI is implemented
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	Artificial Intelligence: Structures and strategies forComplex Problem Solving	Luger G.F. and Stubblefield W.A.	Addison Wesley	6th edition 2008
2	Artificial Intelligence: A Modern Approach	Russell S. and Norvig P	Prentice-Hall	3rd Edition 2009
3	Lecture note provided by Dept. of CS&E, AKS University, Satna.			

B. Alternative NPTEL/SWAYAM/MOOC Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Artificial Intelligence	Prof. Bhushan Trivedi	GLS University
2.	Artificial Intelligence: Search Methods for Problem Solving	Prof. Deepak Khemani	IIT Madras
3.	Fuzzy Logic and Neural Networks	Prof. Dilip Kumar Pratihar	IIT Kharagpur

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7. Ms. Pinki Sharma, Assistant Professor, Department of Computer Science and Engineering.
8. Ms. Pushpa Kushwaha, Assistant Professor, Department of Computer Science and Engineering.

CO, PO and PSO Mapping

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

Course Code: PC502

Course Title: Optimization Techniques in Machine Learning

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
	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-long learning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies
CO1	3	3	3	2	3	3	1	1	1	1	2	3	2	2	3	2	3
CO2	3	3	2	3	3	2	1	2	1	1	2	3	2	2	2	1	3
CO3	3	2	3	3	3	2	1	2	1	1	2	3	3	3	2	2	3
CO4	3	2	3	3	3	2	1	2	2	1	2	3	2	2	3	2	2
CO5	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	3	2

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: Demonstrate knowledge of the fundamental principles of Optimization.	SO1.1 SO1.2 SO1.3		Unit-1.0 **Introduction.** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8, 1.9, 1.10	As Mentioned in Page no._____to _____
PO: 1,2,3,4,5,6,7, 8,9,10,11,12 PSO: 1,2,3,4	CO 2: Apply Machine Learning Strategy.	SO2.1 SO2.2 SO2.3		Unit-2 **Apply Machine Learning Strategy** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7,2.8,2.9,2.10,2.11	
PO: 1,2,3,4,5,6,7, 8,9,10,11,12 PSO: 1,2,3,4	CO3 : Use of Machine Learning.	SO3.1 SO3.2 SO3.3		Unit-3: **Search Methods** 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	CO4: Familiarize machine learning in Production and planning.	SO4.1 SO4.2 SO4.3		Unit-4: **Knowledge representation and logical inference** 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 PSO: 1,2,3,4	CO 5: Comprehend the use of care and feeding of Machine Learning.	SO5.1 SO5.2		Unit5: **Learning Techniques** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11, 5.13	

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(Revisedason01August2023)

SEMESTER-IV

Course Code: EEC401

Course Title: Minor Project

Pre- requisite: Student should have knowledge of programming languages, Software Engineering, and Many more tools and framework.

Rationale:

- To apply the knowledge and skills learnt in previous semesters, to solve real life industrial / engineering / professional problems.
- To modify/ improve the existing engineering / professional systems.
- To develop systems / components / methods / processes / resources to cater the needs of the nearby small scale / medium industry.
- To learn to solve real life engineering / professional problems which often have many aspects to be considered and addressed.

Course Outcomes:

The details of COs and LOs are as follows: -

EEC401.1: - The student will be able to prepare a detailed project plan for solving any real-life related engineering / technical / professional / industrial problem.
EEC401.2: - The student will be able to implement the project plan and manage the project.
EEC401.3: - The student will be able to present the complete project work.

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)	
EEC	EEC401	Minor Project	0	6	0	0	6	3

INTRODUCTION TO PROJECT WORK/INTERNSHIP

Project work is a very important course in all branches of diploma programmes. It offers following opportunities to students of final semester: -

1. To learn skills and abilities which are otherwise not possible either in classroom or in structured environment of laboratory such as: -
   - Skill to work in groups or teams,
   - Skill to face real life professional problems and to create reallife solutions for them.
   - Skill to take professional decisions under real life constraints and circumstances,
   - Skill to learn in self-directed way to pursue the specific

professional projects (Self Directed Learning)

- Skill to learn from real life self- experiences (l i f e l o n g learning)
- Skill to manage the real- l i f e engineering / professional projects
- Skill to plan and organize the self / group professional work
- skills to apply the engineering management principles in real lifeprofessional projects
- Skill to defend / justify self- real- l i f e engineering / professionalwork in front of significant others
- Skill to complete the professional tasks / work keeping in viewsocietal, legal and environmental considerations
- Skill to collect relevant data in real life situations
- Skill to relate engineering / professional knowledge gained in various semesters with real life engineering / professional problems
- Skill to estimate the duration and costs in real life engineering / professional work
- Skill to assess the theoretical feasibility, financial feasibility and time feasibility of real- l i f e engineering / professional tasks.

With an objective to ensure the learning of above skills and abilities as well as to earn maximum marks in NBA assessment,

The Course on Project Work consists of five phases: -

	Description of phases	Learn Hrs.
1	Literature / industry's need survey and finalization of topic / title	15Hrs
2	Detailed planning of the project work	60Hrs
3	Implementing the detailed project plan	
4	Managing the project activities	
5	Reporting of the project work output /outcome / prototype	15Hrs
	Total	90 Hrs

General Guidelines for Internship/Project Work

- The project topics should be related to concerned branch of engineering / profession, but, should not be the exact content of the curriculum taughtin the discipline.
- Student's project topics should be preferably 'real life' topics. It means the project topics should have substantial element of uncertainty, complexity and multi-disciplinary-ness which can be coped up by the students. These elements offer opportunities to students to apply engineering/ professional knowledge in real life settings, solve real life problems and to take real life decisions. As a project guide, concerned teacher should ensure these by suitably altering / framing / reframing the statement of topic / title.
- The project topics should be such that students can get opportunity to refer IS codes, Manuals, Handbooks, norms and standards, opportunity to conduct standard tests, and opportunity to operate modern laboratory equipment's following SOPs.
- For student's interest, active participation and ownership in the project work, their self-motivation is necessary. Therefore, students should be actively involved in finalizing the topic of project.
- Students should be asked to conduct a brief review of literature for problems and issues in their engineering / professional areas of interest,where they think they can contribute effectively. The project guide should facilitate them in this regard, through his/her expertise and experience.

Every student group should be asked to propose at least three topics oftheir interest.

- The topics proposed by student project groups should be assessed by the facilitator-teacher on following three criteria: -
  - **The work on the topic should be theoretically and practically feasible.**
  - **The project work on the topic should be completed within approx. Three and half months.**
  - **Availability of required resources should be certain. Cost of project work should also be bearable.**
- Normally, students' project works should be carried out in small groups (1 to 2 students).
- All faculty members of department should be engaged as project guides. Every faculty member should be project guide of at least one student project group.
- Normally, project guides should be assigned to the students through lottery system and students under each faculty should be asked to formtheir small groups.

COs, POs and PSOs Mapping

Course Title: B. Tech. Computer Science & Engineering *(AI-DS)*

Course Code: EEC401

Course Title: Minor Project

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO 1: The student will be able to prepare a detailed project plan for solving any real-life related engineering / technical / professional / industrial problem.	2	3	3	2	3	2	3	1	3	1	3	3	2	3	3	1	2
CO 2: The student will be able to implement the project plan and manage the project.	2	3	3	2	3	2	3	1	3	1	3	3	2	2	2	2	3
CO 3: The student will be able to present the completed project work.	2	2	3	1	3	2	2	1	3	1	3	3	2	3	2	2	2

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: The student will be able to prepare a detailed project plan for solving any real-life related engineering / technical / professional / industrial problem.				As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2: The student will be able to implement the project plan and manage the project.				
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 3: The student will be able to present the completed project work.				

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Semester V

Course Code: **AU301**

Course Title: **Indian Constitution**

Pre-requisite: N/A

Rationale: Understanding of the constitutional framework, rights, duties, and institutions that define India's democracy. It provides the necessary knowledge to become informed citizens and professionals in fields related to law, politics, public administration, and more.

Course Outcomes:

CO1: Demonstrate a comprehensive understanding of the nature and characteristics of the Indian Constitution, including its historical background, key principles, evaluate the concepts of federalism and unitary form of government in the Indian context, assessing their advantages, disadvantages, and implications for governance and power distribution.

CO2: Examine the provisions and significance of citizenship and fundamental rights in the Indian Constitution, and critically analyze their role in safeguarding individual liberties, promoting equality, and ensuring social justice.

CO3: Recognize the role that the Directive Principles of State Policy play in providing a framework for government action; examine the complex interactions that shape the constitutional ethos between fundamental rights and directive principles; and recognize the role that fundamental duties play in promoting civic engagement and fortifying the basis of a just and inclusive society.

CO4: Understand the structure and functioning of the Union Executive, Legislature, and Judiciary, including the roles and powers of the President, Vice President, Council of Ministers, and the Supreme Court, and assess their significance in the Indian system of governance.

CO5: Analyze the structure and functioning of the State Executive, Legislature, and Judiciary, including the roles and functions of the Governor, State Legislature (Vidhan Sabha and Vidhan Parishad), and High Court, and assess their significance in the state-level governance and legal system.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	PI	SA	SL	Total Study Hours (CI+PI+SW+SL)	
Audit Course	AU301^	Indian Constitution	3	0	1	1	5	3

Legend: CI: Class room Instruction (Includes different instructional strategies. .Lecture (L) and Tutorial (T) and others).

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PI: Practical Instruction
SA: Sessional assignment.
SL: Self Learning,
C: Credits.

Note: SA & SL have 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 15 marks (CA)	Class Test 1 10 marks (CT)	Presentation (P)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+P+CAT+AT)	(ESA)	(PRA+ESA)
Audit Course	AU301^	Indian Constitution	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), Practical Instruction (PI), Sessional Assignment (SA), 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: Demonstrate a comprehensive understanding of the nature and characteristics of the Indian Constitution, including its historical background, key principles, evaluate the concepts of

federalism and unitary form of government in the Indian context, assessing their advantages, disadvantages, and implications for governance and power distribution.

Approximate Hours

Item	AppX. Hrs
Cl	10
PI	00
SW	01
SL	01
Total	**12**

Session Outcomes (SOs)	**Practical Instruction (PI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand background, meaning, definition, nature and fundamental features of constitution. **SO1.2** Understand Types of Constitution. **SO1.3** Understand Types of Government. **SO1.4**Understand Characteristics of federalism. **SO1.5** Understand the concepts of federalism. .	.	**Unit-1. Introduction of Constitution (10 Lectures)** 1.1 Historical Evolution of Constitutions 1.2 Concept and Meaning of Constitution 1.3 Definition and Nature of Constitution 1.4 Fundamental Features of a Constitution 1.5 Preamble and its Significance 1.6 Written and unwritten Constitution 1.7 Rigid Constitution vs. Flexible Constitution 1.8 Codified Constitution vs. Uncodified Constitution 1.9 Characteristics of a Good Constitution, Democracy: Types and Principles 1.10 Monarchy: Absolute vs. Constitutional	1. Remembering the Preamble of the Constitution.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Importance of Preamble.

ii. Is Indian Constitution federal or unitary?

CO2: Examine the provisions and significance of citizenship and fundamental rights in the Indian Constitution, and critically analyze their role in safeguarding individual liberties, promoting equality, and ensuring social justice.

Approximate Hours

Item	AppXHrs
Cl	9
PI	00
SW	01
SL	00
Total	**10**

Session Outcomes (SOs)	**Practical Instruction (PI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO2.1 To understand the citizenship. **SO2.2** To understand the essential elements of state. **SO2.3** To learn about fundamental rights.	.	**Unit-2. Citizenship Fundamental Rights (9 Lectures)** 1.1 Definition and Concept of Citizenship 1.2 Different Types of Citizenship Dual Citizenship: Advantages and Disadvantages 1.3 Definition and Concept of a State 1.4 Sovereignty: Meaning and Significance 1.5 Government: Structure and Functions 1.6 Definition and	

		Significance of Fundamental Rights 1.7 Historical Evolution of Fundamental Rights 1.8 Constitutional Safeguards for Fundamental Rights 1.9 Limitations on Fundamental Rights for Public Interest.	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. How to acquire citizenship?

ii. Constitutional remedies available for violation of fundamental rights.

CO3: Recognize the role that the Directive Principles of State Policy play in providing a framework for government action; examine the complex interactions that shape the constitutional ethos between fundamental rights and directive principles; and recognize the role that fundamental duties play in promoting civic engagement and fortifying the basis of a just and inclusive society.

Approximate Hours

Item	AppX Hrs
Cl	09
PI	00
SW	02
SL	00
Total	**11**

Session Outcomes (SOs)	Practical Instruction (PI)	Classroom Instruction (CI)	Self Learning (SL)
SO3.1 Comprehend the significance of Directive Principles of State Policy in shaping government actions, enabling them to recognize their role as a framework for achieving a just and welfare state.	.	**Unit-3: Fundamental duties and directive principles of state policy.** **(9 Lectures)** 1.1 Definition and Purpose of Directive Principles, Categories of Directive Principles	

SO3. Analyze the intricate interactions between fundamental rights and directive principles to appreciate how these constitutional elements work in tandem to establish a harmonious constitutional ethos that balances individual liberties with the welfare of society. **SO3.3** Recognize the importance of fundamental duties as a means of promoting civic engagement and social responsibility, strengthening the foundational principles of a just and inclusive society in the context of Indian democracy. **SO3.4** Develop the capacity to critically assess how the interplay between directive principles, fundamental rights, and fundamental duties influences government policies, legal decisions, and social outcomes in India, and how these factors collectively contribute to the nation's progress and well-being.		(e.g., social, economic, political) 1.2 Relationship between Directive Principles and Fundamental Rights 1.3 Legal and Judicial Perspectives on the Interplay 1.4 Objectives and Significance of Fundamental Duties 1.5 Correlation between Fundamental Duties and Rights 1.6 Enforcement Mechanisms and Legal Implications 1.7 Civic Education and Awareness of Fundamental Duties 1.8 Fundamental Duties as the Foundation of a Just Society 1.9 Ensuring Inclusivity through the Fulfillment of Fundamental Duties	

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Directive Principles and Policy Implementation.

ii. Balancing Fundamental Rights and Directive Principles

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CO4: Understand the structure and functioning of the Union Executive, Legislature, and Judiciary, including the roles and powers of the President, Vice President, Council of Ministers, and the Supreme Court, and assess their significance in the Indian system of governance.

Approximate Hours

Item	App. Hrs
Cl	08
PI	00
SW	02
SL	00
Total	**10**

Session Outcomes (SOs)	Practical Instruction (PI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Describe the roles, powers, and functions of the President and Vice President of India in the Union Executive. **SO4.2** Distinguish between the Lok Sabha and Rajya Sabha as the two houses of the Indian Parliament. **SO4.3** Explain the jurisdiction and powers of the Supreme Court of India in interpreting and upholding the Constitution. **SO4.4** Recognize how the Union Executive, Legislature, and Judiciary are interconnected and provide checks and balances on one another.	.	**Unit-4: Union executive, legislature and judiciary** **(8 Lectures)** 4.1 Constitutional, emergency and executive powers of the President 4.2 Role of the Vice President in the Union Executive 4.3 Composition and Membership of Lok Sabha and Rajya Sabha 4.4 Composition and Membership of Legislative Powers of Lok Sabha 4.5 Legislative Powers of Rajya Sabha 4.6 Representation of States in Rajya Sabha 4.7 Original Jurisdiction of the Supreme Court 4.8 Appellate Jurisdiction of the Supreme Court.	

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SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. The roles, powers, and functions of the President and Vice President of India in the Union Executive.

ii. Supreme Court of India in interpreting and upholding the Constitution.

CO5: Analyze the structure and functioning of the State Executive, Legislature, and Judiciary, including the roles and functions of the Governor, State Legislature (Vidhan Sabha and Vidhan Parishad), and High Court, and assess their significance in the state-level governance and legal system.

Approximate Hours

Item	App. Hrs
Cl	09
PI	00
SW	02
SL	01
Total	**12**

Session Outcomes (SOs)	**Practical Instruction (PI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO5.1 Describe the role and powers of the Governor in the state executive and assess the relationship between the Governor and the Chief Minister. **SO5.2** Differentiate between the Vidhan Sabha and Vidhan Parishad as the two houses of the state legislature. **SO5.3** Examine the jurisdiction and functions of the High Court in the state judiciary, including its role as a guardian of the state's legal system.		**Unit 5: State Executive, Legislature and judiciary (9 Lectures)** 1.1 Constitutional Powers of the Governor 1.2 Executive Functions of the Governor 1.3 Discretionary Powers vs. Constitutional Duties 1.4 Composition and Membership of Vidhan Sabha 1.5 Power of Judicial Review in State Matters 1.6 Composition and Membership of Vidhan Parishad	**1.** High Court in the state judiciary.

SO5.4 Recognize how the State Executive, Legislature, and Judiciary in each state interact and provide checks and balances on one another.		1.7 Legislative Powers of Vidhan Sabha and Vidhan Parishad 1.8 Representation of Local Authorities in Vidhan Parishad 1.9 State Executive Oversight by the Legislature	

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Role and powers of the Governor in the state executive.

ii. Vidhan Sabha and Vidhan Parishad.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Sessional Assignment (SA)	Self Learning (SL)	Total hour (CL+SA+SL)
CO1: Demonstrate a comprehensive understanding of the nature and characteristics of the Indian Constitution, including its historical background, key principles, evaluate the concepts of federalism and unitary form of government in the Indian context, assessing their advantages, disadvantages, and implications for governance and power distribution.	10	01	01	**12**
CO2: Examine the provisions and significance of citizenship and fundamental rights in the Indian Constitution, and critically analyze their role in safeguarding individual liberties, promoting equality, and ensuring social justice.	9	01	00	**10**
CO3: Recognise the role that the Directive Principles of State Policy play in providing a framework for government action; examine the complex interactions that shape the constitutional ethos between fundamental rights and	9	02	00	**11**

directive principles; and recognise the role that fundamental duties play in promoting civic engagement and fortifying the basis of a just and inclusive society.				
CO4: Understand the structure and functioning of the Union Executive, Legislature, and Judiciary, including the roles and powers of the President, Vice President, Council of Ministers, and the Supreme Court, and assess their significance in the Indian system of governance.	8	02	00	**10**
CO5: Analyze the structure and functioning of the State Executive, Legislature, and Judiciary, including the roles and functions of the Governor, State Legislature (Vidhan Sabha and Vidhan Parishad), and High Court, and assess their significance in the state-level governance and legal system.	09	02	01	**12**
Total Hours	**45**	**08**	**02**	**55**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Demonstrate a comprehensive understanding of the nature and characteristics of the Indian Constitution, including its historical background, key principles, evaluate the concepts of federalism and unitary form of government in the Indian context, assessing their advantages, disadvantages, and implications for governance and power distribution.	03	04	03	10
CO-2	Examine the provisions and significance of citizenship and fundamental rights in the Indian Constitution, and critically analyze their role in safeguarding individual liberties, promoting equality, and ensuring social justice.	05	03	02	10

CO-3	Recognize the role that the Directive Principles of State Policy play in providing a framework for government action; examine the complex interactions that shape the constitutional ethos between fundamental rights and directive principles; and recognise the role that fundamental duties play in promoting civic engagement and fortifying the basis of a just and inclusive society.	05	03	02	10
CO-4	Understand the structure and functioning of the Union Executive, Legislature, and Judiciary, including the roles and powers of the President, Vice President, Council of Ministers, and the Supreme Court, and assess their significance in the Indian system of governance.	04	05	01	10
CO-5	Analyze the structure and functioning of the State Executive, Legislature, and Judiciary, including the roles and functions of the Governor, State Legislature (Vidhan Sabha and Vidhan Parishad), and High Court, and assess their significance in the state-level governance and legal system.	03	05	02	10
Total		20	17	13	50

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

The end of semester assessment will be held with written examination of 50 marks.

Suggested Instructional/ Implementation Strategies:

1. Improved Lecture.
2. Tutorial.
3. Case Method.
4. Group Discussion.
5. Moot court.
6. Visit to court.
7. Demonstration
8. Online sources.
9. Brainstorming.

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Suggested Learning Resources:

A. Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Constitution of India	V.N. Shukla	Wdhawa and company.	Revised edition 21 edition 2020
2	Constitutional law of India	J.N. Pandey	Central law agency	2022
3	Constitutional law of India	D.D. Basu	Central law agency	2020
4	Constitution of India	M.P. Jain	Wdhawa and company.	2018
5	Constitution of India (Vols. 3)	H.M. Seervai	Wdhawa and company.	2018
6	Constitutional law of India	Kailash Ra	Central law publication	2023
9	Lecture notes provided by Dept. of Law, AKS University, Satna.			

Curriculum Development Team

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CO, PO and PSO Mapping

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

Course Code: AU301

Course Title: Indian Constitution

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
	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-long learning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies
CO1	1	2	1	2	1	1	1	3	2	2	1	3	2	2	2	2	2
CO2	1	1	2	2	1	1	1	3	2	2	1	3	2	2	2	1	2
CO3	1	1	1	2	1	1	1	3	1	1	1	3	2	1	2	2	2

CO4	1	2	1	2	1	2	1	3	1	1	1	3	2	2	1	2	2
CO5	1	1	1	2	2	2	1	3	1	1	1	3	2	2	1	2	2

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Practical Instruction(PI)	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: Demonstrate a comprehensive understanding of the nature and characteristics of the Indian Constitution, including its historical background, key principles, evaluate the concepts of federalism and unitary form of government in the Indian context, assessing their advantages, disadvantages, and implications for governance and power distribution	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 **Introduction of Constitution** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	As Mentioned in Page no. ___to _
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO2: Examine the provisions and significance of citizenship and fundamental rights in the Indian Constitution, and critically analyze their role	SO2.1 SO2.2 SO2.3		Unit-2 **Citizenship Fundamental Rights** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9	

	in safeguarding individual liberties, promoting equality, and ensuring social justice.				
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO: 1,2,3,4	CO3: Recognize the role that the Directive Principles of State Policy play in providing a framework for government action; examine the complex interactions that shape the constitutional ethos between fundamental rights and directive principles; and recognise the role that fundamental duties play in promoting civic engagement and fortifying the basis of a just and inclusive society.	SO3.1 SO3.2 SO3.3 SO3.4		Unit-3: **Fundamental duties and directive principles of state policy.** 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	CO4: Understand the structure and functioning of the Union Executive, Legislature, and Judiciary, including the roles and powers of the President, Vice President, Council of Ministers, and the Supreme Court, and assess their significance in the Indian system of governance.	SO4.1 SO4.2 SO4.3 SO4.4		Unit-4: **Union executive, legislature and judiciary** 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	CO 5: Analyze the structure and functioning of the State Executive, Legislature, and Judiciary, including the roles and functions of the Governor, State Legislature (Vidhan Sabha and Vidhan Parishad), and High Court, and assess their significance in the state-level governance and legal system.	SO5.1 SO5.2 SO5.3 SO5.4		Unit5: **State Executive, Legislature and judiciary** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,2.9	

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

Semester - VI

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

SEMESTER-VI

Course Code: EEC601

Course Title: Internship

Pre- requisite: Student should have knowledge of programming languages, Software Engineering, and Many more tools and framework.

Rationale:

- To apply the knowledge and skills learnt in previous semesters, to solve real life industrial / engineering / professional problems.
- To modify/ improve the existing engineering / professional systems.
- To develop systems / components / methods / processes / resources to cater the needs of the nearby small scale / medium industry.
- To learn to solve real life engineering / professional problems which often have many aspects to be considered and addressed.

Course Outcomes:

The details of COs and LOs are as follows: -

EEC601.1: - The student will be able to prepare a detailed project plan for solving any real-life related engineering / technical / professional / industrial problem.
EEC601.2: - The student will be able to implement the project plan and manage the project.
EEC601.3: - The student will be able to present the complete project work.

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)	
EEC	EEC601	Internship	0	24	0	0	12	12

Internship option	
• Within India or Abroad (MITACS/DAAD/Any other aligned with GOI schemes) • To enhance hands-on skills (As per NEP-2020) • Refer below options for some suggested Internships.	

Please note the following points pertaining to internship semester:

1. Internship semester is kept as 6th Semester, there is a reason for it. All **International Internships** (List of few such internships provided below), there is a necessary condition that at least one semester study should be left to complete the degree after undertaking that internship. They want students to come back to India and bring cross culture back.

2. For students opting for industry internships also, 6th Semester is a good option, as most of the industries visit for campus placements in 7th Semester. At PEC 6th Semester for all students of all branches there is compulsory internship, industry OR research. Benefit of these internships in 6th Semester is that our 60% students get Pre-Placement Offers (PPO) to join the companies where they have undertaken internships. Then they do not appear for Campus Placement interviews, and it becomes a win-win situation for all stakeholders, because companies also do not waste their time and efforts on students who may not join them. Here I want to mention that all types of companies namely a few: Microsoft, Amazon, Deshaw, JP Morgan, Goldman Sach, Maruti, BCG, PWC, TVS, Simens and many more follow the same procedure.

3. A small list of International Fully Funded Internship Programmes (Few of them are especially for Indian Students), Like with MITACS, AICTE has tie-up, with other Programmes also collaborations can be explored**.**

[**To explore tie-ups/collaborations AICTE/MHRD may explore with Indian Origin Academicians working in foreign universities. AICTE have prepared a database of about 25000 Indian Origin Academicians working in US, UK, Australia and Canada as outcome of an on-going DST research project (available on http://ioa-dst.pec.ac.in/)**].

It is not an exhaustive list:

- USC Summer Internships
- UNIL Summer Undergraduate Research Program
- World Bank Internship
- Petro Jacyk Visiting Scholars Program
- Charles Wallace India Trust Visiting Fellowship
- Google Summer of Code Internship
- RTC Summer Research Program for Undergraduates
- Mitacs Globalink Research Internship
- Charpak – Research Internship Program
- CNIO Summer Training Programme

- Vienna Biocenter Summer School
- Global Challenges Fellowship Program
- Google Site Reliability Engineering Internship
- Balmoral Residential Fellowships
- Nestle Sales Division Internship In USA
- William J. Clinton Fellowship for Indian Students
- American Foreign Service Association (AFSA) Communication Internship
- IST Summer Internship in Austria – Fully Funded Internship in Europe
- DESY Summer Student Program 2020 in Germany
- Japan Summer Internship 2020 in Kashiwa
- CRG Summer Internship 2020 in Barcelona, Spain
- The World Bank Summer Internship Program
- EPFL Summer Research Program 2020 in Switzerland
- Curatorial Internship Program 2020-2021 | Fully Funded Internship in Canada
- CERN Short Term Internship 2020 in Switzerland
- Taiwan International Internship 2020
- RIPS 2020 Summer Internship in the USA
- Echidna Global Scholars Program 2021 in the USA
- Netherlands Government Scholarship 2021 | Fully Funded | Orange Knowledge Programme
- UNIST Undergraduate Scholarship 2021 in South Korea
- Global Intern Program in South Korea 2021 | Fully Funded
- Max Planck Summer Internship in Germany 2021
- CERN Administrative Student Programme 2021 Switzerland – Fully Funded
- Commonwealth Foundation Internship 2021 in the UK
- WHO Internship Program 2021
- University of Tokyo Summer Internship

Semester VI

Course Code: RC601

Course Title: English for Research Paper Writing

Pre- requisite: Students should have basic knowledge of presenting themselves, their thoughts and ideas

Rationale: Writing a research paper is the primary channel for passing on knowledge to the scientist working in the same field or related fields. It is important to know the skill of writing papers to demonstrate your ability to understand, relate to what has been learnt, as well as receive critical peer feedback.

CO 1: Student will learn how to improve their writing skills, and level of readability

CO2: Students will understand the concept of plagiarism, and how to avoid ambiguity and vagueness

CO3: Students will learn about what to write in each section of paper

CO4: Students will understand significance of each section of paper, and learn how to write it at the same time.

CO5: Ensure the good quality of paper at very first-time submission

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)	
RC	RC601	English for Research Paper Writing	2	4	0	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 (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)		
RC	RC 601	English for Research Paper Writing	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 (ESA)	Total Marks (PRA+ ESA)
			Presentation/Viva and Publishing		
RC	RC601	English for Research Paper Writing	Lab assessment will be based on presentation of and publishing of one research/review paper on UGC Care list journal.		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.

CO 1: Student will learn how to improve their writing skills, and level of readability

Approximate Hours

Item	Appx Hrs.
Cl	6
LI	
SW	0
SL	1
Total	7

Session Outcomes (SOs)	**(LI)**	**Class room Instruction (CI)**	**(SL)**
SO1.1 Students learn to designthe research paper. SO1.2 Students learn to read theresearch paper in a systematic way. SO1.3 Examine and identifythe redundancy in a research paper SO1.4 Learn to summarize andbe concise SO1.5 Understand the conceptof ambiguity and vagueness	.	Unit 1: Preparation of Research Paper 1.1 Steps to introduce to the techniqueof reading research paper 1.2 Breaking up of sentences, 1.3 structuring paragraphs 1.4 Making the paper concise and 1.5 removing redundancy 1.6 Concept of Ambiguity and Vagueness	Reading research papers on relevant topics

2. Students will understand the concept of plagiarism, and how to avoid ambiguity and vagueness

Approximate Hours

Item	Appx Hours
Cl	6
LI	0
SW	0
SL	1
Total	7

Session Outcomes (SOs)	**(LI)**	**Class room Instruction (CI)**	**Self - Learning (SL)**
SO2.1: Students learn to create a contrast between previous and present work. SO2.2: Learn paraphrasing	.	UNIT 2 – Paraphrasing and checking Plagiarism 2.1 Clarifying Who Did What, Highlighting Your Findings,	
tool SO2.3: Use of plagiarism check tool SO2.4: Students understand the concept of hedging and criticising		2.2 Hedging and Criticising, Paraphrasing and Plagiarism, 2.3 : Clarification of previous work and their order 2.4 : Highlighting your work 2.5: Paraphrasing and its tools 2.6: Plagiarism Check and its tools	

3: Students will learn about what to write in each section of paper

Approximate Hours

Item	Appx Hours
Cl	6
LI	0
SW	0
SL	1
Total	7

Session Outcomes (SOs)	**(LI)**	**Class room Instruction (CI)**	**(SL)**

SO3.1**:** Students learn to write a research paper in proper format. SO3.2: Students are able to understand different sections of paper. SO3.3: Create an effective abstract and introduction. SO3.4**:** Describe Review of Literature. SO3.5: Learn to write Methodology of Research Paper.		Unit-3**:**Planning Sections of a Paper 3.1: Introduction to sections of a research paper.3.2: Key skills to write an Abstract and 3.3 Key skills to write an Introduction. 3.4: Skills to write Review of Literature.3.5: Key skills to write Methodology. -I 3.6: Key skills to write Methodology. -II	

CO4**:** Students will understand significance of each section of paper, and learn how to write it atthe same time.

Approximate Hours

Item	Appx Hours
Cl	6
LI	0
SW	0
SL	1
Total	7

Session Outcomes (SOs)	**(LI)**	**Class room Instruction (CI)**	**(SL)**
SO4.1: Students learn to state the result of their findings. SO4.2: Students learn to draw conclusions of their research SO4.3: Students are able to analyse and discuss their result of paper	.	Unit-4 : Finalizing the Research Paper 4.1: Results of research findings-I 4.2. Results of research findings-II 4.3: Drawing conclusion of the research 4.4: Discussion on the result of paper-I 4.5: Discussion on the result of paper-I 4.6: Final check of the paper	

SO4.4: Students are able to evaluate their paper SO4.5: Students learn to assess their work through a final check.			

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5 CO5: Ensure the good quality of paper at very first-time submission

Item	Appx Hours
Cl	6
LI	0
SW	0
SL	1
Total	7

Session Outcomes(SOs)	**Laboratory Instructions (LI)**	**Class room Instruction (CI)**	**(SL)**
SO5.1: Students are able to understand effective research paper writing skills		Unit 5- Research Paper Publication 5.1: Useful Phrases for effective researchpaper writing-I 5.1: Useful Phrases for effective researchpaper writing-II 5.1: Useful Phrases for effective researchpaper writing-III 5.2: Paper submission techniques-I 5.2: Paper submission techniques-II 5.2: Paper submission techniques-III	

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)

1: CO 1: Student will learn how to improve their writing skills, and level of readability	6	0	1	7
2: CO2: Students will understand the concept of plagiarism, and how to avoid ambiguity and vagueness	6	0	1	7
3: CO3: Students will learn about what to write in each section of paper	6	0	1	7
4- CO4: Students will understand significance of each section of paper, and learn how to write it at the same time.	6	0	0	7
5- CO5: Ensure the good quality of paper at very first-time submission.	6	0	1	7
Total Hours	30	0	05	35

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
1	Unit 1: Preparation of Research Paper				
2	Unit 2: Paraphrasing and checking Plagiarism				
3	Unit 3: Planning Sections of a Paper				
4	Unit 4: Finalising the Research Paper				
5	Unit 5: Research Paper Publication				
Total					

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

The end of semester assessment for communication skills will be held with written examination of 50 marks

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

Suggested Instructional/Implementation Strategies:

1. Improved Lecture

2. Tutorial
3. Case Method
4. Group Discussion
5. Brainstorming

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht eidelberg London, 2011

Curriculum Development Team

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COs, POs and PSOs Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]
Course Code : RC601
Course Title: English for Research PaperWriting

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO 1: : Student will learn how to improve their writing skills, and level of readability	2	2	1	1	3	2	2	3	2	2	1	1	**2**	**3**	**3**	**1**	**2**
CO 2 : Students will understand the concept of plagiarism, and how to avoid ambiguity and vagueness	2	2	2	1	3	2	2	3	2	2	2	1	**2**	**2**	**2**	**1**	**3**
CO 3: Students will learn about what to write in each section of paper	2	3	2	1	3	2	2	3	2	3	2	1	**1**	**1**	**2**	**2**	**2**
CO 4: Students will understand significance of each section of paper, and learn how to write it at the same time	1	-	2	1	1	1	-	-	1	-	2	1	**3**	**3**	**3**	**2**	**2**
CO 5: Ensure the good quality of paper at very first-time submission	1	2	2	1	2	2	1	3	1	2	2	1	**3**	**3**	**1**	**3**	**3**

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	1: CO 1: Student will learn how to improve their writing skills, and level of readability	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1 Self-grooming, Basic Etiquettes andPresentation Skill 1.1,1.2,1.3,1.4,1.5,1.6	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	2: CO2: Students will understand the concept of plagiarism, and how to avoid ambiguity and vagueness	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2 Confidence building skills, InterviewSkills and Resume Writing 2.1, 2.2, 2.3, 2.4, 2.5, 2.6	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	3: CO3: Students will learn about what to write in each section of paper	SO3.1 SO3.2 SO3.3 SO3.4 So3.5		Unit-3 Public Speaking Skills& Conversational Skills 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, 5	4- CO4: Students will understand significance of each section of paper, and learn how to write it at the same time.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 Functional Grammar and Vocabulary Building 4.1,4.2,4.3,4.4,4.5,4.6	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 5: The Understanding of Indian Culture and English Language will be developed through the study of Dramas and Poems written by Indian Writers	SO5.1		Unit-5 **Indian Writing inEnglish& Hindi** Statistics 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10, 5.11,5.12,5.13,5.14,5.15	

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Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

Semester-VI

Course Code:	**RC602**
Course Title :	Research Methodology and IPR
Pre-requisite:	Student should have basic knowledge of research and Statistics.
Rationale:	This course will help them to select an appropriate research design. With the help of this course, students will be able to take up and implement a research project/ study. The course will also enable them to collect the data, edit it properly and analyze it accordingly.

Course Outcomes:

RC602.1: Understand research problem formulation.

RC602.2: Analyze research related information and Follow research ethics

RC602.3: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

RC602.4: Understanding that when IPR would take such important place in growth of Individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering In particular.

RC602.5: UnderstandthatIPRprotectionprovidesanincentivetoinventorsforfurtherresearch work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credit (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
RC	RC602	Research Methodology and IPR	2	4	2	1	9	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performance 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)		
RC	RC602	Research Methodology and IPR	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 (ESA)	Total Marks (PRA+ ESA)
			Presentation/Viva and Publishing		
RC	RC602	Research Methodology and IPR	Lab assessment will be based on presentation of and publishing of one research/review paper on UGC Care list journal.		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: Understand research problem formulation.

•

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)**
SO1.1 Define a research problem **SO1.2** Explain Characteristics of a good research problem **SO1.3** Explain Scope and objectives of research problem **SO1.4** Discuss data collection **SO1.5** Explain analysis, interpretation .	.	**Unit-1** 1.1 Meaning of research problem, Sources of research problem 1.2 Criteria Characteristics of a good research 1.3 problem, Errors in selecting a research problem 1.4 Scope and objectives of research problem. 1.5 Approaches of investigation of solutions for research problem 1.6 data collection, 1.7 analysis, interpretation, 1.8 Necessary instrumentations	1. Write a Process of research problem identification

SW-1 Suggested Sessional Work (SW):

a. Assignments:

(i) Discuss about Errors in selecting a research problem

b. Presentation

c. Pictorial representation of different components of computer:

CO.2: Analyze research related information and Follow research ethics

Approximate Hours

Item	Appx Hrs
Cl	5
LI	0
SW	2
SL	1
Total	07

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 To Understand Effective literature studies. SO2.2 To learn different approaches. SO2.3 Explain Plagiarism. SO2.4 Explain research ethics.	.	**Unit-2** 2.1 Effective literature studies 2.2 Approaches, 2.3 analysis 2.4 Plagiarism, 2.5 Research ethics,	1.Write a Review

SW-2 Suggested Seasonal Work (SW):

a. Assignments:

(i) Write the different approaches of analysis?

b. Presentation

c. Pictorial representation of different components of research design?

CO.3: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity

Approximate Hours

Item	Appx Hrs
Cl	6
LI	0
SW	2
SL	1
Total	7

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3. 1 To understand Effective technical writing, SO3.2 know the Format of research proposal SO3.3 Develop a Research Proposal SO3.4 know about presentation of research proposal SO3.5 To understand the assessment of research proposal.		**Unit-3:** 3.1 Effective technical writing, 3.2 How to write report, Paper. 3.3 Developing a Research Proposal, 3.4 Format of research proposal 3.5 presentation 3.6 assessment by a review committee	**i. Design a research proposal**

SW-2 Suggested Seasonal Work (SW):

a. Assignments:
(i) Explain writing a project proposal?
b. Presentation
c. Pictorial representation of different components of computer

CO.4: Understanding that when IPR would take such important place in growth of individuals& nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

Approximate Hours

Item	Appx Hrs
Cl	6
LI	0
SW	2
SL	1
Total	9

Session Out comes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)

SO4.1 To Understand Nature of Intellectual Property **SO4.2** To understand Patents, Designs, Trade and Copyright **SO4.3** Explain the process of patenting **SO4.4** To understand the development of technological research **SO4.5** To Understand Procedure for grants of patents, Patenting under PCT.	.	**Unit-4 : MEMORY SYSTEM:** 4.1 Nature of Intellectual Property. 4.2 Patents, Designs, Trade and Copyright 4.3 Process of Patenting and Development technological research 4.4 innovation, patenting, development. 4.5 International cooperation on Intellectual Property 4.6 Procedure for grants of patents, Patenting under PC	i. Prepare a intellectual property proposal ii. Draw a classification diagram of RAID

SW-4 Suggested Seasonal Work (SW):

a. Assignments:
b. (i) Write the process of patent design
c. Presentation
d. Pictorial representation of different steps of patent design.

CO.5: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and

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)
SO5.1 Explain Patent Rights **SO5.2** Discuss Licensing and transfer of technology **SO5.3**Discuss about Patent information and databases **SO5.4** Understand Geographical Indications	....	**Unit5:** 5.1 Patent Rights: 5.2 Scope of Patent Rights 5.3 Licensing and transfer of technology 5.4 Patent information and databases 5.5 Geographical Indications	i. Learn about scope of patent rights

SW-5Suggested Seasonal Work (SW):

a. Assignments:

(i) Explain in detail about geographical indications.

b. Presentation:

c. Other Activities (Specify):

(i) Group discussion of important topics.

CO.5: To better products, and in turn brings about, economic growth and social benefits

Approximate Hours

Item	AppXHrs
Cl	7
LI	0
SW	2
SL	2
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO6.1 Understand Administration of Patent System **SO6.2** Explain new developments in IPR **SO6.3**Discuss about IPR of Biological		**Unit6: New Developments in IPR** 6.1 Administration of Patent System. 6.2 New developments in IPR; 6.3 IPR of Biological	ii. Learn about IPR

Systems, Computer Software etc. **SO6.4** Understand Traditional knowledge Case Studies, IPR and IITs.		Systems, Computer Software etc. 6.4 Traditional knowledge 6.5 Case Studies, IPR and IITs	

SW-5Suggested Seasonal Work (SW):

d. Assignments:
Write a case study on Patents.

e. Presentation:

f. Other Activities (Specify): Group discussion

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
C01 At the end of this chapter the student will Understand research problem formulation.	7	2	1	10
C02 At the end of this chapter the student will Analyze research related information and Follow research ethics	4	2	1	7
C03 At the end of this chapter the student will Understand that today's world	4	2	1	7
C04 At the end of this chapter the student will know about Intellectual Property Right	6	2	1	9
C05 At the end of this chapter the student will Understand that IPR protection	4	2	1	7
C05: At the end of this chapter the student will Understand that R & D leads to creation of new and better products	5	2	1	8
Total Hours	30	10	5	48

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Unit-1	03	02	03	08
CO-2	Unit-2	03	01	05	09
CO-3	Unit-3	03	07	02	12
CO-4	Unit-4	03	05	05	13
CO-5	Unit-5 and Unit-6	03	02	03	08
Total		15	17	18	50

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

Suggested Instructional/Implementation Strategies:

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

Suggested Learning Resources:

B. Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Research Methodology	C R Kothari ,Gaurav Garg	New Age International	2023
2	Research Methodology: Concepts And Cases	Deepak Chawla (Author), Neena Sondhi (Author)	Vikas Publishing House	May 2016

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Curriculum Development Team

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COs, POs and PSOs Mapping

Course Title: B.Tech(CSE)
Course Code: RC602
Course Title: Research Methodology and IPR

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
RC602.1 At the end of this chapter the student will Understand research problem formulation.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1	2
RC602.2 At the end of this chapter the student will Analyze research related information and Follow research ethics	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1	3
RC602.3 At the end of this chapter the student will Understand that today's world	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2	2
RC602.4 At the end of this chapter the student will know about Intellectual Property Right	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3	3
RC602.5 at the end of this chapter the student will Understand that IPR protection	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	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** At the end of this chapter the student will Understand research problem formulation.	SO1.1 SO1.2 SO1.3 SO1.4		Unit-1 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO2** At the end of this chapter the student will Analyze research related information and Follow research ethics	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2 2.1, 2.2, 2.3, 2.4, 2.5	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO3** At the end of this chapter the student will Understand that today's world	SO3.1 SO3.2 SO3.3 SO3.4		Unit-3 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, 5	**CO4** At the end of this chapter the student will know about Intellectual Property Right	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 4.1,4.2,4.3,4.4,4.5,4.6	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO5** at the end of this chapter the student will Understand that IPR protection	SO5.1 SO5.2 SO5.3 SO5.4		Unit-5 5.1,5.2,5.3,5.4,5.5	

Semester - VII

AKS University

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Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

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SEMESTER VII

Course Code: **PC701**

Course Title: **Soft Computing**

Pre- requisite: To study this Course, a student must have basic knowledge of Soft Computing

Rationale: Soft computing provides an approach to problem-solving using means other than computers

Course Outcomes:

PC701.1: Understand, Identify and describe soft computing techniques and their roles in building intelligent machines.

PC701.2: Apply a soft computing methodology for a particular problem.

PC701.3: Analyze and compare solutions by various soft computing approaches for a givenproblem.

PC701.4: Apply genetic algorithms to combinatorial optimization problems

PC701.5: Evaluate and compare solutions by various soft computing approaches for a given 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 (PC)	PC701	**Soft Computing**	3	2	1	1	7	4

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

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

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

SL: Self Learning,

C: Credits.

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

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Scheme of Assessment:

Theory

Board Of Study	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	otal 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)
PC	**PC701**	**Soft Computing**	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PC	PC701	Soft Computing	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.

PC701.1: **Understand, Identify and describe soft computing techniques and their roles in building intelligent machines**.

Approximate Hours

Item	AppX Hrs
Cl	13
LI	6
SW	2
SL	2
Total	23

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the Artificial neural networks and its applications **SO1.2** Explain Structure and working of Biological Neural Network **SO1.3** Discuss advantages & Characteristics of Artificial Neural Networks **SO1.4** History of neural network **SO1.5** characteristics of neural networks terminology	LI1.1 study of Neural Network. LI1.2 Write a program of Perceptron. LI1.3 Study the Language used to implement perceptron.	**Unit 1.0 Introduction (6 Lectures)** 1.1 Introduction to neural networks . 1.2 Structure and working of Biological Neural Network Value for visualization 1.3 Artificial Neural Networks 1.4 Applications Time series 1.5 Applications Time series 1 1.6 Numerical on neural network 1.7 Characteristics of Artificial Neural Networks 1.8 History of neural network research 1.9 Some research papers on neural network 1.10 characteristics of	**1.** working of Biological Neural Network **2.** Characteristics of Artificial Neural Networks

		neural networks terminology 1.11 Biological terminology of neural network. 1.12 Study of different activation functions. 1.13 Sigmoid, ReLU, TanH	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Artificial neural networks and its applications

ii. Impact and Examples of neural networks, Application domains of neural networks

PC701.2: Apply a soft computing methodology for a particular problem

Approximate Hours

Item	AppXHrs
Cl	13
LI	6
SW	2
SL	2
Total	23

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO2.1. To Understand Models of neuron **SO2.2** To learn Adaline model **SO2.3** To lean Topology of neural network architecture **SO2.4 Explain** Multilayer	LI2.1 Create a Python script to make McCulloch Pitts Model.	**Unit 2.0 Neural Networks model and Learning Methods (8 Lectures)** 2.1 Model of neuron McCulloch –Pitts model 2.2 Perceptron. Model	SL1 State Topology of neural network architecture SL2. Backpropagation, Counter propagation
Neural Networks **SO2.**5 Explain Backpropagation	LI2.2 Write a script of Adaline model..	transforms 2.3 Adaline model 2.4 Basic learning	

	LI2.3 Write a Python module to implement Multilayer Neural Network.	laws 2.5 Topology of neural network architecture 2.6 Gradient Descent. 2.7 Gradient Descent 1 2.8 Stochastic gradient descent 2.9 Multilayer Neural Networks 2.10 Learning Methods 2.11 Learning Methods 1 2.12 Numerical on Learning methods. 2.13 Back Propagation Counter	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Models of neuron McCulloch – Pitts model, Perceptron
ii. Multilayer Neural Networks, BAM

b. Mini Project:

c. Other Activities (Specify):

PC701.3. Analyze and compare solutions by various soft computing approaches for a given problem.

Approximate Hours

Item	AppX Hrs
Cl	12
LI	6
SW	2
SL	2
Total	22

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Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 To Understand Fuzzy Logic **SO3.2** To learn Fuzzy model **SO3.3** To understand the Fuzzy inference system **SO3.4** Explain Defuzzification **SO3.5** learn about Architecture of a Neuro-Fuzzy system	LI 3.1 Write Python script to implement fuzzy sets. LI3.2 Write a script to implement of union of fuzzy set. LI3.3 Write a program to implement Fuzzy model.	**Unit-3.0 Introduction of Fuzzy Logic and Neuro Fuzzy systems** **(5 Lectures)** 3.1 Introduction, 3.2 Fuzzy sets 3.3 Fuzzy sets 1 3.4 Fuzzy model 3.5 Different types of fuzzy model 3.6 Fuzzy rule generation 3.7 Fuzzy inference system 3.8 Defuzzification 3.9Architecture of a Neuro-Fuzzy system and its applications 3.10 numerical on fuzzy sets. 3.11 Applications of fuzzy systems. 3.12 case study on fuzzy sets.	SL1.Fuzzy sets & Fuzzy model SL2. Architecture of a Neuro-Fuzzy system

SW-3 Suggested Sessional Work (SW):

a. Assignments:

a. Fuzzy rule generation Fuzzy inference system
b. Fuzzy model
c. Architecture of a Neuro-Fuzzy system

b. Mini Project:

c. Other Activities (Specify):

PC701.4 Apply genetic algorithms to combinatorial optimization problems.

Approximate Hours

Item	Appx Hrs
Cl	13
LI	6
SW	2
SL	2
Total	23

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Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Explain Primitive algorithms **SO4.2** Understanding the Generative algorithms **SO4.3** To learn Support Vector Machine **SO4.4** To lean about Independent component analysis **SO4.**5 **Discuss** Reinforcement learning and control	LI4.1. Write Python script to Create SVM. LI4.2 Write a Python module to implement of Naive Bayes classifier algorithm. LI4.3 Write a Python script to implement PCA for dimensionality reduction.	**Unit-4.0 Machine Learning (9 Lectures)** 4.1 Primitive algorithms 4.2 Generative algorithms 4.3 Generative algorithms 1 4.4 Support Vector Machine 4.5 Support Vector Machine 1 4.6 Ensemble methods 4.7 Ensemble methods 1 4.8 Case study on ensemble Techniques. 4.9 Unsupervised learning: K-means 4.10 Principal component analysis 4.11 Independent component analysis 4.12 Independent component analysis 1 4.13 Reinforcement learning and control	**SL1.** Primitive algorithms **SL2.** Reinforcement learning and control

SW-4 Suggested Sessional Work (SW):

a. Assignments:

a. Primitive algorithms
b. Reinforcement learning and control

b. Other Activities (Specify):

PC701.5: Evaluate and compare solutions by various soft computing approaches for a given problem.

Approximate Hours

Item	Appx Hrs
Cl	9
LI	6
SW	2
SL	2
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 To Understand Applications of GA **SO5.2** Explain Applications of GP **SO5.3** Learn Hybrid systems	LI5.1 Write a Python script to implement Implementing K-means Clustering. LI5.2 Write a Python script to implement Implementing Hierarchical Clustering. LI5.3 Write a Python script to implement Random Forest.	**Unit 5.0 Planning (8 Lectures)** 5.1 Applications of GA 5.2 case study of genetic algorithm 5.3 Applications of GP 5.4 Case study of GP 5.5 Case study of GP 1 5.6 Hybrid systems 5.7Applications of hybrid systems. 5.8 real time application of genetic algorithm 5.9 real time application of genetic algorithm 1	SL1. Applications of GA SL2.Applications of GP

SW-5 Suggested Sessional Work (SW):

a. Assignments:

a. Applications of GA & GP
b. Hybrid systems

. Mini Project:

c. Other Activities (Specify):

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)
PC701.1: Understand, Identify and describe soft computing techniques and their roles in building intelligent machines.	13	**6**	02	02	23
PC701.2: Apply a soft computingmethodology for a particular problem.	13	**6**	02	02	23
P PC701.3: Analyze and comparesolutions by various soft computing	12	**6**	02	02	22

approaches for a given problem.					
PC701.4: Apply genetic algorithmsto combinatorial optimization problems.	13	**6**	02	02	23
PC701.5: Evaluate and comparesolutions by various soft computing approaches for a given problem.	9	**6**	02	02	19
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**	03	02	03	08
CO-2	**Neural Networks model and Learning Methods**	03	01	05	09
CO-3	**Introduction of Fuzzy Logic and Neuro Fuzzy systems**	03	07	02	12
CO-4	**Machine Learning**	03	05	05	13
CO-5	**Planning**	03	02	03	08
Total		15	17	18	50

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

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:

A. Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Neuro fuzzy and soft computing Intelligence	Jang	Pearson Education	**1996**
2	Learning and Soft Computing	Kecman	Pearson Education	2001
3	Fuzzy Sets and Fuzzy Logic	Klir and Yuan	PHI	1995

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Introduction to Soft Computing	Prof. Debasis Samanta	IIT Kharagpur
2.	Fuzzy Logic and Neural Netwroks	Prof. Dilip Kumar Pratihar	IIT Kharagpur

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7. Ms. Pinki Sharma, Assistant Professor, Department of Computer Science and Engineering.
8. Ms. Pushpa Kushwaha, Assistant Professor, Department of Computer Science and Engineering.
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COs, POs and PSOs Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]
Course Code: PC701
Course Title: Soft Computing

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO1: Analyzing the graph of a function is a powerful way to understand its behavior, make predictions, and solve mathematical and real-world problems.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1	2
CO2 : Discuss of Derivatives and optimization are closely related concepts in mathematics and have important applications in various fields, engineering, and machine learning.	1	1	2	2	1	2	1	2	1	1	3	2	2	2	2	1	3
CO3: Use of operations involving vectors and matrices depend on the specific operations being performed.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2	2
CO4: Use and apply hypothesis testing on different datasets.	3	2	2	2	3	2	3	2	2	1	2	3	2	3	3	2	2
CO 5: Use statistical methods to analyze and collect data.	-	-	-	1	1	3	3	3	1	1	2	2	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:1,2,3,4	CO1: Understand, Identify and describesoft computing techniques and their roles in building intelligent machines.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	LI1.1, LI1.2, LI1.3	Unit-1.0 **Introduction** 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 no. —to —
PO: 1,2,3,4,5,6,7,8,9, 10,11,12 PSO:1,2,3,4	CO2: Apply a soft computing methodology fora particular problem.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LI2.1, LI2.2, LI2.3	Unit-2 **Neural Networks model and Learning Methods** 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	CO3: Analyze and compare solutions by various soft computing approaches for a given problem.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	LI3.1, LI3.2, LI3.3	Unit-3: **Visualization Design**. 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	
PO: 1,2,3,4,5,6,7,8,9, 10,11,12PSO: 1,2,3,4	CO4: Apply genetic algorithms to combinatorialoptimization problems.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LI4.1, LI4.2, LI4.3	Unit-4: **Multidimensional Data and Interaction** 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: 1,2,3,4	CO 5: Evaluate and compare solutions by various soft computing approaches for a given problem	SO5.1 SO5.2 SO5.3	LI5.1, LI5.2, LI5.3	Unit5: **Collaboration.** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

Semester-VII

Course Code: **PC702**

Course Title : **AI for Everyone**

Pre- requisite: Student should have good knowledge of mathematics, analytical skills, programming language and ability to understand complex algorithm.

Rationale: Artificial intelligence (AI) has the potential to revolutionize education byproviding students with personalized learning experiences, real-time feedback, and access to a wealth of educational resources.

Course Outcomes : After completion of course, students will able to

PC702.1 Understand the basic concepts of AI and machine learning.

PC702.2 Understand the working of self-driving systems.

PC702.3 Understand how to build different AI projects.

PC702.4 Evaluate the impact of AI on society.

PC702.5 Apply AI techniques to any application domain.

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)	
PC	PC702	AI for everyone	3	0	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) andTutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratoryworkshop, 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

feedbackof 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)		
PC	PC702	AI for everyone	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course

progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in theoverall achievement of Course Outcomes (COs) upon the course's conclusion.

PC702.1 Understand the basic concepts of AI and machine learning.

Approximate Hours

Item	AppX Hrs
Cl	08
LI	4

SW	2
SL	1
Total	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1 Understand the concept of machine learning. **SO1.2** Explanation of various terminologies of AI **SO1.3** Understand non technical explanation of deep learning. **SO1.4** Understand Basics of neural network. **SO1.5** Examples and application domains of AI. .	LI1.1Familiarize yourself with basic Python syntax. LI1.2Write a Python script that prints "Hello, AI!" to the console..	**Unit-1.0 Introduction to Artificial Intelligence.** 1.1 Understanding definition and role of data in machine learning. 1.2 Overview of machine learning. 1.3 Learning various terminologies like deep learning, machine learning and artificial intelligence. 1.4 What do we need to establish an AI company. 1.5 What Machine Learning Can and Cannot Do. 1.6 Understanding	1. Understand how to manipulate and prepare data for machine learning.
		basics of neural network like – Neurons, Layers, Weights and Biases etc. 1.7 Learning about examples of AI like virtual assistance, Recommendation system, Image	

		recognition, Natural language processing etc. 1.8 Understanding use of AI in various application domain.	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i) Explore the application of AI in processing and understanding human language.

ii) Explore the societal impacts and ethical considerations of AI.

b. Mini Project:

i) Choose a dataset (e.g., from Kaggle) and load it using a Python library like Pandas. Explore the data,handle missing values, and perform basic preprocessing.

Other Activities (Specify):

Write a short essay or create a presentation discussing the ethical considerations in AI. Address topics likebias, transparency, and accountability.

PC702.2 Understand the working of self-driving systems.

Approximate Hours

Item	AppX Hrs
Cl	8
LI	6
SW	2
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
O2.1 To Understand the work flow in machine learning and data science projects. **SO2.2** To learn data cleaning, preprocessing, exploring and analyzing. **SO2.3** How to select an AI project for your company. S**O2.4** To process and visualize	**LI2.1** Explore and clean datasets using tools like Pandas **LI2.2**. Handle missing data, outliers, and categorical variables. **LI2.3**	**Unit-2 Building AI project** **2.1** Workflow of a machine learning project. **2.2** Workflow of a data science project. **2.3** how to use data **2.4** How to choose an AI project	i. Understand the organization's goal and challenges for AI projects. ii. Use libraries like Pandas for cleaning and processing data.

data. **SO2.5** Learn technical tools for AI and use of python in AI projects.	Implement a simple machine learning model using Scikit-learn.	**2.5** Working with an AI team. **2.6** How to process and visualize data. **2.7** Technical tools for AI teams. **2.8** use of python in AI related projects	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Explore a dataset of your choice. Clean the data, visualize key trends using graphs or charts,and perform basic statistical analysis.

ii. Create a guide or presentation on essential technical tools for AI teams.

b. Mini Project:

Develop a simple AI project using Python. This could be a basic machine learning model, a dataanalysis task, or a script to interact with an API

c. Other Activities (Specify):

Form a hypothetical AI team and assign roles to each member. Develop a communication plan,set up collaborative tools, and outline a project management strategy for a given AI project.

PC702.3 Understand how to build different AI projects.

Approximate Hours

Item	AppX Hrs
Cl	07
LI	6
SW	2
SL	1
Total	16

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

O3.1 A case study of new smart speaker with advanced AI capabilities **SO3.2** A case study of self-driving car to enhance safety. **SO3.3** Understanding example roles of an AI team. **SO3.4** AI pitfall to avoid project failure. **SO3.5** Survey of major AI application area.	**LI 3.1**. Fuzzy logic and neural network. **LI 3.2** Integrate the deployed model into a web application or API. **LI 3.3** Tokenize and preprocess text data.	**Unit-3** : **Building AI in your company.** **3.1** The goal is to case study a device that not only plays music but also understands and responds to user commands, acting as a virtual assistant. **3.2** A case study of a self-driving car to enhance safety and provide an autonomous driving experience. **3.3** Evaluate the role of AI project team members. **3.4** Understanding AI pitfalls to avoid project failure. **3.5** Understanding AI pitfalls to avoid project failure 1 **3.6** Understanding the use of AI in major application areas. **3.7** Understanding the use of AI in major application areas. 1	i. Clearly outline the goals of the smart speaker, including the desired AI features. ii.Explore the motivation behind creating smart speakers.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Introduce the specific smart speaker or brand you will focus on for the case study.

ii. Research and identify at least five common pitfalls associated with AI development anddeployment.

b. Mini Project:

Explore the machine learning and AI models used in the development of smart speakers.

Other Activities (Specify):

Speculate on potential future developments in smart speaker technology.

PC702.4 Evaluate the impact of AI on society.

Approximate Hours

Item	AppX Hrs
Cl	10

LI	6
SW	4
SL	2
Total	22

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
O4.1 To understand realistic view of AI. **SO4.2** Understanding the discrimination/Bias in AI **SO4.3** Understanding adversarial attacks on AI. **SO4.4** Understand adverse uses of AI. **SO4.5** Impact of AI on employment.	**LI 4.1** Explore ethical implications of AI projects. **LI 4.2** Address bias, fairness, and privacy concerns in your models. **LI4.3** Automate	**Unit-4 : AI and Society** **4.1** Assessment of AI's current capabilities, limitations and challenges. **4.2** Define the concepts of discrimination and bias in the context of AI. **4.3** Define adversarial attacksand their significance in the context of AI with example.	i. Find out areas where AI struggles, such as common-sense reasoning, ethical considerations, and the need for massive amounts of data. ii. Explore how bias can emerge in AI systems
	testing and deployment processes.	**4.4** Explore the ethical implications of using AI for malicious purposes. **4.5** Explore how AI can benefit developing economies, such as improving healthcare, optimizing agriculture, and enhancing education. **4.6** Explore how AI can benefit developing economies, such as improving healthcare, optimizing agriculture, and enhancing education 1 **4.7** Examine the impact of AI on different sectors of employment. **4.8** Examine the impact of AI on different sectors of	

		employment 1. **4.9** Discuss instances where AI may lead to job displacement and scenarios where it contributes to job creation. **4.10.** Explore how the job market may require new skill sets due to AI integration.	

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

a. Assignments:

i. Highlight AI applications that have made positive impacts, such as healthcare diagnostics,language translation and automation.

ii. Explore how the job market may require new skill sets due to AI integration.

c. Mini Project:

Create a report to discuss potential policy interventions to manage the impact onemployment, such as retraining programs and social safety nets.

d. Other Activities (Specify):

Power Point Presentation on adverse uses of AI.

PC702.5 Apply AI techniques to any application domain.

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)**

SO5.1 Explore AI case studies related to a specific domain.	**LI.5.1** Implement self-driving vehicle algorithm. **LI 5.2** Use techniques like one-hot encoding, scaling, and dimensionality reduction. **LI 5.3** Train a neural network using a deep learning library like TensorFlow or PyTorch.	**Unit 5: AI case studies related to aspecific domain.** **5.1** Case study of medical Imaging using AI. **5.2** Case study of Retina scan using AI. **5.3** Case study of Mining surveying using AI. **5.4** Case study of AI in Share Market. **5.5** Case study of Google weather forecasting usingAI. **5.6** Case study of smart watch using AI. **5.7** Case study of Tesla self-driving cars using AI. **5.8** Case study of AI in vaccination development. **5.9** Case study of " HANOOMAN" BharatGPT. **5.10** Case study of AI in Airforce. **5.11** Case study of AI in Defence. **5.12** Case study of AI in chandrayaan 3.	1.Try to study some major AI application domains like : Healthcare, finance, retail, Education, manufacturing, autonomous vehicles, Entertainment, agriculture, cybersecurity etc.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Find out uses AI to make trading decisions based on market trends and historical data.
ii. Adapts educational content to individual student needs.

b. Mini Project:
Implement self-driving vehicle algorithm.

c. Other Activities (Specify):
Demonstrate the versatility of AI in addressing complex challenges and optimizing processesacross various industries.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)

PC702.1 Understand the basic concepts of AI and machine learning.	8	2	1	10
PC702.2 Understand the working of self-driving systems.	8	2	1	12
PC702.3 Understand how to build different AI projects.	7	2	1	12
PC702.4 Evaluate the impact of AI on society.	10	4	2	15
PC702.5 Apply AI techniques to any application domain.	12	2	1	11
Total Hours	45	12	6	60

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Understand the basic concepts of AI and machine learning.	03	01	01	05
CO-2	Understand the working of self-driving systems.	02	06	02	10
CO-3	Understand how to build different AI projects.	03	07	05	15
CO-4	Evaluate the impact of AI on society.	02	08	05	15
CO-5	Apply AI techniques to any application domain.	03	02	-	05
Total		13	24	13	50

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

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial

3. Case Method
4. Group Discussion
5. Role Play
6. Case study on AI domain
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	Artificial Intelligence: A Modern Approach	Stuart Russell	Prentice Hall	2010
2	Artificial Intelligence: The Basics	Kevin Warwick	Routledge2011	1999
3	Artificial Intelligence for Humans	Jeff Heaton	CreateSpace Independent Publishing	2015
4	https://www.coursera.org/learn/ai-for-everyone#syllabus			
5	https://www.edx.org/course/artificial-intelligence-for-everyone			

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COs, POs and PSOs Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]
Course Code : PC702
Course Title: AI for Everyone

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into accoun the environmental context, being conscious of professional ethics and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineerin and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO 1: Understand the basic concepts of AI and machine learning.	1	1	2	2	3	2	3	2	3	1	3	2	2	3	3	1	2
CO 2 Understand the working of self-driving systems	1	1	2	2	1	2	3	2	1	1	3	2	2	2	1	1	3
CO 3: Understand how to build different AI projects	2	2	1	1	1	2	2	2	1	2	1	2	1	1	3	2	2
CO 4: Evaluate the impact of AI on society.	3	2	2	1	3	2	3	2	2	1	2	3	2	3	3	2	2
CO 5: Us Apply AI techniques to any application domain.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 1: Understand the basic concepts of AI and machine learning	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	LI1.1 LI1.2 LI1.3	Unit-1 1 Introduction to Artificial Intelligence. 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2 Understand the working of self-driving systems	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LI2.1 LI2.2 LI2.3	Unit-2 Building AI project . 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7,2.8,	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 3: Understand how to build different AI projects	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	LI3.1 LI3.2 LI3.3	Unit-3 Building AI in your company. 3.1,3.2,3.3,3.4,3.5,3.6,3.7	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: Evaluate the impact of AI on society.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LI4.1 LI4.2 LI4.3	Unit-4 AI and Society 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 Apply AI techniques to any application domain.	SO5.1	LI5.1 LI5.2 LI5.3	Unit-5 AI case studies related to a specific domain.5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11,5.12,	

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

Semester-VII

Course Code: PE001

Course Title : Statistical Thinking for Data Science

Pre-requisite: Student should have basic knowledge of Statistics and database

Rationale: Statistical Thinking for Data Science boosts the discovery of new and unexpected insightsFrom data.

Course Outcomes:

PE001.1At the end of this chapter the student will Understand the statistical foundation for datascience.

PE001.2 At the end of this chapter the student will Apply statistical thinking in collecting, modeling and analyzing data.

PE001.3 At the end of this chapter the student will visualize all types of data

PE001.4 At the end of this chapter the student will Understand how to use R for different types ofdata

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)	
PE	PE001	Statistical Thinking for Data Science	3	2	2	1	8	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performance 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	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)		
PE	PE001	Statistical Thinking for Data Science	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PE	PE001	Statistical Thinking for Data Science	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.

PE001.1: Understand the statistical foundation for data science

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Define Data acquisition **SO1.2** Explain cleaning and aggregation **SO1.3** Explain Exploratory data analysis **SO1.4** Discuss data Visualization **SO1.5** Model creation and validation .	LI1.1. Calculate the mean, median, and mode for a given dataset. LI1.2. Determine the standard deviation and variance of a set of data points. LI1.3. Create a histogram and interpret the distribution of a dataset.	**Unit 1: Introduction to Data Science: (9 lecture)** 1.1 Data acquisition-I 1.2 Data acquisition-II 1.3 Cleaning-I 1.4 Cleaning-II 1.5 Aggregation 1.6 Exploratory data analysis 1.7 Visualization 1.8 Feature engineering 1.9 Model creation and validation	1. Learn Feature engineering

SW-1 Suggested Sessional Work (SW):

a. Assignments:

(i) Discuss about different techniques of data analysis

b. Presentation

PE001**.2:** Apply statistical thinking in collecting, modeling and analyzing data

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 To Understand Statistical Thinking, SO2.2 To learn different approaches of data sampling SO2.3To Explain Probability SO2.4 To Explain Statistical Inference	LI2.1. Apply the concept of conditional probability to a real-world scenario. LI2.2. Use the binomial distribution to model a probability scenario. LI2.3. Apply the normal distribution to solve a problem involving z-scores. .	**Unit-2: Statistical Thinking 1(9 lectures)** 2.1 Examples of Statistical Thinking, 2.2 Numerical Data 2.3 Summary Statistics 2.4 From Population to Sampled Data 2.5 Different Types of Biases 2.6 Introduction to Probability 2.7 Concepts of Probability 2.8 Introduction to Statistical Inference 2.9 Concepts of Statistical Inference	1. learn different types of Biases.

SW-2 Suggested Seasonal Work (SW):

a. Assignments:

(i) Write about numerical data?

b. Presentation

PE001.**3**: Apply statistical thinking in collecting, modeling and analyzing data

Approximate Hours

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

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

SO3. 1 To understand Association and Dependence SO3.2 know the Conditional Probability and Bays Rule SO3.3 To understand the Linear Regression. SO3.4 develop a Special Regression Model	LI3.1. Compute probabilities for simple events and joint events. LI3.2. Calculate the margin of error and construct a confidence interval. LI3.3. Perform a hypothesis test and interpret the results.	**Unit3:Statistical Thinking 2 (9 lecture)** 3.1 Association and Dependence 3.2 Association and Causation 3.3 Conditional Probability 3.4 Conditional Probability 3.5 Bays Rule 3.6 Simpsons Paradox 3.7 Confounding 3.8 Introduction to Linear Regression 3.9 Special Regression Model.	I. Learn about Simpsons Paradox

SW-2 Suggested Seasonal Work (SW):

a. Assignments:

(i) Explain Association and Causation

b. Presentation

PE001.**4:** Ability to visualize all types of data

Approximate Hours

Item	App X Hrs
Cl	9
LI	0
SW	2
SL	1
Total	12

Session Out comes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**

SO4.1 To Understand the Goalsof statistical graphics and data visualization **SO4.2** Explain the Graphs of Data **SO4.3** implement Graphs of Fitted Models **SO4.4** To Understand the Principles of graphics	LI4.1. Use autocorrelati onand partial autocorrelati onfunctions in time series analysis. LI4.2. Apply ARIMA modeling to make predictions ina time series dataset. LI4.3. Evaluate the accuracy of time series forecasts using appropriate metrics.	**Unit-4 : Exploratory Data Analysis and Visualization (9 lectures)** 4.1. Goals of statistical graphics and 4.2. data visualization 4.3. Graphs of Data 4.4. Graphs of Data 4.5. Graphs of Fitted Models 4.6. Graphs to Check Fitted Models 4.7. What makes a good graph? 4.8. Principles of graphics. 4.9. Principles of graphics.	i. Draw a different graphs to fitted models

SW-4 Suggested Seasonal Work (SW):

a. Assignments:

(i) Write the Principles of graphics?

b. Presentation

c. Pictorial representation of different graphs for data visualization.

PE001.**5:** Understand how to use R for different types of data

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)
SO5.1To Understand Bayesian inference **SO5.2** Discuss combining models and data in a forecasting problem	LI5.1. Apply Bayes' Theorem to update probabilities based on new	**Unit5: Introduction to Bayesian Modeling (8 lectures)** 5.1 Bayesian inference-I	I. Learn forecasting problem

SO5.3 To Explain Bayesian hierarchical modeling for studying public opinion **SO5.4** To Understand Bayesian modeling for Big Data	information. LI5.2. Identify trends and seasonality in a time series dataset. LI5.3. Develop a research question for a data science project.	5.2 combining models and data 5.3 forecasting problem 5.4 Bayesian hierarchical modeling 5.5 studying public opinion 5.6 Bayesian modeling for Big Data	

SW-5Suggested Seasonal Work (SW):

a. Assignments:

(i) Explain in detail about Bayesian hierarchical modeling

b. Presentation:

c. Other Activities (Specify): Group discussion of important topics.

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. Understand the statistical foundation for data science	9	2	1	**12**
CO2 Apply statistical thinking in collecting, modeling and analyzing data	9	2	1	**12**
CO3 Apply statistical thinking in **collecting**, modeling and analyzing data	10	2	1	**13**
CO4 Ability to visualize all types of data	9	2	1	**12**
CO5 Understand how to use R for different types of data	8	2	1	**11**
Total Hours	45	10	5	60

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Unit 1: Introduction to Data Science	03	02	03	08
CO-2	Unit-2: Statistical Thinking 1	03	01	05	09
CO-3	Unit3:Statistical Thinking2	03	07	02	12

CO-4	Unit-4 : Exploratory Data Analysis and Visualization	03	05	05	13
CO-5	Unit5: Introduction to Bayesian Modeling	03	02	03	08
Total		15	17	18	50

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

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Pla
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	Computational Thinking: A Primer For Programmers And Data Scientists	G Venkatesh	Notion Press	2022
2	Data Science A Beginner's Guide	C. Raju	Penguin Random House	2023

Curriculum Development Team

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COs, POs and PSOs Mapping

Course Title: B. Tech. Computer Science & Engineering

Course Code: PE001

Course Title: Statistical Thinking for Data Science

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO1 Understand the statistical foundation for data science	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1	2
CO2 Apply statistical thinking in collecting, modeling and analyzing data	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1	3
CO3 Apply statistical thinking in collecting, modeling and analyzing data	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2	2
CO4 Ability to visualize all types of data	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3	3
CO5 Understand how to use R for different types of data	2	3	1	1	2	3	-	-	2	-	2	2	3	2	2	3	2

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO1** Understand the statistical foundation for data science	SO1.1 SO1.2 SO1.3 SO1.4	LI1.1,LI1.2,LI1 .3	**Unit 1: Introduction to Data Science: (9 lecture)** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO2** Apply statistical thinking in collecting, modeling and analyzing data	SO2.1 SO2.2 SO2.3 SO2.4	LI2.1,LI2.2,LI2 .3	**Unit-2: Statistical Thinking 1** 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 statistical thinking in collecting, modeling and analyzing data	SO3.1 SO3.2 SO3.3 SO3.4	LI3.1,LI3.2,LI3 .3	**Unit3:Statistical Thinking2** 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	**CO4** Ability to visualize all types of data	SO4.1 SO4.2 SO4.3 SO4.4	LI4.1,LI4.2,LI4 .3	**Unit-4 : Exploratory Data Analysis and Visualization** 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	**CO5** Understand how to use R for different types of data	SO5.1 SO5.2 SO5.3 SO5.4	LI5.1,LI5.2,LI5 .3	**Unit5: Introduction to Bayesian Modeling** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

Semester-VII

Course Code: PE002

Course Title: Machine Learning for Data-Science

Pre-requisite: Python and R Programming

Rationale: Machine Learning is important because it helps to process and store large amount of data sets on intelligent machine.

Course Outcomes:

On successful completion of this course, the students will be able to:

PE002.1 Students should be familiar with various characteristics of the algorithm including various tools and techniques for analyzing algorithm's complexity.

PE002.2 Learn how algorithm works for data processing and instance generation, such as graph, tree, mapping, and searching.

PE002.3 Create genome sequence by using machine learning algorithm along with various applications of machine learning and data science in genome sequencing.

PE002.4 Understand the advance machine learning concepts with respect to classification and regression process techniques for data processing.

PE002.5 Understand contribution of statistics in machine learning with special emphasis on probabilistic analysis.

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)	
(PE)	PE002	Machine Learning for Data Science	3	2	2	1	8	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.

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	Class Test 2 (2 best out of 3) 10 marks each	Seminar one	Class Activity any one	Class Attendance	Total Marks (CA+CT+SA+ CAT+AT)		
PE	PE002	Machine Learning for Data Science	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)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PE	PE002	Machine Learningfor Data Science	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.

PE002.l Students should be familiar with various characteristics of the algorithm including various tools and techniques for analyzing algorithm's complexity.

Approximate Hours

Item	Appx. Hrs.
Cl	8

LI	6
SW	2
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understanding the characteristics of algorithm. **SO1.2** Understanding various tools useful for algorithm. **SO1.3** Understanding various techniques available for algorithm analysis. **SO1.4** Understanding benefits of divide and conquer technique. **SO1.5** Understanding randomization technique and its application. .	LI1.1. Write a program for reading different types of data sets (.txt, .csv) from the web and disk and writing in a file in a specific disk location. LI1.2. Write a program to read Excel data in R. LI1.3. Write an R program to take input from the user (name and age) and display the values.	**Unit-1.0 Introduction** 1.1 Algorithms and Machine Learning, 1.2 Introduction to algorithms, 1.3 Tools to analyse algorithms-I 1.4 Tools to analyse algorithms-II 1.5 Algorithmic techniques: 1.6 Divide and conquer, examples-I 1.7 Divide and conquer, examples-II 1.8 Randomization, Applications	Learning algorithmits tools and techniques.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Introduction to algorithms

ii. Algorithms and Machine Learning

b. Mini Project:

Divide and Conquer

c. Other Activities (Specify):

Randomization, Applications

PE002.2 Learn how algorithm works for data processing and instance generation, such as graph, tree, mapping, and searching.

Approximate Hours

Item	Appx. Hrs.
Cl	10
LI	6
SW	2
SL	1
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Understanding graph and its mapping technique. **SO2.2** Understanding dictionaries and hashing technique. **SO2.3** Understanding tree and searching technique. **SO2.4** Understanding dynamic programming technique.	LI2.1. Write an R program to get the first 10 Fibonacci numbers. LI2.2. Write an R program to compute the sum, mean, and product of a given vector element. LI2.3. Write an R program to create a Data Frames that contain details of 5 employees and display a summary of the data.	**Unit-2.0 Algorithms** 2.1 Graphs-I 2.2 Graphs-II 2.3 Maps, 2.4 Map Searching, 2.5 Application of algorithms: 2.6 Stable Marriages example, 2.7 Dictionaries and 2.8 Hashing 2.9 Search Trees, 2.10 Dynamic Programming	Learning different types of algorithms and its working.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Graphs

ii. Trees

b. Mini Project:

Dynamic Programming

c. Other Activities (Specify):

Dictionaries and Hashing

PE002.3 Create genome sequence by using machine learning algorithm along with various applications of machine learning and data science in genome sequencing.

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)
SO3.1 Understanding personalgenomics. **SO3.2** Understanding MassiveRaw data in Genomics. **SO3.3** Understanding Interconnectedness onPersonal Genomes.	LI3.1. Write an R program to create a list of heterogeneous data, which includes character, numeric, and logical vectors. LI3.2. Write a program to find the data distributions using a box and scatter plot. LI3.3. Plot the histogram, bar chart, and pie chart on the sample data	**Unit-3.0 Application to PersonalGenomics** 3.1 Linear Programming 3.2 Linear Programming 3.3 NP Completeness, 3.4 Introduction to personalGenomics, 3.5 Massive Raw data inGenomics, 3.6 Data Science on PersonalGenomes 3.7 Data Science on PersonalGenomes 3.8 Interconnectedness onPersonal Genomes, 3.9 Case studies	Learning application of machine learning and data science in genome sequencing.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Massive Raw data in Personal Genomics

ii. Interconnectedness on Personal Genomes

b. Mini Project:

iii. Data Science on Personal Genomes

c. Other Activities (Specify):

i. Linear Programming

PE002.4 Understand the advance machine learning concepts with respect to classificationand regression process techniques for data processing.

Approximate Hours

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

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction(CI)**	**Self-Learning (SL)**
SO4.1 Understanding classification technique in machine learning. **SO4.2** Understanding specialized ensemble classification. **SO4.3** Understanding machine learning model selection. **SO4.4** Understanding the procedure of cross validation.	LI4.1 Write a program to find the outliers using a plot. LI4.2. Write a program to find the correlation matrix. LI4.3. Plot the correlation plot on the dataset.	**Unit-4.0 Machine Learning** 4.1 Introduction, 4.2 Classification, 4.3 Linear Classification, 4.4 Ensemble Classifiers, 4.5 Model Selection-I 4.6 Model Selection-II 4.7 Cross Validation-I 4.8 Cross Validation-II 4.9 Holdout	Learning classification and regression techniques of machine learning.

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

a. Assignments:
- i. Linear Classification
- ii. Ensemble Classifiers

b. Mini Project:
i. Cross Validation

c. Other Activities (Specify):
Model Selection

PE002.5 Understand contribution of statistics in machine learning with special emphasis on probabilistic analysis.

Approximate Hours

Item	**Appx. Hrs.**
Cl	9
LI	6
SW	2

SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understanding probabilistic modelling. **SO5.2** Understanding Probabilistic Inference. **SO5.3** Understanding data description and preparation. **SO5.4** Understanding relationship between machine learning and statistics.	LI5.1. Write a program to implement any four statistical functions. LI5.2. Write a program to perform basic matrix operations LI5.3.Write a program to perform Exploratory Data Analysis(EDA) tasks.	**Unit-5.0 Machine Learning Applications** 5.1 Probabilistic modelling, 5.2 Topic modelling, 5.3 Probabilistic Inference, 5.4 Application-I 5.5 Application-II 5.6 Prediction of Preterm Birth, 5.7 Data description and preparation-I 5.8 Data description and preparation-II 5.9 Relationship between machine learning and statistics	Learning statistical analysis applicable in machine learning.

SW-5 Suggested Sessional Work (SW):

a. Assignments
i. Probabilistic Modelling
ii. Probabilistic Inference

b. Mini Project:
i. Prediction of Preterm Birth

c. Other Activities (Specify):
Relationship between machine learning and statistics

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)
PE002.l Students should be familiar with various characteristics of the algorithm including various tools and techniques for analyzing algorithm's complexity.	8	6	2	1	17
PE002.2 Learn how algorithm works for data processing and instance generation, such as graph, tree, mapping, and searching.	10	6	2	1	19

PE002.3 Create genome sequence by using machine learning algorithm along with various applications of machine learning and data science in genome sequencing.	9	6	2	1	18
PE002.4 Understand the advance machine learning concepts with respect to classification and regression process techniques for data processing.	9	6	2	1	18
PE002.5 Understand contribution of statistics in machine learning with special emphasis on probabilistic analysis.	9	6	2	1	18
Total Hours	45	6	10	5	58

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
PE002.1	Students should be familiar with various characteristics of the algorithm including various tools and techniques for analyzing algorithm's complexity.	02	01	01	04
PE002.2	Learn how algorithm works for data processing and instance generation, such as graph, tree, mapping, and searching.	02	04	02	08
PE002.3	Create genome sequence by using machine learning algorithm along with various applications of machine learning and data science in genome sequencing.	03	05	04	12
PE002.4	Understand the advance machine learning concepts with respect to classification and regression process techniques for data processing.	02	08	05	15
PE002.5	Understand contribution of statistics in machine learning with special emphasis on probabilistic analysis.	03	05	03	11
Total		12	23	15	50

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

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	Introduction to Machine Learning	Jeeva Jose	Khanna Book Publishing House	
2	Machine Learning	Rajiv Chopra	Khanna Book Publishing House	
3	Data Science and Machine Learning: Mathematical and Statistical Methods Machine Learning & Pattern Recognition	Dirk P. Kroese, Zdravko Botev, Thomas Taimre, Radislav Vaisman, Chapman & Hall	CRC Publication	2017
4	Hands-On Data Science and Python Machine Learning	Frank Kane	Packt Publishers	2019

Curriculum Development Team

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4. Ms. Pragya Shrivastava, Assistant Professor, Department of Computer Science and Engineering.
5. Mr. Lokendra Gaur, Assistant Professor, Department of Computer Science and Engineering.
6. Mr. Vinay Kumar Dwivedi, Assistant Professor, Department of Computer Science and Engineering.
7. Ms. Pinki Sharma, Assistant Professor, Department of Computer Science and Engineering.
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COs, POs and PSOs Mapping

Program: B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]
Course Code : PE002
Course Title: Machine Learning for Data Science

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
PE002.l Students should be familiar with various characteristics of the algorithm including various tools and techniques for analyzing algorithm's complexity.	-	-	-	-	1	1	1	2	3	3	1	-	2	3	3	1	2
PE002.2 Learn how algorithm works for data processing and instance generation, such as graph, tree, mapping, and searching.	-	1	1	-	-	2	2	2	3	3	2	-	2	2	2	1	3
PE002.3 Create genome sequence by using machine learning algorithm along with various applications of machine learning and data science in genome sequencing.	-	-	-	-	-	-	-	-	2	3	1	-	1	1	2	2	2
PE002.4 Understand the advance machine learning concepts with respect to classification and regression process techniques for data processing.	-	-	-	-	-	-	-		1	3	-	-	3	3	3	2	2
PE002.5 Understand contribution of statistics in machine learning with special emphasis on probabilistic analysis.	-	-	1	-	-	1	-	-	1	3	-	-	3	3	1	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	PC402.l Students should be familiar with various characteristics of the algorithm including various tools and techniques for analyzing algorithm's complexity.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	LI1.1,LI1.2,LI1 .3	**Unit-1.0 Introduction** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	PC402.2 Learn how algorithm works for data processing and instance generation, such as graph, tree, mapping, and searching.	SO2.1 SO2.2 SO2.3 SO2.4	LI2.1,LI2.2,LI2 .3	**Unit-2.0 Algorithms** 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	PC402.3 Create genome sequence by using machine learning algorithm along with various applications of machine learning and data science in genome sequencing.	SO3.1 SO3.2 SO3.3	LI3.1,LI3.2,LI3 .3	**Unit-3.0 Application to Personal Genomics** 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	PC402.4 Understand the advance machine learning concepts with respect to classification and regression process techniques for data processing.	SO4.1 SO4.2 SO4.3 SO4.4	LI4.1,LI4.2,LI4 .3	**Unit-4.0 Machine Learning** 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	PC402.5 Understand contribution of statistics in machine learning with special emphasis on probabilistic analysis.	SO5.1 SO5.2 SO5.3 SO5.4	LI5.1,LI5.2,LI5 .3	**Unit-5.0 Machine Learning Applications** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,	

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

SEMESTER-VII

Course Code: PE004

Course Title: Data Science &Visualization

Pre-requisite: A foundational understanding of statistics and mathematics, and familiarity with data manipulation tools and visualization libraries such as Matplotlib or Plotly. Optional knowledge in web development and machine learning may also be beneficial.

Rationale: Data visualization is important because it helps people understand data better. It can help people analyse complex data, identify patterns, and extract valuable insights. Data visualization can also help people make informed and effective decisions quickly and accurately.

Course Outcomes: After completion of course, students would be able to:

1. Apply data visualizations in order to derive more meaning out of data.
2. Understand python visualization libraries.
3. Apply data visualization on different types of data.
4. Perceive hidden meanings from data using data visualization.

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)	
PE	PE004	Data Visualization	3	2	2	1	9	4

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

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A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

(Revised as on 01 August 2023)

Scheme of Assessment:

Theory

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/HomeAssignment 5number 3 marks each (CA)	Class Test 2 (2	Seminar one (Presentation) (SA)	Class Activity	Class	Total Marks (CA+CT+SA		
PE	PE004	Data Visualization	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PE	PE004	Data Visualization	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.

PE004.1. Study of The Computer and the Human**.**

Approximate Hours

Item	Appx. Hrs.
Cl	9
LI	6

SW	2
SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self- Learning (SL)
Sos 1.1 Understand principles of effective data visualization techniques. Sos 1.2 Demonstrate skills in creating 2-D graphics using SVG. Sos 1.3 Apply knowledge of photorealistic and non-photorealistic rendering. Sos 1.4 Comprehend human retina functions in perceiving dimensions. Sos 1.5 Execute 3-D graphics and explore perspective visualization.	LI1.1. Understanding the basic python visualization tools. LI1.2. Write a python program to find the best of two test average marks out of three test's marks accepted from the user. LI1.3. Develop a Python program to check whether a given number is palindrome or not andalso count the number of occurrences of each digit in the input number.	**Module-1.0** The Computer and the Human : 1.1. Overview of Visualization 1.2. Introduction to 2-D Graphics 1.3. Example using SVG (Scalable Vector Graphics) 1.4. Principles of 2-D Drawing 1.5. Understanding 3-D Graphics 1.6. Concepts of Photorealism 1.7. Non-Photorealistic Rendering Techniques 1.8. Human Retina: Perception of Two Dimensions 1.9. Exploration of Perspective in Visualization	1. Grasp SVG for graphic creation. 2. Explore non-photorealistic rendering techniques

SW-1 Suggested Sessional Work (SW):

a. Assignments:
Create a 2-D graphic using SVG.

b. Mini Project:
Develop a 3-D visualization model.

c. Other Activities (Specify):
Analyse photorealistic vs. non-photorealistic renderings.

PE004.2 Study the Visualization tools

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SL 2.1 Create effective visualizations using line plots. SL 2.2 Apply area plots for data representation. SL 2.3 Understand and interpret histogram distributions. SL 2.4 Construct informative bar charts for data insights. **SL 2.5** Analyze data composition through pie charts.	LI2.1 Implement different types of charts and graphs. LI2.2. Write a Python program to Demonstrate how to Draw a Bar Plot using Matplotlib. LI2.3. Write a Python program to Demonstrate how to Draw a Scatter Plot using Matplotlib.	Module 2.0 Visualization tools 2.1 Introduction to Line Plots 2.2 Exploring Area Plots 2.3 Understanding Histograms 2.4 Principles of Bar Charts 2.5 Analysis of Pie Charts 2.6 Implementation of Scatter Plots 2.7 Creating Bubble Plots 2.8 Introduction to Waffle Charts 2.9 Utilizing Word Clouds for Visualization	SL 2.1 Master techniques for scatter plots. SL 2.2 Explore creative uses of word clouds.

SW-1 Suggested Sessional Work (SW):

a. Assignments:
   i. Compare line plots and area plots for data trends.
b. Mini Project:
   i. Design a histogram for real-world data.
c. Other Activities (Specify):
   Critique the effectiveness of bar charts.

PE004.3 Can extend the Visualization of numerical data.

Approximate Hours

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

SW-1 Suggested Sessional Work (SW):

Session Outcomes (SOs)	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self-Learning(SL)
Sos 3.1 Apply numerical data visualization techniques proficiently. **Sos 3.2 Utilize data mapping strategies for accurate representation.** **Sos 3.3 Create various charts for numerical data interpretation.** **Sos 3.4 Understand the significance and usage of glyphs.** **Sos 3.5 Implement parallel coordinates and stacked graphs effectively.**	LI3.1 Implement visualization of numerical data. LI3.2. Write a Python program to Demonstrate how to Draw a Histogram Plot using Matplotlib. LI3.3. Write a Python program to Demonstrate how to Draw a Pie Chart using Matplotlib.	**Module-3.0 Visualization of numerical data** **3.1** Introduction to Numerical Data Visualization **3.2** Understanding Data Mapping in Visualization **3.3** Types and **3.4** Characteristics of Charts **3.5** Exploring Glyphs in Data Representation **3.6** Concepts of Parallel Coordinates **3.7** Implementation of Stacked Graphs **3.8** Analysis of Tufte's Design Rules **3.9** Effective Use of Color in Visualization	SL 3.1 Master Tufte's principles for design. SL 3.2 Explore advanced color utilization techniques.

a. Assignments:
   i. Critically evaluate a numerical data visualization.

b. Mini Project:
   i. Design a parallel coordinates visualization.

c. Other Activities (Specify):
   Analyze the impact of colour choices.

PE004.4 To Understand Visualization of non-numerical data.

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)**
Sos 4.1 Apply techniques for non-numerical data visualization. **Sos 4.2 Represent and interpret graphs and network data.** **Sos 4.3 Embed planar graphs for effective visualization.** **Sos 4.4 Utilize principles for effective graph visualization.** **Sos 4.5 Create and interpret hierarchical data using Tree Maps.**	LI4.1 Implement visualization of non-numerical data. LI4.2. Write a Python program to illustrate Linear Plotting using Matplotlib. LI4.3. Write a Python program to illustrate liner plotting with line formatting using Matplotlib.	Module 4.0 Visualization of non-numerical data 4.1. Introduction to Non-Numerical Data Visualization 4.2. Graphs and Networks Representation 4.3. Techniques for Embedding Planar Graphs 4.4. Principles of Graph Visualization 4.5. Understanding and Creating TreeMaps 4.6. Application of Principal Component Analysis (PCA) 4.7. Multidimensional Scaling in Data Visualization	1. Master PCA techniques for visualization. 2. Explore applications of multidimensional scaling.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Evaluate a non-numerical data visualization critically.

b. Mini Project:

i. Design a graph visualization for a dataset.

c. Other Activities (Specify):

Discuss challenges in embedding planar graphs.

PE004.5 To Understand Python visualization libraries.

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)**
SO1.Master Python libraries for diverse data visualization. SO2.Create advanced visualizations using Matplotliband Pandas. SO3. Apply statistical visualization techniques withSeaborn. SO4.Understand the principles of ggplot for data representation. SO5.Develop interactive visualizationsusing Plotly.	LI5.1 Implement basic functions of matplot lib, pandas , seaborn, ggplot , pyplot. LI5.2. Write a Python program which explains uses of customizing seaborn plots with Aesthetic functions. LI5.3. Write a Python program to draw 3D Plots using Plotly Libraries.	**Module 5.0** Python visualization libraries 5.1 Introduction to Python Visualization Libraries, Basics of Matplotlib Library 5.2 Advanced Features of Matplotlib, Data Visualization with Pandas, Seaborn: Statistical Data Visualization, Exploring ggplot in Python 5.3 Interactive Visualizations with Plotly 5.4 Combining Multiple Libraries for Visualization,	SL 5.1 Explore customization options in Matplotlib. SL 5.2 Master geographic data visualization with Plotly.

		Customization Techniques in Matplotlib 5.5 Pandas Plotting for Data Exploration 5.6 Seaborn Styling and Themes, Advanced Data Analysis with ggplot 5.7 Creating Dashboards with Plotly, Comparative Analysis of Visualization Libraries 5.8 Best Practices for Matplotlib Usage, Effective Data Storytelling with Pandas 5.9 Seaborn for Categorical Data Visualization, Extending ggplot Functionality in Python, Plotly for Geographic Data Visualization,integration of Visualization Libraries in Python Projects	

SW-1 Suggested Sessional Work (SW):

b. Assignments:
   i. Compare Matplotlib and Pandas for data plotting.
b. Mini Project:
   i. Design an advanced Seaborn visualization.
c. Other Activities (Specify):
   Discuss real-world applications of ggplot.

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)
CO.1. Understand Computer and the Human**.**	9	6	1	1	17
CO.2. Apply the Visualization tools	9	6	1	1	17
CO.3. Apply the Visualization of numerical data.	9	6	1	1	17
CO.4. Apply Visualization of non-numerical data.	9	6	1	1	17
CO.5. Apply Python visualization libraries.	9	6	1	1	17
Total Hours	45	30	5	5	85

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
PE004.1	Unit-1: The Computer and the Human	03	04	03	10
PE004.2	Unit-2: Visualization tools	05	03	02	10
PE004.3	Unit-3 Visualization of numerical data	05	03	02	10
PE004.4	Unit-4: Visualization of non-numerical	04	05	01	10
PE004.5	Unit-5: Python visualization libraries	03	05	2	10
Total		20	17	13	50

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

Suggested Learning Resources:

a. Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Taming Python by Programming	Jeeva Jose	Khanna Book Publishing House	-
2	Data Visualization with Python and JavaScript	Scrape, Clean, Explore &Transform Your Data, Kyran Dale	O'Reilly	2016
3	Introduction to Computing & Problem Solving with Python	Jeeva Jose	Khanna Book Publishing House	-
4	Data Visualization with Python	Mario Döbler	Packet Publishers	2019
5	Mastering Python Data Visualization	Kirthi Raman	Packet Publishers	2015

Curriculum Development Team

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COs, POs and PSOs Mapping

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

Course Code : PE004

Course Title: Data Visualization

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

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO.1. Understand Computer and the Human.	SO1.1 SO1.2 SO1.3 SO1.4	LI.1.1,LI1.2,LI1.3	Unit-1: The Computer and the Human 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO.2. Apply the Visualization tools	SO2.1 SO2.2 SO2.3 SO2.4	LI.2.1,LI2.2,LI2.3	Unit-2: Visualization tools 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	CO.3. Apply the Visualization of numerical data.	SO3.1 SO3.2 SO3.3 SO3.4	LI3.1,LI3.2,LI3.3	Unit-3 Visualization of numerical data 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. Apply Visualization of non-numerical data.	SO4.1 SO4.2 SO4.3 SO4.4	LI4.1,LI.4.2,LI4.3	Unit-4: Visualization of non-numerical 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. Apply Python visualization libraries.	SO5.1 SO5.2 SO5.3 SO5.4	LI.5.1,LI5.2,LI5.3	Unit-5: Python visualization libraries 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) Program

SEVENTH SEMESTER

Course Code: **PE005**

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:

PE005.1. Understand and apply big data flow to actual projects as well as apply data analytics life cycle to big data projects.

PE005.2. Apply appropriate techniques and tools to solve big data problems.

PE005.3. Describe big data and use cases from selected business domains.

PE005.4. Explain NoSQL big data management.

PE005.5. 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)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
PE	PE005	**Big Data Analytics**	3	2	1	1	7	4

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

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

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

SL: Self Learning,

C: Credits.

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

Scheme of Assessment: Theory

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)
PE	PE005	Big Data Analytics	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)
			Class/Home Assignment 5 number 3 marks each (CA)	**Viva1 (5)**	**Viva2 (5) (SA)**	**Class Attendance (AT)**	**Total Marks (CA+CT+SA+CAT+AT)**		
PC	PE005	Big Data Analytics	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.

PE005.1. 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	9
LI	4
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand about concept of Bigdata **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	LI 1.0 Describe big data and use cases from selected business domains. LI 2.0 Installation of Hadoop Framework, it 's components and study the HADOOP Ecosystem.	**Module 1: Introduction to big data** 1.1 Introduction to Bigdata Platform 1.2 Traits of Big data 1.3 Challenges of Conventional Systems 1.4 Web Data, Evolution of Analytic, 1.5 Scalability 1.6 Analysis vs Reporting 1.7 Statistical Concepts: Sampling Distributions 1.8 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. N/A

c. Other Activities (Specify):

Quiz, Class Test.

PE005.2. Apply appropriate techniques and tools to solve big data problems.

Approximate Hours

Item	AppX Hrs
Cl	10
LI	8
SW	2

SL	1
Total	21

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 **SO2.**8 about Introduction to R.	LI 2.1 Explain NoSQL big data management. LI 2.1 Installation of R-Studio on windows. LI2.3Perform data visualization using any data. LI.2.4 Perform any two statical operations Using R Programming.	**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 2.6 Rule Induction 2.7 Neural Networks: Learning and Generalization, Competitive Learning 2.8 Principal Component Analysis and Neural Networks	SL1. Learn about basics of data analysis

		2.9 Fuzzy Logic: Extracting Fuzzy Models from Data Fuzzy Decision Trees, Stochastic Search Methods. 2.10 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):
Oral Presentation

PE005.3. Describe big data and use cases from selected business domains

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Mining Frequent item sets: Market Based Model **SO3.2** Understand about Apriori Algorithm.	LI 3.1 Install, configure, and run Hadoop and HDFS. LI 3.2 Explain Any two-	**Module-3.0 Frequent item sets and clustering** 3.1 Mining	1. About Clustering 2.Diffrent Types of clustering

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	clustering method with program using any dataset. LI 3.3 Explain Regression method with program using any dataset. LI 3.4 Write a program to implement K-means Clustering algorithm using MapReduce.	Frequent item sets: 3.2 Market Based Model 3.3 Apriori Algorithm 3.4 Handling Large Data Sets in Main Memory 3.5 Limited Pass Algorithm 3.6 Counting Frequent item sets in a Stream 3.7 Clustering Techniques: Hierarchical 3.8 K-Means 3.9 Frequent Pattern based Clustering Methods	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. What are the Requirements of Clustering Data Mining Techniques?

ii. Explain application of clustering.

b. Mini Project:

i. Write a program to implement clustering in R programming.

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

PE005.4. Explain NoSQL big data management

Approximate Hours

Item	AppX Hrs
Cl	9
LI	4
SW	1
SL	1
Total	13

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	LI.1. Pre-Processes Techniques on Data Set	**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 4.4 Counting Distinct Elements in a Stream. 4.5 Estimating Moments, Counting Oneness in a Window 4.6 Decaying Window, Real time	1. Source of data
		Analytics Platform (RTAP) Applications 4.7 Case Studies, 4.8 Real Time Sentiment Analysis, 4.9 Stock Market	

		Predictions	

SW-1 Suggested Sessional Work (SW):
Assignments:

i. **Explain REAL TIME ANALYTICS PLATFORM (RTAP) APPLICATION.**
ii. **CASE STUDIES - REAL TIME SENTIMENT ANALYSIS, STOCK MARKETPREDICTIONS.**

b. Mini Project:

i. Why the rapid growth of unstructured data is putting greater pressure on businesses. Explain it.

c. Other Activities (Specify):
Power Point Presentation

PE005.5: Design a database scenario for handling big data.

Approximate Hours

Item	AppX Hrs
Cl	9
LI	8
SW	1
SL	1
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
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	LI5.1 Perform map-reduce analytics using Hadoop. LI5.2 Develop a MapReduce to analyze weather data set and print whether the day is shinny or cool day. LI5.3Develop a MapReduce to find the maximum electrical consumption in each year given electrical consumption for each month in	**Module -5.0 Framework, technologies, tools and visualization** 5.1 Map Reduce: Hadoop 5.2 Hive 5.3 MapR, Sharding 5.4 NoSQL Databases: S3, 5.5 Hadoop Distributed File Systems 5.6 Visualizations: Visual Data Analysis Techniques, 5.7 Interaction Techniques;	1.Big Data

	each year. LI5.4 Develop a MapReduce program to find the grades of students.	Systems and Analytics Applications. 5.8 Analytics using Statistical packages 5.9 Industry challenges and application of Analytics	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Create Word Count Map Reduce program to understand Map Reduce Paradigm

ii. Implementing Matrix Multiplication with Hadoop Map Reduce.

b. Mini Project:

i. To setup Hadoop.

ii. To run sample program using Hadoop.

Other Activities (Specify):

Class Test, Quiz

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)
PE005.1.Understand and apply big data flow to actual projects as well as apply data analytics life cycle to big data projects.	8	4	1	1	14
PE005.2. Apply appropriate techniques and tools to solve big data problems	10	8	1	1	21
PE005.3. Describe big data and use cases from selected business domains	9	6	1	1	17
PE005.4. Explain NoSQL big data management	9	4	1	1	15

PE005.5. Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics	9	8	1	1	19
Total Hours	45	30	5	5	86

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
PE005.1	Introduction to big data	03	04	03	10
PE005.2	Basic data analysis and data analytic methods using R	05	03	02	10
PE005.3	Frequent item sets and clustering	05	03	02	10
PE005.4	Mining data streams	04	05	01	10
PE005.5	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 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 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)	2005
3	Intelligent Data Analysis",	Michael Berthold, David J. Hand	Springer	2003
4	Mining of Massive Datasets	Anand Rajaraman and Jeffrey David Ullman	Cambridge University Press, 2020.	2020
5	Beginner's Guide for Data Analysis using R Programming	Jeeva Jose	Khanna Book Publishing House, 2019	2019

Curriculum Development Team

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COs, POs and PSOs Mapping

Course Title: B. Tech. Computer Science & Engineering

Course Code: PE005

Course Title: Big Data Analytics

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO 1: Understand and apply big data flow to actual projects as well as apply data analytics life cycle to big data projects.	1	1	2	2	3	2	3	1	2	1	3	2	2	3	3	1	2
CO 2: Apply appropriate techniques and tools to solve big data problems.	1	1	2	2	1	2	3	1	1	1	2	2	2	2	2	2	3
CO 3: Describe big data and use cases from selected business domains.	2	2	1	1	1	2	2	1	1	1	1	2	2	3	2	2	2
CO 4: Explain NoSQL big data management.	3	2	2	2	3	2	3	1	2	1	2	3	3	3	3	2	2
CO 5: Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.	2	2	3	2	2	3	3	1	1	1	2	2	3	3	1	3	3

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 1: Understand 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	3	Unit-1 Introduction to big data 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2 : 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	4	Unit-2 : Basic data analysis and data analytic methods using R 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7,2.8,2.9,2.10	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 3: Describe big data and use cases from selected business domains.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5 SO3.6	4	Unit-3 Frequent item sets and clustering 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: Explain NoSQL big data management.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5 SO4.6	1	Unit-4 Mining data streams 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: 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	4	Unit-5 Framework, technologies, tools and visualization 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

SEMESTER-VII

Course Code: EEC701

Course Title: Capstone Project-I

Pre- requisite: Student should have knowledge of programming languages, Software Engineering, and Many more tools and framework.

Rationale:

- To apply the knowledge and skills learnt in previous semesters, to solve real life industrial / engineering / professional problems.
- To modify/ improve the existing engineering / professional systems.
- To develop systems / components / methods / processes / resources to cater the needs of the nearby small scale / medium industry.
- To learn to solve real life engineering / professional problems which often have many aspects to be considered and addressed.

Course Outcomes:

The details of COs and LOs are as follows: -

EEC701.1: - The student will be able to prepare a detailed project plan for solving any real-life related engineering / technical / professional / industrial problem.
EEC701.2: - The student will be able to implement the project plan and manage the project.
EEC701.3: - The student will be able to present the complete project work.

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)	
EEC	EEC401	Minor Project	0	12	0	0	12	6

INTRODUCTION TO PROJECT WORK/INTERNSHIP

Project work is a very important course in all branches of diploma programmes. It offers following opportunities to students of final semester: -

2. To learn skills and abilities which are otherwise not possible either in classroom or in structured environment of laboratory such as: -
   - Skill to work in groups or teams,
   - Skill to face real life professional problems and to create reallife solutions for them.
   - Skill to take professional decisions under real life constraints and circumstances,
   - Skill to learn in self-directed way to pursue the specific professional projects (Self Directed Learning)

- Skill to learn from real life self- experiences (l i f e l o n g learning)
- Skill to manage the real- l i f e engineering / professional projects
- Skill to plan and organize the self / group professional work
- skills to apply the engineering management principles in real lifeprofessional projects
- Skill to defend / justify self-real-l i f e engineering / professionalwork in front of significant others
- Skill to complete the professional tasks / work keeping in viewsocietal, legal and environmental considerations
- Skill to collect relevant data in real life situations
- Skill to relate engineering / professional knowledge gained in various semesters with real life engineering / professional problems
- Skill to estimate the duration and costs in real life engineering / professional work
- Skill to assess the theoretical feasibility, financial feasibility and time feasibility of real- l i f e engineering / professional tasks.

With an objective to ensure the learning of above skills and abilities as well as to earn maximum marks in NBA assessment,

The Course on Project Work consists of five phases: -

	Description of phases	Learn Hrs.
1	Literature / industry's need survey and finalization of topic / title	15Hrs
2	Detailed planning of the project work	60Hrs
3	Implementing the detailed project plan	
4	Managing the project activities	
5	Reporting of the project work output /outcome / prototype	15Hrs
	Total	90 Hrs

General Guidelines for Internship/Project Work

- The project topics should be related to concerned branch of engineering / profession, but, should not be the exact content of the curriculum taughtin the discipline.
- Student's project topics should be preferably 'real life' topics. It means the project topics should have substantial element of uncertainty, complexity and multi-disciplinary-ness which can be coped up by the students. These elements offer opportunities to students to apply engineering/ professional knowledge in real life settings, solve real life problems and to take real life decisions. As a project guide, concerned teacher should ensure these by suitably altering / framing / reframing the statement of topic / title.
- The project topics should be such that students can get opportunity to refer IS codes, Manuals, Handbooks, norms and standards, opportunity to conduct standard tests, and opportunity to operate modern laboratory equipment's following SOPs.
- For student's interest, active participation and ownership in the project work, their self-motivation is necessary. Therefore, students should be actively involved in finalizing the topic of project.
- Students should be asked to conduct a brief review of literature for problems and issues in their engineering / professional areas of interest,where they think they can contribute effectively. The project guide should facilitate them in this regard, through his/her expertise and experience.

Every student group should be asked to propose at least three topics oftheir interest.

- The topics proposed by student project groups should be assessed by the facilitator-teacher on following three criteria: -
  - **The work on the topic should be theoretically and practically feasible.**
  - **The project work on the topic should be completed within approx. Three and half months.**
  - **Availability of required resources should be certain. Cost of project work should also be bearable.**
- Normally, students' project works should be carried out in small groups (1 to 2 students).
- All faculty members of department should be engaged as project guides. Every faculty member should be project guide of at least one student project group.
- Normally, project guides should be assigned to the students through lottery system and students under each faculty should be asked to formtheir small groups.

COs, POs and PSOs Mapping

Course Title: B. Tech. Computer Science & Engineering *(AI-DS)*

Course Code: EEC701

Course Title: Capstone Project-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	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO 1: The student will be able to prepare a detailed project plan for solving any real-life related engineering / technical / professional / industrial problem.	2	3	3	2	3	2	3	1	3	1	3	3	2	3	3	1	2
CO 2: The student will be able to implement the project plan and manage the project.	2	3	3	2	3	2	3	1	3	1	3	3	2	2	2	2	3
CO 3: The student will be able to present the completed project work.	2	2	3	1	3	2	2	1	3	1	3	3	2	3	2	2	2

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: The student will be able to prepare a detailed project plan for solving any real-life related engineering / technical / professional / industrial problem.	-	-	-	As mentioned in page number _ to _
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2: The student will be able to implement the project plan and manage the project.	-	-	-	
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 3: The student will be able to present the completed project work.	-	-	-	

Semester - VIII

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Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

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SEMESTER VIII

Course Code: PE006

Course Title: Pattern Recognition & Visual Recognition

Pre- requisite: Basic understanding of Business concepts and Online technologies.

Rationale: This syllabus aims to equip students with a robust foundation in e-commerce, integrating historical context, technological advancements, and critical security considerations for a comprehensive understanding of this dynamic field.

Course Outcomes:

PE006.1: Understand basic mathematical and statistical techniques commonly used in pattern recognition.
PE006.2: Apply a variety of pattern recognition algorithms.
PE006.3: Understand and apply various pre-processing algorithms.
PE006.4: Assess the use of FCM and soft-computing techniques in pattern recognition.
PE006.5: Assess the use of FCM and soft-computing techniques in pattern recognition.

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)	
PE	PE006	Pattern Recognition & Visual Recognition	3	2	1	1	7	4

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

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

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

SL: Self Learning,

C: Credits.

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

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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)		
PE	PE006	Pattern Recognition & Visual Recognition	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
P E	PE006	Pattern Recognition & Visual Recognition	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.

PE006.1: Understand basic mathematical and statistical techniques commonly used in pattern recognition.

Approximate Hours

Item	AppXHrs
Cl	05
LI	06
SW	02
SL	01
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the basic mathematical concepts to pattern recognition problems. **SO1.2** Analyze the uses and mathematical foundations of pattern recognition, including classification and Bayesian rules. **SO1.3** Differentiate between clustering and classification in the context of pattern recognition. **SO1.4** Apply linear algebra concepts to understand vector spaces in pattern recognition. **SO1.5** Apply eigenvalues and eigenvectors for feature extraction in pattern recognition. .	LI1.1. Apply mathematical preliminaries and principles of pattern recognition to design and implement a classification algorithm in Python or MATLAB. LI1.2. Use principles of linear algebra and vector spaces to compute eigenvalues and eigenvectors of image datasets, demonstrating their significance in feature extraction and pattern representation.	**Unit-1.0 Introduction and mathematical Preliminaries (5 Lectures)** 1.1 Basics of mathematical Preliminaries 1.2 Principles of pattern recognition: Uses, mathematics 1.3 Classification and Bayesian rules, Clustering classification 1.4 Basics of linear algebra and vector spaces 1.5 Eigen values and eigen vectors, Rank of matrix and SVD.	1. Explore online resources to deepen understanding of linear algebra concepts relevant to pattern recognition. 2. Investigate real-world applications of pattern recognition, focusing on recent advancements and case studies.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Analyze and implement Bayesian rules for classification in pattern recognition systems.

b. Mini Project:

i. Develop a visual recognition system using clustering techniques, incorporating linear algebra principles.

c. Other Activities (Specify):

Participate in group discussions on ethical considerations and societal impacts of pattern recognition technologies.

PE006.2 Apply a variety of pattern recognition algorithms.

Approximate Hours

Item	AppXHrs
Cl	12
LI	04
SW	02
SL	01
Total	19

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
O1.1 Define the basics of pattern recognition, including pattern recognition basics and decision theory. **SO1.2** Explain classifiers, discriminant functions, and decision surfaces. **SO1.3** Apply parameter estimation methods and Hidden Markov models in pattern recognition. **SO1.4** Analyze dimension reduction methods, including Fisher discriminant analysis and Principal Component Analysis. **SO1.5** Implement algorithms for clustering, such as K-means and hierarchical methods, in unsupervised learning scenarios.	LI2.1. Implement a K-Means Clustering Algorithm for Unsupervised Learning in Pattern Recognition LI2.2. Apply Fisher Discriminant Analysis and Principal Component Analysis for Dimension Reduction in Pattern Recognition.	**Unit-2.0 Pattern Recognition basics (12 Lectures)** 2.1 Bayesi and ecision theory 2.2 Classifiers, Discriminant functions 2.3 Decision surfaces 2.4 Parameter estimation methods 2.5 Hidden Markov models 2.6 Dimension reduction methods 2.7 Fisher discriminant analysis 2.8 Principal component analysis 2.9 non-parametric techniques for density estimation 2.10 non-metric methods for pattern	SL1. Learn about Model transforms: translations, rotations and scaling.

		classification	
		2.11 unsupervised learning algorithms for clustering: K-means 2.12 Hierarchical and other methods	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Apply classifiers, discriminant functions, and decision surfaces in practical pattern recognition scenarios.

b. Mini Project:

Implement Hidden Markov Models for sequence analysis in a visual recognition project.

c. Other Activities (Specify):

Engage in discussions and explore dimension reduction techniques, such as Fisher discriminant analysis and Principal Component Analysis.

PE006.3 Understand and apply various pre-processing algorithms.

Approximate Hours

Item	AppX Hrs
Cl	07
LI	06
SW	02
SL	01
Total	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Recall the importance of feature selection and extraction in addressing real-world problems. **SO3.**2. Comprehend the problem statement and diverse applications of feature selection. **SO3.**3. Implement the Branch and Bound algorithm for efficient feature selection. **SO3.**4. Evaluate the Sequential Forward and Backward Selection methods and the Cauchy Schwartz	LI3.1. Implement basic pattern recognition concepts, including feature selection, extraction, and problem statement analysis. LI3.2. Apply and compare	**Unit-3: Basics of Feature Selection (7 Lectures)** 3.1. Feature Selection and extraction 3.2. Problem statement and uses, 3.3. Branch and bound algorithm, 3.4. Sequential forward and backward selection, 3.5. Cauchy Schwartz inequality, 3.6. Feature selection criteria function: Probabilistic separability based and Interclass distance	1. Investigate the relevance and practical uses of Cauchy-Schwarz inequality in the context of Feature Selection and Extraction in Pattern Recognition.

inequality. **SO3.5**. Assess feature selection criteria functions, focusing on Probabilistic Separability and Interclass Distance.	feature selection methods like Branch and Bound, Sequential Forward and Backward Selection, utilizing Cauchy Schwartz inequality and Feature Selection Criteria functions for Probabilistic Separability and Interclass Distance.	based 3.7 Feature Extraction: principles.	

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Explore the application of Branch and Bound algorithm in feature selection for Pattern Recognition, analyzing its efficiency and limitations.

b. Mini Project:

Develop a Sequential Forward and Backward Selection algorithm for optimizing feature subsets in a visual recognition system, assessing its impact on classification accuracy.

c. Other Activities (Specify):

Implement a mini-project focusing on the development and evaluation of Feature Selection Criteria functions, emphasizing Probabilistic Separability and Interclass Distance based methods.

PE006.4 Apply various algorithms for image classification.

Approximate Hours

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

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Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Identify components of human visual recognition: low-level features, mid-level segmentation, and high-level reasoning. **SO4.**2. Explain detection and segmentation methods in visual recognition. **SO4.**3. Apply concepts of context, scenes, and saliency in visual recognition. **SO4.**4. Analyze the significance of large-scale search and recognition in visual processing. **SO4.5**. Evaluate applications of egocentric vision, human-in-the-loop systems, and 3D scene understanding in interactive visual systems.	LI4.1. Implement low-level recognition methods by extracting features from images and assess their impact on pattern recognition accuracy. LI4.2. Explore mid-level abstraction techniques by performing image segmentation, and analyze their role in enhancing scene understanding within the context of pattern recognition.	**Unit-4: Basics of Visual Recognition** **(12 Lectures)** 4.1 Visual Recognition 4.2 Human visual recognition system 4.3 Recognition methods: Low-level modelling (e.g. features) 4.4 Mid-level abstraction (e.g. Segmentation) 4.5 High-level reasoning (e.g. Scene understanding) 4.6 Detection/Segmentation methods 4.7 Context and scenes 4.8 Importance and saliency 4.9 Large-scale search and recognition 4.10 Egocentric vision systems 4.11 Human-in-the-loop interactive systems 4.12 3D scene understanding.	1. Explore foundational concepts of human visual recognition, from low-level features to high-level reasoning, through online resources and academic papers.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Analyse and compare different detection and segmentation methods in the context of visual recognition, emphasizing the importance of context and scenes.

b. Mini Project:

i. Develop an egocentric vision system with interactive features, integrating low-level modelling and mid-level abstraction for real-world applications.

c. Other Activities (Specify):

Conduct a hands-on exploration of large-scale search and recognition techniques, emphasizing the role of human-in-the-loop interactive systems in enhancing 3D scene understanding.

PE006.5: Assess the use of FCM and soft-computing techniques in pattern recognition

Approximate Hours

Item	AppX Hrs
Cl	09
LI	06
SW	02
SL	01
Total	18

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO5.1. Recall recent advances in Pattern Recognition. **SO5.2.** Comprehend and compare classifier performance metrics. **SO5.**3. Apply basic statistical concepts, including covariance and its properties. **SO5.**4. Examine data condensation, feature clustering, and probability density estimation. **SO5.5**. Develop skills in data visualization, aggregation, and the application of FCM and soft-computing techniques using real-life datasets.	LI5.1 Implement classifiers, analyze classification results, and compare metrics such as accuracy, precision, recall, and F1-score. LI5.2 Visualize datasets, calculate covariance matrices, perform feature clustering using techniques like FCM, and interpret results to understand data patterns.	**Unit 5: Advancements in Pattern recognition: (9 Lectures)** 5.1 Recent advancements in Pattern Recognition 5.2 Comparison between performance of classifiers 5.3 Basics of statistics, covariance and their properties 5.4 Data condensation 5.5 feature clustering, Data visualization 5.6 Probability density estimation 5.7 Visualization and Aggregation 5.8 FCM and soft-computing techniques 5.9 Examples of real-life datasets	1. Explore cutting-edge developments in Pattern Recognition through research papers and online resources.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Analyze and compare the performance of various classifiers on a designated dataset, highlighting strengths and weaknesses.

***b.* Mini Project:**

Implement a feature clustering algorithm to enhance pattern recognition in a real-world application, showcasing practical problem-solving skills.

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

Organize a seminar or workshop on the application of FCM (Fuzzy C-Means) and soft-computing techniques in visual recognition, fostering collaborative learning and skill development.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
PE006.1. Understand basic mathematical and statistical techniques commonly used in pattern recognition.	5	2	2	9
PE006.2. Apply a variety of pattern recognition algorithms.	12	2	1	15
PE006.3. Understand and apply various pre-processing algorithms.	7	2	1	10
PE006.4. Apply various algorithms for image classification.	12	2	1	15
PE006.5. Assess the use of FCM and soft-computing techniques in pattern recognition.	9	2	1	12
Total Hours	45	8	6	59

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
PE006.1	Introduction and mathematical Preliminaries	03	04	03	10
PE006.2	Pattern Recognition basics	05	03	02	10
PE006.3	Basics of Feature Selection	05	03	02	10

PE006.4	Basics of Visual Recognition	04	05	01	10
PE006.5	Advancements in Pattern Recognition	03	05	2	10
Total		20	17	13	50

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

The end of semester assessment for Pattern Recognition & Visual Recognition 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 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:

A. Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Pattern Recognition and Machine Learning	Christopher M.Bishop	Springer	2006
2	Pattern Classification:	Richard O. Duda, Peter E. Hart, David G. Stork, Wiley	John Wiley & Sons	2012
3	https://nptel.ac.in/courses/106/106/106106046/			
4	Lecture note provided by Dept. of Computer Science and Engineering, AKS University, Satna.			

Alternative NPTEL/SWAYAM Course (if any):

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S.No.	NPTEL Course Name	Instructor	Host Institute
1.	Pattern Recognition and Application	Prof. P.K Biswas	IIT Kharagpur
2.	Pattern Recognition	Prof. C.A. Murthy	IIT Madras

Curriculum Development Team

1. Dr. Akhilesh K. Waoo, HOD, Department of Computer Science and Engineering.
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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.
8. Ms. Pushpa Kushwaha, Assistant Professor, Department of Computer Science and Engineering.
9. Ms. Arpana Tripathi, Assistant Professor, Department of Computer Science and Engineering.

CO, PO and PSO Mapping

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

Course Code: PE006

Course Title: Pattern Recognition & Visual Recognition

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3	PSO4	PSO5
	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-long learning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies
CO1	3	2	3	2	3	3	1	1	1	1	1	3	2	2	3	2	3
CO2	3	3	2	3	3	2	1	2	1	1	1	3	2	3	2	1	3
CO3	3	3	3	3	3	2	1	2	2	1	1	3	2	3	2	2	3
CO4	3	2	3	2	3	2	1	2	1	1	1	3	2	2	3	2	2
CO5	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	3	2

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 basic mathematical and statistical techniques commonly used in pattern recognition.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	LI1.1, LI1.2	Unit-1.0 **Introduction and mathematical Preliminaries** 1.1,1.2,1.3,1.4,1.5	As Mentioned in Page no. ___to ___
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO2: Understand and apply various pre-processing algorithms.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LI2.1, LI2.2	Unit-2 **Pattern Recognition basics** 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 PSO: 1,2,3,4	CO3: Understand and apply various pre-processing algorithms.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	LI3.1, LI3.2	Unit-3: **Basics of Feature Selection** 3.1,3.2,3.3,3.4,3.5,3.6,3.7	
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO: 1,2,3,4	CO4: Assess the use of FCM and soft-computing techniques in pattern recognition.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LI4.1, LI4.2,	Unit 4: **Basics of Visual Recognition** 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 Assess the use of FCM and soft-computing techniques in pattern recognition.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	LI5.1, LI5.2	Unit 5: **Advancements in Pattern recognition** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,	

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

Semester-VIII

Course Code: **PE007**

Course Title: **IMAGE AND VIDEO PROCESSING**

Pre- requisite: Some mathematical background, such as calculus, complex arithmetic, statistics, linear algebra, basic understanding of signal processing (Fourier transform), some programming experience.

Rationale: The main objective of image processing is to transform an image into digitalform and perform certain operations on it in order to obtain specific modelsor to extract useful information from the image.

Course Outcomes:

PE007.1: Understand the basics of Image representation and analysis
PE007.2: Learn how to use Image Segmentation.
PE007.3: Acquire skills in Object Motion and tracking.
PE007.4: Explore Robotic localization
PE007.5: Learn how to use Image Restoration

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)	
PE	PE007	IMAGE AND VIDEO PROCESSING	3	2	1	1	7	4

Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture(L)and Tutorial (T) and others)
LI: Laboratory Instruction (Includes Practical performance sin laboratory workshop, field or other locations using different instructional strategies)
SW: Seasonal 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

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks (PRA +ESA)
			Class/ Home Assignment 5 number 3 marks each (CA)	Class Test2 (2bestout of3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT+AT)	(ESA)	
PE	PE007	IMAGE AND VIDEO PROCESSING	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PE	PE007	Image and Video Processing	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 show case the Mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) up on the course's conclusion.

PE007.1: Demonstrate knowledge of the fundamental principles of image representation

Approximate Hours

Item	AppXHrs
Cl	09
LI	06
SW	02
SL	01
Total	18

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the concept of image representation **SO1.2**Use the different technology for image representation **SO1.3**Apply changes in image representation	LI1.1 Various form of image representation LI1.2 Apply various image segmentation algorithm. LI1.3 Apply object motion and tracking.	**Unit-1.0** **Image representation and analysis** **(7 Lectures)** 1.1 Introduction to computer Vision 1.2 Numerical representation of images. 1.3 Image augmentation I 1.4 Image augmentation II 1.5 Enhancement, processing. 1.6 Color transforms. 1.7 Geometric transforms I 1.8 Geometric transforms I 1.9 Feature recognition and extraction.	1. Learn advanced technology for Image represent ation.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Demonstrate Image representation
ii. Numerical representation of images
iii. Enhancement, image processing.

PE007.2: Learn how to use Image Segmentation.

Approximate Hours

Item	AppXHrs
Cl	06
LI	06
SW	02
SL	02
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Object detection **SO2.2** Finding contours and edges of various objects in image. **SO2.3** Background subtraction for video	LI2.1 Implement any image segmentation algorithms. LI2.2 improve the performance of image segmentation algorithms. LI2.3 handle images with complex backgrounds.	**Unit-2.0 Image Segmentation: (4 Lectures)** 2.1. Object detection. 2.2. Breaking image into part. 2.3. importance of image segmentation in computer vision. 2.4. techniques that can improve the performance of image segmentation algorithms 2.5. finding contours and edges of various objects in image. 2.6. Background subtraction for video.	1. How Object detection works. 2. Background subtraction for video.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

iv. How Object detection works?
v. Finding contours and edges of various objects in image.
vi. Background subtraction for video.

PE007.3: Acquire skills in Object Motion and tracking.

Approximate Hours

Item	AppXHrs
Cl	08
LI	06
SW	02
SL	01
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Tracking a single point **SO3.2** Methods to track a set of features over time.	LI3.1 Integrate feedback from stakeholders and users into the UI design. LI3.2 approach designing a user interface for different platforms (e.g., web, mobile, desktop) LI3.3 Apply latest trends and innovations in UI design	**Unit-3.0 UI Design** **(5 Lectures)** 3.1. importance of UI design 3.2. importance of visual hierarchy and how it influences user interaction? 3.3. Tracking a single point 3.4. over time analyze videos as sequences of individual image frames I 3.5. over time analyze videos as sequences of individual image frames II 3.6. methods to track a set of features over time 3.7. matching features from image frame to other 3.8. tracking a moving car using optical flow	1. key principles of UI design, and how do they influence the design process?

SW-3 Suggested Sessional Work (SW):

Assignments:

vii. Tracking a single point.

viii. Tracking and moving a car using optical flow.

PE007.4: Explore Robotic localization

Approximate Hours

Item	AppXHrs
Cl	08
LI	06
SW	02
SL	1
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Sensor measurements to safely navigate an environment **SO4.2** Robotic localization **SO4.3** Bayesian statistics to locate a robot in space	LI.4.1 implement a Bayesian filter to estimate the location of a robot. LI4.2 Write a Python function to update the belief of the robot's location based on new sensor measurements using Bayesian inference. LI4.3 Implement a function in Python to simulate sensor measurements from virtual sensors placed in a simulated environment for robot navigation.	**Unit-4.0 Robotic localization (3 Lectures)** 4.1. Bayesian statistics to locate a robot in space 4.2. concept of prior, likelihood, and posterior probabilities in the context of Bayesian statistics for robot localization. 4.3. implement a Bayesian filter to estimate the location of a robot. 4.4. Discuss how Bayesian statistics and sensor measurements are integrated to update the belief state of a robot's location over time. 4.5. sensor measurements to safely navigate an environment 4.6. types of sensor measurements commonly used for robot localization I 4.7. types of sensor measurements commonly used for robot localization II 4.8. Gaussian uncertainty his to gram filter for robot localization in python.	1. How do you represent the belief state of a robot using particles in a particle filter?

SW-4 Suggested Sessional Work (SW):

a. Assignments:

ix. Bayesian statistics to locate a robot in space

PE007.5: Learn how to use Image Restoration

Approximate Hours

Item	AppXHrs
Cl	14
LI	06
SW	02
SL	01
Total	23

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Learn about Restoration filters are designed to mitigate specific types of degradation in images. **SO5.2** Evaluating the performance of image restoration algorithms requires appropriate metrics such as peak signal-to-noise ratio (PSNR).	LI5.1 Implement single-image super-resolution algorithms LI5.2 Implement Deblurring techniques. LI5.3 Implement Weiner filtering or Inverse filters	**Unit-5.0 Image Restoration** (14 Lectures) 5.1. Degradation model I 5.2. Degradation model II 5.3. noise models I 5.4. noise models II 5.5. Noise Removal 5.6. Deblurring 5.7. Super-Resolution 5.8. Estimation of degradation function by modeling. 5.9. Get and Post method 5.10. Restoration using Weiner filters 5.11. Restoration using Inverse filters 5.12. Inverse Problems 5.13. Evaluating the performance of image restoration algorithms requires appropriate metrics 5.14. Application Areas	1. Find Image restoration techniques applications in various fields.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

x. Explain degradation 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)
PE007.1: **U**nderstand the basics of Image representation and analysis.	09	02	01	12

PE007.2: Learn how to use Image Segmentation.	06	02	02	08
PE007.3: Acquire skills in Object Motion and tracking.	08	02	01	11
PE007.4: Explore Robotic localization	08	02	01	06
PE007.5: Learn how to use Image Restoration	14	02	01	17
Total Hours	45	10	06	61

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO1	Image representation and analysis:	03	02	03	08
CO2	Image Segmentation	03	01	05	09
CO3	Object Motion and tracking	03	07	02	12
CO4	Robotic localization	03	05	05	13
CO5	Image Restoration	03	02	03	08
Total		15	17	18	50

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

The end of semester assessment for IMAGE AND VIDEO PROCESSING will be held with written examination of 50 marks

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

Suggested Instructional/Implementation Strategies:

1. Improved Lecture

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

A. Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Audio Video Systems	Bali &Bali	Khanna Book Publishing	2020
2	Handbook of Image and Video Processing	Alan C. Bovik	Academic Press	2000
3	Lecture note provided by Dept. of CSE, AKS University, Satna.			

B. Alternative NPTEL/SWAYAM/MOOC Course (if any):

S.No.	NPTEL Course Name	Instructor	Host Institute
1.	Digital Image Processing	Prof. P.K. Biswas	IIT Kharagpur
2.	Image Signal Processing	Prof. A.N.Rajagopalan	IIT Madras

Curriculum Development Team

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CO,PO and PSO Mapping

Course Title: B. Tech (AI & DS)
Course Code: PE007
Course Title: IMAGE AND VIDEO PROCESSING

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
	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-long learning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies
CO1	3	2	3	2	3	3	1	1	1	1	1	3	2	2	3	2	3
CO2	3	3	2	3	3	2	1	2	1	1	1	3	2	3	2	1	3
CO3	3	3	3	3	3	2	1	2	2	1	1	3	2	3	2	2	3
CO4	3	3	3	2	3	2	1	2	1	1	1	3	2	2	3	2	2
CO5	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	3	2

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: Student will understand the basics of Image representation and analysis	SO1.1 SO1.2 SO1.3	LI1.1 LI1.2 LI1.3	Unit-1.0 Image representation and analysis 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	As Mentioned in Page no. ____to ____
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO2: Student will learn how to use Image Segmentation	SO2.1 SO2.2 SO2.3	LI2.1 LI2.2 LI2.3	Unit-2.0 Image Segmentation 2.1,2.2,2.3,2.4,2.5,2.6	
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO3: Student will acquire skills in Object Motion and tracking.	SO3.1 SO3.2	LI3.1 LI3.2 LI3.3	Unit-3.0 Object Motion and tracking 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: Student will explore Robotic localization	SO4.1 SO4.2 SO4.3	LI4.1 LI4.2 LI4.3	Unit-4: Robotic localization 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	CO 5: Student will learn how to use Image Restoration	SO5.1 SO5.2	LI5.1 LI5.2 LI5.3	Unit5: Image Restoration 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	

A K S University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech. (Computer Science & Engineering) [Artificial Intelligence and Data Science] Program

Semester VIII

Course Code: **PE009**

Course Title: **Autonomous Systems**

Pre-requisite: Student should have basic knowledge of computer network

Rationale: An Autonomous Network can accelerate the enforcement of network policies across an organization's devices and can self-monitor and continuously optimize itself to the demands of the users.

Course Outcomes:

PE009.1: Complete understanding of autonomous systems.
PE009.2 functional architecture in autonomous systems is a robust, scalable, flexible, and efficient system
PE009.3: Create a model of basic autonomous vehicle
PE009.4: Understand, design and implement an autonomous robot.
PE009.5: Understand, design and implement an autonomous drone

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)	
PE	PE009	**Autonomous Systems**	4	0	2	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 performance 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)		
PE	PE009	Autonomous Systems	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

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

PE009: Complete understanding of autonomous systems.

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 To understand autonomous systems SO1.2 Explain AI in autonomous systems SO1. 3To understand Robots SO1.4 Discuss about the difference between Autonomous systems vs robots .		**Unit 1: Introduction (7 lectures)** 1.1 What are autonomous systems? 1.2 AI in autonomous systems 1.3 Robots 1.4 Autonomous systems Vs robots. 1.5 Learning working autonomous systems 1.6 Sensor Fusion 1.7Localization and Mapping (SLAM) 1.8 Safety and Reliability 1.9 Safety and Reliability 1.10 Continuous Learning and Adaptation 1.11 Examples 1.12 Case study	1. Learn about the components of Autonomous systems

SW-1 Suggested Sessional Work (SW):

a. Assignments:
(i) Discuss about Robots

b. Pictorial representation of a simple Robot

PE009.2 : functional architecture in autonomous systems is a robust, scalable, flexible, and efficient system

Approximate Hours

Item	Appx. Hrs.
Cl	12
LI	00

SW	02
SL	01
Total	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 To Understand Major functions in an autonomous system **SO2.2** To learn Motion Modeling **SO2.3** To Explain Coordinate frames and transforms **SO2.4** To Understand point mass model	.	**Unit-2: Functional architecture (12 lectures)** **2.1** Major functions in an autonomous system **2.2** Motion Modeling **2.3** Kinematics **2.4** Dynamics **2.5** Trajectory Planning **2.6** Motion Control **2.7** Uncertainty Estimation **2.8** Coordinate frames **2.9** frames transform **2.10** point mass model **2.11** examples **2.12** case study	1. learn the coordination between frames

SW-2 Suggested Seasonal Work (SW):

a. Assignments:
   (i) Draw a motion model.
   (ii) Presentation

PE009.2: Create a model of basic autonomous vehicle

Approximate Hours

Item	Appx. Hrs.
Cl	12
LI	00
SW	02
SL	01
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3. 1 To understand Vehicle modeling SO3.2 know the Sensor Modeling SO3.3 To understand the inertial sensors SO3.4 To understand GPS		**Unit3:** Modeling in autonomous systems (9 lectures) 3.1 Vehicle modeling 3.2 kinematic and dynamic 3.3 bicycle model 3.4 two-track models 3.5 Sensor Modeling 3.6 encoders 3.7 inertial sensors 3.8 GPS. 3.9 State Estimation and Localization 3.10 Human Behavior Modeling 3.11 Validation and Verification 3.12 Case study	1. Learn about two-track models

SW-2 Suggested Seasonal Work (SW):

a. Assignments:

i. Explain bicycle model

b. Presentation

PE009.3: Understand, design and implement an autonomous robot.

Approximate Hours

Item	Appx. Hrs.
Cl	12
LI	00
SW	02
SL	01
Total	15

Session Out comes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 To Understand Localization and mapping fundamentals of LIDA Rand and visual SLAM **SO4.2** Explain the Navigation of Global path planning and Local path planning **SO4.3** To Understand Control structures **SO4.4** Implementation of Sample controllers	.	**Unit-4: SLAM** **(12 lectures)** 4.1 Localization and mapping fundamentals 4.2 LIDA Rand 4.3 visual SLAM 4.4 Navigation 4.5 Global path planning 4.6 Local path planning 4.7 Vehicle control 4.8 Control structures 4.9 PID control 4.10 Linear quadratic regulator 4.11 Sample controllers. 4.12 case study	1. Draw a Vehicle control structures

SW-4 Suggested Seasonal Work (SW):

a. Assignments:
   i. Discuss about the PID control?
b. Presentation
c. Pictorial representation of Linear quadratic regulator

PE009.4: Understand, design and implement an autonomous drone

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 To **Understand** drones and its applications **SO5.2** To Discuss components and plate forms propulsion **SO5.3** To Explain concepts of flight, regulatory norms and regulations **SO5.4** To **Understand** Machine learning and deep learning for autonomous driving		**Unit5: Drones (12 lectures)** 5.1 Overview 5.2 Definition 5.3 applications 5.4 components 5.5 platforms 5.6 Propulsion 5.7 on-board flight control 5.8 payloads, communications 5.9 concepts of flight, regulatory norms and regulations 5.10 Machine learning and deep learning for autonomous driving 5.11 Learning by example 5.12 Case study.	1. case study on applications of drones

SW-5Suggested Seasonal Work (SW):

a. Assignments:

i. Explain in detail about the components of drones

b. Presentation:

c. Other Activities (Specify): Draw a basic diagram of the parts of drones?

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
PE009.1: Complete understanding of autonomous systems.	12	2	1	**15**
PE009.1: Complete understanding of autonomous systems.	12	2	1	**15**
PE009.2: Create a model of basic autonomous vehicle	12	2	1	**15**
PE009.3: Understand, design and implement an autonomous robot.	12	2	1	**15**
PE009.4: Understand, design and implement an autonomous drone.	12	2	1	**15**
Total Hours	60	10	5	75

Suggestion for End Semester Assessment

Suggested Specification Table (ForESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction	03	02	03	08
CO-1	Functional architecture	03	01	05	09
CO-2	Modeling in autonomous systems	03	07	02	12
CO-3	SLAM	03	05	05	13
CO-4	Drones	03	02	03	08
Total		15	17	18	50

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

The end of semester assessment for autonomous system for AI and DS 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	Reinforcement Learning: An Introduction	Richard S. Sutton, Andrew G. Barto	Bradford Books	2018

2	Intelligent Autonomous Systems	Dilip Kumar Pratihar, Lakhmi C. Jain	Web of Science.	2010

Curriculum Development Team

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COs, POs and PSOs Mapping

Course Title: B. Tech. Computer Science & Engineering [Artificial Intelligence and Data Science]

Course Code: PE009

Course Title: Autonomous Systems

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3	PSO4	PSO5
	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-long learning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies
CO1	3	2	3	2	3	3	1	1	1	1	1	3	2	2	3	2	3
CO2	3	3	2	3	3	2	1	2	1	1	1	3	2	3	2	1	3
CO3	3	3	3	3	3	2	1	2	2	1	1	3	2	3	2	2	3
CO4	3	2	3	2	3	2	1	2	1	1	1	3	2	2	3	2	2
CO5	2	2	3	2	2	2	1	1	1	1	1	3	2	2	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, 3, 4, 5	CO1: Complete understanding of autonomous systems.	SO1.1 SO1.2 SO1.3 SO1.4		Unit-1 Introduction 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11,1.12	As mentioned in page number above
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO2: functional architecture in autonomous systems is a robust, scalable, flexible, and efficient system	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2 Functional architecture 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 PSO 1,2, 3, 4, 5	CO3 Create a model of basic autonomous vehicle	SO3.1 SO3.2 SO3.3 SO3.4		Unit-3 Modeling in autonomous systems 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, 5	CO3: Understand, design and implement an autonomous robot.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 SLAM 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.4: Understand, design and implement an autonomous drone	SO5.1 SO5.2 SO5.3 SO5.4		Unit-5 Drones 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11, 5.12	

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

(Revised as on 01 August 2023)

SEMESTER VIII

Course Code: **PE017**

Course Title: **Predictive Analytics**

Pre- requisite: Student should have knowledge of excel in predictive analytics, you should focus on acquiring the following skills: Statistics and Mathematics: A thorough understanding of statistical concepts, probability theory, and linear algebra is essential for predictive analytics.

Rationale: Predictive analytics is important because it helps organizations make critical decisions based on accurate predictions.

Course Outcome:

PE017.1. Understand the basics of Data Product.
PE017.2. Understand Processing Structured Data in Python
PE017.3. Understand Numpy, Introduction to Data Visualization.
PE017.4. Design and implement Training and Testing.
PE017.5. Design Classification Diagnostics.

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)	
PE	PE017	Predictive Analytics	3	2	1	1	7	4

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

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

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

SL: Self Learning,

C: Credits.

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

Scheme of Assessment:

Theory

Board of Study	Course Code	CourseTitle	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/ Home Assignment5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activityany one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+ AT)		
PE	PE017	Predictive Analytics	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 (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Viva1 (5)	Viva2 (5) (SA)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PE	PE017	Predictive Analysis	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.

PE017.1. Understand the basics of Data Product

Approximate Hours

Item	AppXHrs
Cl	10
LI	06
SW	02
SL	01
Total	19

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand about Data Product **SO1.2** Understand about Data Product Examples in Enterprise **SO1.3** Understand about Developing a Data Product Strategy	LI1.1 Write a Python script to collect data from a public API and preprocess it for further analysis. LI1.2 Create Python functions to engineer features from raw data, such as extracting time-based features from timestamp data or creating categorical variables from text fields. LI1.3 Build a web-based dashboard using Dash or Flask to interactively visualize data	**Unit 1.0 Introduction (10 Lectures)** 1.1 Data Product. 1.2 Data as a Core Component 1.3 purpose of a data product is to deliver value to users or organizations 1.4 various forms of data product 1.5 Data Product Examples in Enterprise. 1.6 Automation and Integration 1.7 Iterative Development and Improvement 1.8 Data Governance and Compliance 1.9 Business Impact 1.10 Developing a Data Product Strategy	1. Learn about Developing a Data Product Strategy.

	insights and model predictions.		

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Discuss about Data Product Examples.

ii. Explain Data Product Strategy.

b. Other Activities (Specify):

Explain Data Product Examples in Enterprise.

PE017.2 Understand Processing Structured Data in Python

Approximate Hours

Item	AppXHrs
Cl	08
LI	06
SW	02
SL	01
Total	17

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Understand CSV and JSON file. **SO2.2** Able to understand Reading CSV & JSON Files **SO2.3** Able to understand Processing Structured Data in Python **SO2.4** Understand about Live-Coding **SO2.5** Understand Extracting Simple Statistics from Datasets	LI 2.1 Create a Python script for Reading CSV & JSON Files. LI2.2 Read a CSV file in Python using the csv module. LI2.3 Read an Excel file in Python using the pandas library.	**Unit 2.0 Reading Data in Python** **(8 Lectures)** 2.1 Reading CSV & JSON Files 2.2 Processing Structured Data in Python 2.3 Live-Coding: JSON 2.4 Extracting Simple Statistics from Datasets 2.5 Data Filtering and Cleaning 2.6 Processing Text and Strings in Python 2.7 Processing Times and Dates in Python 2.8 Processing Times	1. Learn about Processing Structured Data in Python

		and Dates in Python	

a. Assignments:

i. Explain Reading CSV & JSON Files.

ii. Write script for Processing Text and Strings in Python

b. Mini Project:

Suppose we want to design a database related to your university to help the different departments in the faculty to follow the transactions and processes of textbooks distributed to the students. Complete an information level design for a database that must satisfy the following constraints and requirements:

- Each student can be enrolled in many courses.
- A given course is proposed by one department, but one department can propose many courses.
- Any course is given by one lecturer.
- Each lecturer belongs to one department.
- At the beginning of the semester, each department sends to the "book unit" a document containing the list of requested books.
- Any student receives one book for each course in which he is enrolled.

Based on the previous requirements, do the following:

Define the Live-Coding: JSON.

Write Python script for Reading CSV & JSON Files.

B. Other Activities (Specify):

Write Python Script for Data Filtering and Cleaning.

Write Python Script for Processing Times and Dates in Python

PE017.3. Understand Numpy, Introduction to Data Visualization.

Approximate Hours

Item	AppX Hrs
Cl	08
LI	06
SW	02
SL	01
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Understanding the concepts empowers developers to effectively leverage Python libraries and toolkits.	LI 3.1 Write Python script implementing matrix processing LI3.2 Write Python code to load a CSV file into a pandas Data Frame and perform basic data manipulations such as filtering rows, selecting columns, and calculating summary statistics. LI3.3 Create a line plot using	**Unit 3.0 Python Libraries and Toolkits (8 Lectures)** 1.1 Python Standard Library 1.2 Third-Party Libraries 1.3 Matrix Processing and Numpy 1.4 Introduction to Data Visualization 1.5 Introduction to Matplotlib 1.6 urllib 1.7 Libraries like scikit-learn, TensorFlow, and PyTorch 1.8 Beautiful Soup	1. Write Python script for generating plots using Matplotlib
	matplotlib to visualize the trend of a time-series dataset.		

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Explain Matrix Processing.

ii. Explain Matplotlib, urllib and Beautiful Soup libraries.

PE017.4 Design and implement Training and Testing.

Item	AppX Hrs
Cl	09
LI	06
SW	02
SL	01
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand about Classification in Python **SO4.2** Understand Training and Testing **SO4.3** Understand about Gradient Descent in Python **SO4.4** Apply Gradient Descent in TensorFlow	L4.1. Write Python script to Train and testing. LI4.2 Write Python code to implement batch gradient descent for a simple linear regression problem. LI4.3 Use a toy dataset with two features and one target variable.	**Unit 4.0 Gradient Descent (9 Lectures)** 4.1 Classification in Python 4.2 Introduction to Training and Testing 4.3 Gradient Descent Algorithm 4.4 Batch Gradient Descent 4.5 Gradient Descent in Python 4.6 Examples of Gradient descent I 4.7 Examples of Gradient descent II 4.8 Gradient Descent in TensorFlow 4.9 Optimization Techniques	1. Study about Training and Testing 2. Explain About Gradient Descent in Python

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Explain about classification in Python.

b. Other Activities (Specify):

Explain about the Gradient Descent in TensorFlow

PE017.5: Design Classification Diagnostics.

. Approximate Hours

Item	AppX Hrs
Cl	10
LI	06
SW	02
SL	01
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand about Meaningful Predictive modelling, Regression Diagnostic **SO5.2** Understand about Over- and Under-Fitting, Classification Diagnostics **SO5.3** Learn about Accuracy and Error, Classification Diagnostics and Precision and Recall **SO5.4** Understand about Codebase for Evaluation and Validation **SO5.**4 Understand about Model Complexity and Regularization **SO5.5** Evaluating Classifiers for Ranking	LI5.1 Write Python script to implement Regression Diagnostic, Over- and Under-Fitting. **LI5.2** Write a Python function to identify missing values in a pandas DataFrame. LI5.3 Implement strategies for handling missing values such as imputation, deletion, or flagging.	**Unit -5.0 Diagnostics for Data (10 Lectures)** 5.1 Meaningful Predictive modelling 5.2 Regression Diagnostic. 5.3 Over- and Under-Fitting, 5.4 Classification Diagnostics 5.5 Accuracy and Error, Classification 5.6 Diagnostics: Precision and Recall. 5.7 Codebase for Evaluation and Validation. 5.8 Model Complexity 5.9 Regularization. 5.10 Evaluating Classifiers for Ranking.	1. Implement descriptive statistics (mean, median, mode, variance, skewness, kurtosis) to analyze the distribution of numerical data.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. What is Accuracy and Error?

ii. Explain about Model Complexity and Regularization.

b. Mini Project:

i. Evaluating Classifiers for Ranking.

c. Other Activities (Specify):

The Impact of Regression Diagnostic.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
PE017.1. Introduction	10	2	1	13
PE017.2. Reading Data in Python	8	2	1	11

PE017.3. Python Libraries and Toolkits	8	2	1	11
PE017.4. Gradient Descent	9	2	1	12
PE017.5. Diagnostics for Data	10	2	1	13
Total Hours	45	10	5	60

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
PE017.1	Introduction	03	04	03	10
PE017.2	Reading Data in Python	05	03	02	10
PE017.3	Python Libraries and Toolkits	05	03	02	10
PE017.4	Gradient Descent	04	05	01	10
PE017.5	Diagnostics for Data	03	05	2	10
Total		20	17	13	50

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

The end of semester assessment for **Predictive Analytics** 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 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:

A. Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst	Dean Abbott	Wiley	2014
2	Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking	Jeeva Jose	O′Reilly	2013

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CO-PO Mapping

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

Course Code: PE017

Course Title: Predictive Analytics

Course Outcomes	Program Outcomes												Program Specific Outcomes				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3	PSO4	PSO5
	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-long learning	Use fundamental knowledge of math, science, and engineering g g to comprehend d, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplin eary settings	Applying professiona ll engineering solutions for societal improve me nt while taking into account the environmen ttal context, being conscious of professiona ll ethics, andbeing able to effectively communica tetee.	Learn and use the most recent Artificial Intelligenc ee and Data Science technolog yes in the fields of engineerin gg and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technolog yes
CO	3	2	3	2	3	3	1	1	1	1	1	3	2	2	3	2	3
CO2	3	3	2	3	3	2	1	2	1	1	1	3	2	3	2	1	3
CO3	3	3	3	3	3	2	1	2	2	1	1	3	2	3	2	2	3
CO4	3	2	3	2	3	2	1	2	1	1	1	3	2	2	3	2	2
CO5	2	2	3	2	2	2	1	1	1	1	1	3	2	2	3	3	2

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 the basics of Data Product.	SO1.1 SO1.2 SO1.3	LI1.1, LI1.2, LI1.3	Unit-1.0 **Introduction** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	As Mentioned in Page no. __ to __
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO2: Understand Processing Structured Data in Python	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LI2.1, LI2.2, LI2.3	Unit-2 **Reading Data in Python** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8	
PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO: 1,2,3,4	CO3: Understand Numpy, Introduction to Data Visualization.	SO3.1	LI3.1, LI3.2, LI3.3	Unit-3: **Python Libraries and Toolkits** 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: Design and implement Training and Testing.	SO4.1 SO4.2 SO4.3 SO4.4	LI4.1, LI4.2, LI4.3	Unit 4: **Gradient Descent** 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 Design Classification Diagnostics.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	LI5.1, LI5.2, LI5.3	Unit 5: **Diagnostics for Data** 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10	

AKS University

Faculty of Engineering and Technology

Department of Computer Science & Engineering

Curriculum of B.Tech Computer Science & Engineering [Artificial Intelligence] Program

(Revisedason01August2023)

SEMESTER-VIII

Course Code: EEC801

Course Title: Capstone Project-II

Pre- requisite: Student should have knowledge of programming languages, Software Engineering, and Many more tools and framework.

Rationale:

- To apply the knowledge and skills learnt in previous semesters, to solve real life industrial / engineering / professional problems.
- To modify/ improve the existing engineering / professional systems.
- To develop systems / components / methods / processes / resources to cater the needs of the nearby small scale / medium industry.
- To learn to solve real life engineering / professional problems which often have many aspects to be considered and addressed.

Course Outcomes:

The details of COs and LOs are as follows: -

EEC801.1: - The student will be able to prepare a detailed project plan for solving any real-life related engineering / technical / professional / industrial problem.
EEC801.2: - The student will be able to implement the project plan and manage the project.
EEC801.3: - The student will be able to present the complete project work.

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)	
EEC	EEC801	Capstone Project-II	0	12	0	0	12	6

INTRODUCTION TO PROJECT WORK/INTERNSHIP

Project work is a very important course in all branches of diploma programmes. It offers following opportunities to students of final semester: -

3. To learn skills and abilities which are otherwise not possible either in classroom or in structured environment of laboratory such as: -
   - Skill to work in groups or teams,
   - Skill to face real life professional problems and to create reallife solutions for them.
   - Skill to take professional decisions under real life constraints and circumstances,
   - Skill to learn in self-directed way to pursue the specific

professional projects (Self Directed Learning)

- Skill to learn from real life self- experiences (l i f e l o n g learning)
- Skill to manage the real- l i f e engineering / professional projects
- Skill to plan and organize the self / group professional work
- skills to apply the engineering management principles in real lifeprofessional projects
- Skill to defend / justify self- real- l i f e engineering / professionalwork in front of significant others
- Skill to complete the professional tasks / work keeping in viewsocietal, legal and environmental considerations
- Skill to collect relevant data in real life situations
- Skill to relate engineering / professional knowledge gained in various semesters with real life engineering / professional problems
- Skill to estimate the duration and costs in real life engineering / professional work
- Skill to assess the theoretical feasibility, financial feasibility and time feasibility of real- l i f e engineering / professional tasks.

With an objective to ensure the learning of above skills and abilities as well as to earn maximum marks in NBA assessment,

The Course on Project Work consists of five phases: -

	Description of phases	Learn Hrs.
1	Literature / industry's need survey and finalization of topic / title	15Hrs
2	Detailed planning of the project work	60Hrs
3	Implementing the detailed project plan	
4	Managing the project activities	
5	Reporting of the project work output /outcome / prototype	15Hrs
	Total	90 Hrs

General Guidelines for Internship/Project Work

- The project topics should be related to concerned branch of engineering / profession, but, should not be the exact content of the curriculum taughtin the discipline.
- Student's project topics should be preferably 'real life' topics. It means the project topics should have substantial element of uncertainty, complexity and multi-disciplinary-ness which can be coped up by the students. These elements offer opportunities to students to apply engineering/ professional knowledge in real life settings, solve real life problems and to take real life decisions. As a project guide, concerned teacher should ensure these by suitably altering / framing / reframing the statement of topic / title.
- The project topics should be such that students can get opportunity to refer IS codes, Manuals, Handbooks, norms and standards, opportunity to conduct standard tests, and opportunity to operate modern laboratory equipment's following SOPs.
- For student's interest, active participation and ownership in the project work, their self-motivation is necessary. Therefore, students should be actively involved in finalizing the topic of project.
- Students should be asked to conduct a brief review of literature for problems and issues in their engineering / professional areas of interest,where they think they can contribute effectively. The project guide should facilitate them in this regard, through his/her expertise and experience.

Every student group should be asked to propose at least three topics oftheir interest.

- The topics proposed by student project groups should be assessed by the facilitator-teacher on following three criteria: -
  - **The work on the topic should be theoretically and practically feasible.**
  - **The project work on the topic should be completed within approx. Three and half months.**
  - **Availability of required resources should be certain. Cost of project work should also be bearable.**
- Normally, students' project works should be carried out in small groups (1 to 2 students).
- All faculty members of department should be engaged as project guides. Every faculty member should be project guide of at least one student project group.
- Normally, project guides should be assigned to the students through lottery system and students under each faculty should be asked to formtheir small groups.

COs, POs and PSOs Mapping

Course Title: B. Tech. Computer Science & Engineering *(AI-DS)*
Course Code: EEC801
Course Title: Capstone Project-II

Course Outcomes	Program Outcomes												Program Specific Outcome				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct studies of difficult problems	Utilization of modern tools	Engineers and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-longlearning	Use fundamental knowledge of math, science, and engineering to comprehend, evaluate, and create computer Programmes in the fields of algorithms, multimedia, big data analytics, machine learning, artificial intelligence, and networking for the effective design of computer-based systems of various complexity	Utilize relevant methods and cutting-edge hardware and software engineering tools to develop and integrate computer systems and related technologies. This PSO2 also encourages lifelong learning for the advancement of technology and its use in multidisciplinary settings	Applying professional engineering solutions for societal improvement while taking into account the environmental context, being conscious of professional ethics, and being able to effectively communicate.	Learn and use the most recent Artificial Intelligence and Data Science technologies in the fields of engineering and computer science	Recognize and examine issues in real life, then offer creative software solutions with the help of AI and Data Science Technologies.
CO 1: The student will be able to prepare a detailed project plan for solving any real-life related engineering / technical / professional / industrial problem.	2	3	3	2	3	2	3	1	3	1	3	3	2	3	3	1	2
CO 2: The student will be able to implement the project plan and manage the project.	2	3	3	2	3	2	3	1	3	1	3	3	2	2	2	2	3
CO 3: The student will be able to present the completed project work.	2	2	3	1	3	2	2	1	3	1	3	3	2	3	2	2	2

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: The student will be able to prepare a detailed project plan for solving any real-life related engineering / technical / professional / industrial problem.				As mentioned in page number above
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2: The student will be able to implement the project plan and manage the project.				
PO 1,2,3,4,5,6,7, 8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 3: The student will be able to present the completed project work.				