TKM COLLEGE OF ENGINEERING

(Government Aided and Autonomous)

celebrating 60 years of excellence

COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE)

B. Tech Curriculum 2024
&
First & Second Semester Syllabus

THANGAL KUNJU MUSALIAR COLLEGE OF ENGINEERING
(Government Aided and Autonomous)
KOLLAM-691005, KERALA

Abstract

TKMCE- Academics- B.Tech Artificial Intelligence Curriculum & Syllabus 2024 - orders issued

No: ACU3/644/2024 Date: 04/09 /2024

Order

Read:

1. Minutes of the V Academic Council Meeting held on 31/07/2024

As decided in the fifth Academic council meeting held on 31st July 2024, the Curriculum & Syllabus of B.Tech Computer Science and Engineering (Artificial Intelligence) is circulated to the Academic Council through email and got approved.

Orders are issued accordingly

PRINCIPAL IN-CHARGE
THANGAL KUNJU MUSALIAR
COLLEGE OF ENGINEERING
KOLLAM - 691 005

Copy to: All HODs, Deans, IQAC, COE, AA, AO, SS, JS(A)

Preface to the Curriculum

The new undergraduate curriculum of TKM College of Engineering is designed to provide students with the skills and knowledge they need to become competent engineers capable of tackling real-world problems in a variety of fields. The curriculum is carefully designed to expose students to both theoretical and practical aspects of engineering and provide them with hands-on experience in the latest technologies and tools used in the industry. The courses given in the curriculum are tailored in a student centric fashion to ensure that they receive well-rounded education with the flexibility to customize their own learning experience according to their interests and career goals.

The allocation of 170 credits, of which 167 are from courses and 3 from activity points, over a period of four years, with each year comprising of two semesters. All courses in the curriculum are designed to highlight the significance of applying knowledge to engineering and technology challenges, fostering creativity, innovation, and developing entrepreneurial capabilities.

The curriculum includes project-based courses that emphasize hands-on learning and real-world applications supported by the fundamentals of engineering. These courses are offered with lab components, which allow students to gain practical experience in applying the concepts that they have learned. Additionally, there are basic science courses with lab components, core courses without practical components and lab courses to provide breadth wise knowledge in the area of recent technological trends. These variety of courses ensure that students receive a well-rounded education. They also get the flexibility to customize their own learning experience according to their interests and career goals. In addition to the core courses, students have the opportunity to choose from a wide range of elective courses in specialized areas.

The industry internship included in the curriculum will give students the opportunity to apply their theoretical knowledge to practical situations and expand their industrial knowledge. The students can opt for MOOC courses corresponding to Professional Elective and Open Elective Courses during their 7th and 8th semesters, which will give them opportunity for doing internships.

Moreover, the extracurricular activities that students can participate in to earn activity points will provide them with a well-versed education and help them develop important skills such as leadership, teamwork, and communication. This is a great initiative to ensure that students not only excel academically but also develop important life skills that will help them in their future endavours.

GENERAL COURSE STRUCTURE

1. **Credit and Courses**:

Classification	Credit assigned
1 Hour Lecture [L] per week	1 Credit
1 Hour Tutorial [T]per week	1 Credit
1 Hour Project [J] per week	1 Credit
2 Hours Practice/Practical [P] per week	1 Credit

Credits are a unit of measurement for course work and are based on the number of hours of instruction required per week. One hour of classroom lecture (L) that is 60 minutes long per week, is considered as one Instructional Unit or one Credit. The same goes for a tutorial (T) or a project (J) that is 60 minutes long per week.
In addition, a minimum of 2 hours per week of laboratory session, practical or field work, training (P) or a combination of these, carried out during all weeks of the semester, is also considered one Instructional Unit or one Credit.

Credit pattern

The B.Tech. program curriculum has a total of 167 academic credits and 3 additional pass/fail credits that can be gained through 100 activity points. The program will accommodate courses from other disciplines also, so that students have multi-disciplinary exposure. Additionally, the program provides sufficient opportunities for students to enhance their communication, soft skills and managerial skills, along with technical skills. Depending on the program, the courses fall under engineering, basic science, humanities science, and management categories. The structure

of the UG program essentially have the following categories of courses with the breakup of credits as given below:

Sl No:	Category	Code		Credit Breakup
1	Humanities and Social Sciences including Management courses	HSMC		16
2	Basic Science courses	BSC		22
3	Engineering Science courses including workshop, drawing, basics of electrical/ mechanical/computer etc.	ESC		27
4	Professional Core Courses	PCC		59
5	Professional Elective courses relevant to chosen specialization/ branch	PEC [MS]	[IEC]	12
6	Open Electives – Electives from other technical and /or emerging areas	OEC		9
7	Major Project, seminar and internship in industry or elsewhere	PROJ		17
8	Mandatory Courses	MC		5
9	Mandatory Student Activities	SA		3
	Total Credit			**170**
	Optional Specialization			
10	Honors	HR		20
11	Minor	MR		20
	Total credits with optional specialization			**190**

10 to 15 % deviation in credits is permitted under each discipline. While developing the curriculum, the department offering the program should ensure that the above distribution shall be attained by the students upon their completion of their program. Either Minor or Honors can be opted from the optional specialization.

The courses are organized into 1/2/3/4/5/6/14 credit courses based on the content delivery mechanism and desired depth of the course. The delivery methods include Theory-only, Theory with tutorial, Theory with practice, Theory with project etc. The L-T-P-J notation for each course signifies the allocation of hours for content delivery in terms of Lecture (L), Tutorial (T), Practical (P), and Project (J) per week, as well as the credit earned from the course. Apart from lecture, tutorial, practical/practice and the project hours, the curriculum offers Self learning hours(S) that indicates the number of hours students are expected to spent for activities outside the class defined by the faculty handling courses, and for the activities that support learning, initiated by the students themselves without the guidance from the faculty concerned. For each course, Self-learning hours per week is calculated as:

$$S= (L*1+T*0+P*1+[J/2])$$

where J belongs to the project component of a project-based course. Thus, the L-T-P-J-S-C for each course indicates the number of hours scheduled as Lecture (L), Tutorial (T), Practical (P), Project (J), Self-study hours (S) and the total instructional delivery indicated as Credits (C).

$$C = L+ T + [P/2] + J$$

For mandatory courses, irrespective of number of hours allotted in L-T-P-J the credit assigned will be 1.

Sl No.	Lecture-Tutorial-Practical/ Project [L-T-P-J]	Self-learning hours[S]	Credit [C]	Description
1	1-0-0-0	1	1	Theory course without End

2	2-0-0-0	2	2	Semester Examination [ESE]
3	2-0-2-0	4	3	Theory course integrated with practical
4	2-2-0-0	2	4	Theory course with tutorial
5	2-1-0-0	2	3	
6	3-1-0-0	3	4	
7	3-0-0-0	3	3	Theory course
8	3-1-2-0	5	5	Theory course integrated with practical and tutorial
9	2-1-2-0	4	4	
10	1-0-2-0	3	2	Theory course integrated with practical without ESE
11	3-0-2-0	5	4	Theory course integrated with practical
12	2-0-2-2	5	5	Project based course
13	0-0-2-0	2	1	Practical course without ESE
14	0-0-4-0	4	2	Practical course without ESE
15	0-0-6-0	6	3	Seminar
16	0-0-14-0	12	7	Major Project
Mandatory Courses with 1 credit				
17	2-0-0-0	2	1*	Theory Courses
	3-0-0-0	3		
18	2-0-2-0	4	1*	Theory course integrated with lab
19	0-0-0-2	1	1*	Socially Relevant Project
Minor/ Honors Course				
20	4-0-0-0	4	4	Theory course
21	0-0-0-4	2	4	Project only course

*Credit for Mandatory Courses

Course Category:

In general, the curriculum of each program consists of courses that are categorised into different heads such as Program Core (PCC), Professional Elective (PEC), Project-based courses (PBC), and Open Elective courses (OEC). The details of such courses are given below.

Program Core (PCC) or Professional Core

Program or Professional Core (PCC) courses are program-specific and are typically designed to provide students with a strong foundation in the core concepts and skills of their chosen field of study. By completing the PCC courses, students will have a solid understanding of the fundamental principles and practices in their field, which will prepare them for more advanced coursework and professional work in the future.

Project Based Course (PBC):

Project-based courses (PBC) are designed to provide students with a deeper knowledge and understanding of real-world challenges and problems in their field of study. Through PBC courses, students have the opportunity to actively explore and apply theoretical knowledge to real-world problems. This can help them develop problem-solving skills and gain practical experience that will be valuable in their future careers. Doing multiple projects can also help students develop a range of skills that include project management, teamwork, communication and presentation skills.

Professional Elective (PEC):

Professional Elective (PEC) courses are designed to provide students with an opportunity to study more advanced, applied, or specialized courses than the basic courses they study as part of their program or professional core courses. PEC courses can help students gain in-depth knowledge of a specific sub-field. These courses are typically more focused and specialized than program core courses, and can help students develop expertise in a particular area in their discipline.

PEC courses provide students with the flexibility to tailor their education to their interests and career goals.

Micro specialization:

Electives can be streamlined to certain sub-disciplines of the B.Tech program, which are sometimes referred to as micro-specializations. This allows students to graduate with different micro-specializations by selecting a set of professional elective courses that are aligned with industry requirements or higher studies. A micro-specialization can be acquired by opting any two theory courses from the list of professional electives which is in line with a Program Core Course.

Open Elective courses (OEC):

Open Electives are courses that students need to study in other discipline alongside their primary area of study. These courses are designed to give students greater flexibility over their curriculum, allowing them to pursue their interests and passions. Open Electives promote cross-disciplinary and multidisciplinary learning. Students have the freedom to choose suitable courses from different streams. This can be a great way to broaden the knowledge and skills and to explore new areas of interest.

Seminar

Seminars are given to provide opportunity for students to make technical presentation on their research or ideas on a specific topic, to a peer audience. Seminars can be used to enhance students' communication skills, critical thinking skills, and ability to synthesize information from technical publications. It can be also used to encourage students to read and collect recent and reliable information from technical publications including peer-reviewed journals, conference papers, books, project reports, and other sources. The purpose of seminars is to create a learning environment where students can engage in active discussions and develop their presentation skills. Participating in seminars, students can gain valuable experience and develop the skills they need to succeed in their future careers.

Major Project:

Every student need to complete major project that spans through 7th and 8th semester. The project in the seventh semester shall be continued as the project in the eighth semester.

Minor and Honors courses: The Minor in Engineering program allows students to obtain degree in another domain. They also get interdisciplinary experience and exposure to concepts and perspectives.

- The student should earn additional 20 credits to be eligible for the award of B. Tech Degree with Minor.
- Out of the 20 credits, 12 credits should be earned by undergoing a minimum of three courses, of which one course shall be a mini project based on the chosen area.
- The remaining 8 credits could also be acquired through 2 MOOCs.

This program gives a great opportunity for students to broaden their understanding of the

engineering profession.

Honors

Honors is intended for a student to gain advanced knowledge in an area with their B. Tech discipline in emerging/advanced areas in the branch of engineering concerned. Upon completion of Honors, a student will be better equipped to perform research in their branch of engineering.

- The student should earn additional 20 credits to be eligible for the award of B. Tech Degree with Honors.
- Out of the 20 credits, 12 credits should be earned by undergoing a minimum of three courses, of which one course should be a mini project based on the chosen specific area.
- The remaining 8 credits could be acquired through 2 MOOCs

Activity points:

To qualify for a B. Tech degree, all students are required to earn 100 activity points from various activity segments listed by the institution. These activity points are awarded on a pass/fail basis and are mandatory for obtaining the degree. While these activity points carry three credits, no grade is given for these credits, and they are not included in the calculation of the CGPA. The purpose of these activity points is to encourage students to participate in various extracurricular activities, such as sports, cultural events, and community service. For lateral entry students who join from the third semester, the activity point requirement is reduced to 75. The points earned by the student will be indicated in the consolidated academic statement, which is a record of the student's academic performance during their program.

The activity points can be earned by undertaking activities from different categories. Some of the categories are:

(i) Internship
(ii) MOOC/GRE/ TOEFL /GATE/ IELTS/MAT/SAT/CAT etc/ Foreign language proficiency
(iii) Participation and organization of Co-curricular activities, Extracurricular activities.

Detailed list of activities and the related points are published along with the curriculum.

Socially Relevant Projects

The main purpose of Socially Relevant Projects is to connect the students with the society for mutual benefit. The community will benefit from the focused contribution of students towards local development. At the same time, the institution finds an opportunity to develop social sensibility and responsibility among students.

The objectives of Socially Relevant Projects are:

- ✓ To provide students with an opportunity to engage in meaningful community service and apply their learning to real-world situations.
- ✓ To promote civic responsibility and leadership skills among students, and to foster a deeper understanding of social issues.
- ✓ To facilitate the development of partnerships between colleges and local communities, and to contribute to local development.
- ✓ To encourage students to think critically and creatively about social issues, and to develop innovative solutions to address them.
- ✓ To promote interdisciplinary learning and collaboration, and to provide opportunities for students to apply their knowledge and skills across different fields.

Activities for Socially Relevant Project

- ❖ Conducting surveys and research on social issues and concerns to gain a better understanding of the problem and identify potential solutions.
- ❖ Developing and implementing educational programs to promote awareness and understanding of social issues and concerns.
- ❖ Collaborating with local NGOs and community groups to organize events and activities that promote social welfare and community development.

- ❖ Developing and implementing social welfare programs that address the needs of marginalized and vulnerable communities, such as homeless individuals, refugees, and low-income families.
- ❖ Conducting community service activities, such as volunteering at local shelters, food banks, and community centers.
- ❖ Developing and implementing environmental conservation programs that promote sustainable practices and reduce the impact of human activities on the environment.
- ❖ Creating and distributing educational materials, such as pamphlets and brochures, to raise awareness about social issues and concerns.
- ❖ Organizing fundraising events to support social welfare programs and community development initiatives.
- ❖ Engaging in advocacy and lobbying efforts to influence public policy and promote social justice.

Procedure for doing Socially Relevant Project

- ❖ Assign a group of students or a single student to a particular habitation, village, or municipal ward in the near vicinity of their place of stay.
- ❖ Conduct a survey of the habitation to gain a better understanding of the social issues and concerns that need to be addressed. A common survey format could be designed to ensure consistency.
- ❖ Develop a project work related to the student's domain or subject area that addresses the identified social issues and concerns. The project should be designed to be socially relevant and have a positive impact on the community.
- ❖ Implement the project work with the help of the local community and relevant authorities. This could include organizing awareness programs, developing and implementing educational programs, conducting community service activities, and engaging in advocacy and lobbying efforts.
- ❖ Monitor and evaluate the project work to ensure that it is having the desired impact on the community. This could include conducting surveys and research, gathering feedback from the local community, and tracking key performance indicators.
- ❖ Document the project work and its impact on the community, and share the findings with relevant stakeholders, including the local community, government authorities, and academic institutions

Internships

Internships offer students an excellent opportunity to gain industry exposure and prepare for their future work environment. All B.Tech students shall complete a minimum of six to eight weeks of internship in any reputed industry, research organization, or another esteemed institute of higher learning. This requirement can be fulfilled any time after their first year of study and before the seventh semester. The training can be undertaken in a single stretch or in segments, with each segment lasting at least two weeks. Students should select the organization for their internship in consultation with their senior faculty advisor. Additionally, the curriculum provides the option to undertake full-semester internship in the 7th or 8th semester.

Structure of Course code:

Each course will be identified by a unique Course Code consisting of eight alpha numeric characters (Two digits, three alphabets which together followed by three digits) and is represented as **YYXXCSNN**, which can be interpreted as: YY – Regulation Year XX - Stream Code C- Course Delivery Mode, S – Semester Number (it can have a number from 1 to 8) NN- Course Sequence Number

For eg: 24CET303- is a theory course offered by the civil engineering department in the third semester of the 2024 scheme.

24MEL408 - is a laboratory course offered by the mechanical engineering department in the fourth semester of the 2024 scheme.
24CSP607 - - is a laboratory course offered by the computer science department in the sixth semester of 2024 scheme.

Year of Regulation YY	Course category XX	Course delivery mode C	Semester Number S	Serial No. of course NN
24 for 2024 regulation	BY -BIOLOGY CE - CIVIL ENGINEERING CH - CHEMICAL ENGINEERING CS - COMPUTER SCIENCE & ENGINEERING CY – CHEMISTRY EC- ELECTRONICS & COMMUNICATION ENGINEERING EE – ELECTRICAL & ELECTRONICS ENGINEERING ER – ELECTRICAL& COMPUTER ENGINEERING AI - COMPUTER SCIENCE & ENGINEERING [AI] ES - ENGINEERING SCIENCE COURSE HU - HUMANITY, SOCIAL SCIENCE AND MANAGEMENT MA - MATHEMATICS MC- MANDATORY COURSE ME - MECHANICAL ENGINEERING PY – PHYSICS	T - THEORY ALONE P - THEORY INTEGRATED WITH PRACTICAL COURSE L-LABORATORY COURSE J - THEORY INTEGRATED WITH PROJECT (PROJECT BASED COURSE) E – PROFESSIONAL ELECTIVE COURSE O - OPEN ELECTIVE COURSE H - HONORS COURSE M - MINOR COURSE S - SEMINAR R - RESEARCH BASED MINI PROJECT D - PROJECT N - INTERNSHIP	1 2 3 etc.	01 02 03 etc.

Assessment

In each semester, students shall be evaluated both by Continuous Internal Assessment (CIA) and End Semester Examinations (ESE) or by Continuous Internal Assessment alone based on the credit assigned to the course. The Continuous Internal assessment shall be on the basis of the day-to-day work, periodic tests, assignments, quizzes, presentations and other suitable tools devised by the faculty. The faculty member(s) concerned should carry out the CIA for the courses allotted to them in the following perspectives with respect to all courses:

- Evaluation with respect to knowledge
- Evaluation with respect to Understanding
- Evaluation with respect to skill
- Evaluation with respect to Applications and/or
- Higher Order Thinking Skills

For the Practice part of a course or a pure Practice (Laboratory/Practical) course; due weightage shall be given for carrying out experiments, observations, collection of data, analysis, interpretation of results, inference etc. Timely submission of record work shall also carry due weightage based on the type of laboratories and the course. The CIA marks for individual courses shall be computed by giving weightage to the parameters given in the table below.

Mark Distribution of CIA										
Course Structure [L-T-P-J]	Attendance	Theory [L- T]				Practical [P]		Project [J]		Total Marks
		Assignment	Test-1	Test-2	#Class work	Lab Exam	Evaluation 1	Evalaution 2	Report	
1-0-0-0	5	25	20	-	-	-	-	-	-	**50**
2-0-0-0	5	35	30	30	-	-	-	-	-	**100**
1-0-2-0	5	10	20	-	25	40	-	-	-	**100**
0-0-2-0	5	-	-	-	35	10	-	-	-	**50**
0-0-4-0	5	-	-	-	25	30	-	-	-	**60**
2-1-0-0	5	15	10	10	-	-	-	-	-	**40**
3-0-0-0	5	15	10	10	-	-	-	-	-	**40**
3-1-0-0	5	15	10	10	-	-	-	-	-	**40**
4-0-0-0	5	15	10	10	-	-	-	-	-	**40**
2-0-2-0	5	10	-	15	15	15	-	-	-	**60**
3-1-2-0	5	10	12.5	12.5	10	10				**60**
2-1-2-0	5	10	12.5	12.5	10	10	-	-	-	**60**
3-0-2-0	5	10	12.5	12.5	10	10	-	-	-	**60**
2-0-2-2	5	10	-	15	10		5	10	5	**60**
2-2-0-0	5	10	12.5	12.5						**40**
^2-0-2-0	5	10	20		*45	20				**100**
&0-0-4-0	5				55	40				**100**

^ For Idea lab only, & For Manufacturing Practices only *Split up is given in the syllabus

Assessment of Assignment component of CIA

Based on the course category the number of assignments that shall be given for each course may vary. The table given below gives the details about it.

Course Category	L-T-P-J	Credit	Assessment of Assignment component of CIA
Theory Course	1-0-0-0	1	One assessment per two and half module
	2-0-0-0	2	
Theory Embedded with Practical	1-0-2-0	2	
Theory Course	2-1-0-0	3	Minimum two assessments per two and half modules. If more numbers are given,best two shall be considered for the calculation of CIA.
	2-2-0-0	4	
	3-0-0-0	3	
	3-1-0-0	4	
	4-0-0-0	4	
Theory Embedded with Practical	2-0-2-0	3	
	3-1-2-0	5	
	2-1-2-0	4	
	3-0-2-0	4	
Project Based Course	2-0-2-2	5	

Evaluation Type, CIA & ESE Mark Distribution:

The evaluation type, CIA & ESE mark distribution for courses with various course structures are given in the following table:

Evaluation Type	Course Category	L-T-P-J	Credit	CIA Mark	ESE Mark	CIA %	ESE %
CIA only	Theory Course	1-0-0-0	1	50	-	100%	-
		2-0-0-0	2	100			
	Theory integrated with Practical	1-0-2-0	2				
	Practical	0-0-2-0	1	50			
		0-0-4-0	2	100			
	Seminar	0-0-6-0	3				
	Project [Minor/Honor]	0-0-0-4	4				
	Major Project	0-0-14-0	7				
CIA + ESE	Theory Course	2-1-0-0	3	40	60	40%	60%
		2-2-0-0	4				
		3-0-0-0	3				
		3-1-0-0	4				
		4-0-0-0	4				
	Theory integrated with Practical	2-0-2-0	3	60	40	60%	40%
		3-1-2-0	5				
		2-1-2-0	4				
		3-0-2-0	4				
	Project Based Course	2-0-2-2	5				

Evaluation pattern for End Semester Examination

The end-semester examination shall have the learning assessments from the following perspectives for all courses:

- Evaluation with respect to Knowledge
- Evaluation with respect to Understanding
- Evaluation with respect to Applications

Separate evaluation pattern shall be followed for ESE, as given in table below.

PATTERN	PART A	PART B	ESE Marks
PATTERN 1	10 Questions, each question carries 2 marks Marks: (2x10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x8 = 40 marks) Time: 3 hours	**60**
	Total Marks: 20	Total Marks: [5x8 = 40 marks]	
PATTERN 2	NIL	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x 8 = 40 marks) Time: 2.5 hours	**40**
	Total Marks: 0	Total Marks: [5x8 = 40 marks]	
PATTERN 3 [For the course 24EST108/24EST206 Engineering Graphics 2-2-0-0	NIL	2 questions will be given from each module, out of which 1 question should be answered. Each question carries 12 marks. Marks: (5x 12 = 60 marks) Time: 3 hours	**60**
	Total Marks: 0	Total Marks: [5x12 = 60 marks]	
PATTERN 4 (For the course 24CHP701 Computer-Aided Process Design (2-1-2-0)	NIL	2 Questions, each question carries 40 marks. Each question can have a maximum of 2 sub-divisions. Marks: (1x40 = 40 marks Time: 2.5 hours	**40**
	Total Marks: 0	Total Marks: (1x40 = 40 marks]	

The condition for passing a course shall be 40% for the End Semester Examination, 40% of CIA, and 50% for CIA and ESE put together. Letter grade 'F' will be awarded to the student for a course if either their marks for the ESE is below 40 % or mark for the CIA is below 40 % or the overall mark [Continuous Internal Evaluation + End Semester Examination] is below 50 %. For courses with only CIA [having no ESE], a minimum of 50% of CIA mark is required for passing.

Grade and Grade point

Grading is based on the overall percentage marks obtained by the student in a course. The grade card shows the grades obtained for the courses the student has registered. Semester grade card gives the grade for each registered course, Semester Grade Point Average (SGPA) for the semester as well as Cumulative Grade Point Average (CGPA). The details of assigning Grades and the corresponding Grade point are given in the table below.

Grades	Grade Point [GP]	% of Total Marks obtained
S	10	90% and above
A+	9.0	85% and above but less than 90%

A	8.5	80% and above but less than 85%
B+	8	75% and above but less than 80%
B	7.5	70% and above but less than 75%
C+	7.0	65% and above but less than 70%
C	6.5	60% and above but less than 65%
D	6	55% and above but less than 60%
P [Pass]	5.5	50% and above but less than 55%
F [Fail]	0	Below 50% (CIA + ESE) or Below 40 % for ESE Below 40 % for CIA Below 50% for courses with only CIA and no ESE
FE	0	Failed due to lack of eligibility criteria
I	0	Could not appear for the end semester examination but fulfils the eligibility criteria.
First Class with Distinction		CGPA 8.0 and above
First Class		CGPA 6.5 and above
Equivalent percentage mark shall be = 10 * CGPA		

Allotted and Cumulative Credits

The allotted and cumulative credits of circuit and non- circuit branches are given in table below

Semester	**Circuit branches [CS, EC, EE, ER & AI]**		**Non-Circuit branches [CE, ME &CH]**	
	Allotted Credits	**Cumulative Credits**	**Allotted Credits**	**Cumulative Credits**
First	20	-	23	-
Second	23	43	21	44
Third	24	67	23	67
Fourth	22	89	22	89
Fifth	21	110	21	110
Sixth	20	130	20	130
Seventh	21	151	21	151
Eighth	16	167	16	167

Circuit branches: Computer Science & Engineering [CS], Electronics & Communication [EC], Electrical & Electronics [EC] and Electrical & Computer Science [ER], Computer Science and Engineering [AI]

Non-Circuit branches: Civil [CE], Mechanical [ME] and Chemical Engineering [CH]

CURRICULUM 2024

COMPUTER SCIENCE & ENGINEERING [AI]

FIRST SEMESTER													
Sl No	**Slot**	**Code**	**Category**	**Title**	**L**	**T**	**P**	**J**	**S**	**No. of Hours**	**No. of Credits**	**Total Marks**	
												CIA	**ESE**
1	A	24MAT101	BSC	Calculus and Linear Algebra	3	1	0	0	3	4	4	40	60
2	B	24PYP102	BSC	Engineering Physics	2	1	2	0	4	5	4	60	40
3	C	24EST103	ESC	Engineering Mechanics	3	0	0	0	3	3	3	40	60
4	D	24ESP107	ESC	Technical English for Engineers	2	0	2	0	4	4	3	60	40
5	E	24MCP110	MC	IDEA Lab	2	0	2	0	4	4	1	100	
6	F	24HUL111	HSMC	Design Thinking	0	0	2	0	2	2	1	50	
7	I	24AIT105	PCC	Introduction to Artificial Intelligence	2	0	0	0	2	2	2	100	
8	J1	24ESP106	ESC	Programming Frameworks for AI	1	0	2	0	3	3	2	100	
									25	**27**	**20**		

SECOND SEMESTER													
Sl No	**Slot**	**Code**	**Category**	**Title**	**L**	**T**	**P**	**J**	**S**	**No. of Hours**	**No. of Credits**	**Total Marks**	
												CIA	**ESE**
1	A	24MAP211	BSC	Probability and Statistics	3	1	2	0	5	6	5	60	40
2	B	24CYP203	BSC	Engineering Chemistry	2	1	2	0	4	5	4	60	40
3	C	24ESP204	ESC	Problem solving and Programming	3	0	2	0	5	5	4	60	40
4	D	24EST206	ESC	Engineering Graphics	2	2	0	0	4	4	4	40	60
5	G	24ESL207	ESC	Manufacturing Practices	0	0	4	0	4	4	2	100	
6	K	24MCT210	MC	Sports and Wellness	2	0	0	0	2	2	1	100	
7	E	24HUT211	HSMC	Universal Human Values-II	2	1	0	0	3	3	3	40	60
									27	**29**	**23**		

THIRD SEMESTER													
Sl No	**Slot**	**Code**	**Category**	**Title**	**L**	**T**	**P**	**J**	**S**	**No. of Hours**	**No. of Credits**	**Total Marks**	
												CIA	**ESE**
1	A	24MAP300	BSC	Advanced Linear Algebra and Transforms	3	1	2	0	5	6	5	60	40
2	K	24EST382	ESC	Discrete Mathematics	2	0	0	0	2	2	2	100	
3	B	24AIJ303	PBC	Introduction to Machine Learning	2	0	2	2	5	6	5	60	40
4	C	24CSP304	PCC	Data Structures and Algorithms	2	1	2	0	4	5	4	60	40
5	D	24AIP305	PCC	Computing Systems and Organization	2	1	2	0	4	5	4	60	40
6	E	24HUT310	HSMC	Life Skills and Professional Ethics	3	0	0	0	3	3	3	40	60
7	I	24EST372	ESC	Optimization Techniques	2	0	0	0	2	2	2	100	
8	M /R	24CSM3XX	MR/ RL	MINOR/REMEDIAL	4	0	0	0			4/0	40	60
									25	**29**	**25**		

FOURTH SEMESTER													
Sl No	**Slot**	**Code**	**Category**	**Title**	**L**	**T**	**P**	**J**	**S**	**No. of Hours**	**No. of Credits**	**Total Marks**	
												CIA	**ESE**
1	A	24CST401	PCC	Deep Learning	2	1	0	0	2	3	3	40	60
2	B	24AIP402	PCC	Introduction to Database Systems	2	1	2	0	4	5	4	60	40
3	C	24CSP403	PCC	Operating Systems	2	1	2	0	4	5	4	60	40
4	D	24AIJ404	PBC	Advanced Programming	2	0	2	2	5	6	5	60	40
5	E	24HUT455	HSMC	Management-I (Organizational Behavior)	3	0	0	0	3	3	3	40	60
6	F	24MCT406	MC	Environmental Sciences	3	0	0	0	3	3	1	40	60
7	I	24EST407	ESC	Ordinary Differential Equations and Partial Differential Equations	2	0	0	0	2	2	2	100	
8	M /H /R	24CSM4XX/ 24CSH4XX	MR/ HR/ RL	MINOR/HONORS/ REMEDIAL	4	0	0	0			4/4 /0	40	60

	23	**27**	**22**		

FIFTH SEMESTER													
Sl No	**Slot**	**Code**	**Category**	**Title**	**L**	**T**	**P**	**J**	**S**	**No. of Hours**	**No. of Credits**	**Total Marks**	
												CIA	**ESE**
1	A	24CST501	PCC	Design & Analysis of Algorithms	2	1	0	0	2	3	3	40	60
2	B	24CST502	PCC	Software Engineering	2	1	0	0	2	3	3	40	60
3	C	24AIP503	PCC	Computer Network	2	1	2	0	4	5	4	60	40
4	D	24AIJ504	PBC	Reinforcement Learning	2	0	2	2	5	6	5	60	40
5	E	24HUT555	HSMC	Finance and Accounting	3	0	0	0	3	3	3	40	60
6	F	24MCT506	MC	Constitution of India	MOOC				3		1		
7	I	24ESL507	ESC	Introduction to Robotics & Drone Design	0	0	2	0	2	2	1	50	
8	J	24HUL508	HSMC	Soft Skills	0	0	2	0	2	2	1	50	
9	M/H/R	24CSM5XX / 24CSH5XX		MINOR/HONORS/REMEDIAL	4	0	0	0			4/4/0	40	60
									23	**24**	**21**		

SIXTH SEMESTER													
Sl No	**Slot**	**Code**	**Category**	**Title**	**L**	**T**	**P**	**J**	**S**	**No. of Hours**	**No. of Credits**	**Total Marks**	
												CIA	**ESE**
1	A	24CST601	PCC	Theory of Computation	2	1	0	0	2	3	3	40	60
2	B	24AIP602	PCC	Natural Language Processing	2	1	0	0	4	4	3	60	40
3	C	24CSE6X4	PEC	Professional Elective I	3	0	0	0	3	3	3	40	60
4	D	24CSE6X5/ 24CSI6X5	PEC/ IEC	Professional Elective- 2/ Industry Elective	3	0	0	0	3	3	3	40	60
5	F	24CSS606	SR	Seminar	0	0	4	0	4	4	2	100	
6	U	24SPJ607	MC	Socially Relevant Project	0	0	0	2	1	2	1	100	
7	I	24EST609	ESC	Responsible AI	2	0	0	0	2	2	2	100	

8	J	24HUT609	HSMC	Entrepreneurships and startups	2	0	0	0	2	2	2	100	
9	M/H/R	24CSM6XX / 24CSH6XX		MINOR/HONOURS/REMEDIAL	4	0	0	0			4/4/0	40	60
									21	**23**	**19**		

SEVENTH SEMESTER													
Sl No	**Slot**	**Code**	**Category**	**Title**	**L**	**T**	**P**	**J**	**S**	**No. of Hours**	**No. of Credits**	**Total Marks**	
												CIA	**ESE**
1	A	24CSP701	PCC	Introductory Cyber Security	2	1	2	0	4	5	4	60	40
2	B	24CSP702	PCC	Cloud Computing (Internship Students: Online Classes with virtual lab)	2	1	2	0	4	5	4	60	40
3	C	24CSE7X3	PEC	Professional Elective-3 (Internship Students: MOOC Approved by the Institute/Online Classes)	3	0	0	0	3	3	3	40	60
4	D	24CSO7X4 / 24CSI7X4	OEC /IEC	Open Elective 1/ Industry Elective (Internship Students: MOOC Approved by the Institute/Online Classes)	3	0	0	0	3	3	3	40	60
5	U	24CSD705	PR	PROJECT/ INTERNSHIP Option 1: Major Project Option 2: Internship (4-6 Months)	0	0	14	0	14	14	7	100	
6	M/H/R	24CSM709 / 24CSH7XX	PRM/HR/RL	PROJECT IN MINOR/HONORS/ REMEDIAL	0	0	0	4			4/4/0	100	
									28	**30**	**21**		

The students have the option to undertake an internship either in the 7th or 8th semester. The students taking up the internship shall fulfill all the requirements of internal assessments such as series test, quizzes, assignments etc.

* Option 1: Work on a project within the institute or department under the mentorship of faculty members.
* Option 2: Complete a full-semester internship in an industry or organization.

EIGHTH SEMESTER													
Sl No	**Slot**	**Code**	**Category**	**Title**	**L**	**T**	**P**	**J**	**S**	**No. of Hours**	**No. of Credits**	**Total Marks**	
												CIA	**ESE**
1	A	24CSE8X1	PEC	Professional Elective-4 / MOOC (Internship Students: MOOC Approved by the Institute/Online Classes)	3	0	0	0	3	3	3	40	60
2	B	24CSO8X2	OEC	Open Elective-2/ MOOC (Internship Students: MOOC Approved by the Institute/Online Classes)	3	0	0	0	3	3	3	40	60
3	C	24CSO8X3	OEC	Open Elective- 3/ MOOC (Internship Students: MOOC Approved by the Institute/Online Classes)	3	0	0	0	3	3	3	40	60
4	U	24CSD804 / 24CSN804	PR/ IP	PROJECT/ INTERNSHIP Option 2: Internship (4-6 Months) for the students who have done Major Project in the 7th semester	0	0	14	0	14	14	7	100	
5	H	24CSH809	PRH	PROJECT IN HONORS	0	0	0	4			4	100	
									23	**23**	**16**		

The students taking up the internship shall fulfill all the requirements of internal assessments such as series test, quizzes, assignments etc.

Professional Electives (PE)

Professional Elective 1

Slot	Course Code	Course Name
C	24AIE614	Compiler Design
	24CSE624	Wireless Sensor Networks
	24CSE634	Agile Methodologies*
	24CSE644	Advanced Algorithms
	24CSE654	Data Mining

	24CSE664	Distributed Computing
	24CSE674	Advanced Database System*
	24CSE684	Object Oriented System Design*
	24CSE694	Information Security
	24CSE6104	Mobile And Wireless Security
	24CSE6114	Advanced Computer Architecture
	24CSE6124	Data Storage Technologies And Networks
	24CSE6134	Medical Imaging
	24CSE6144	Information Retrieval
	24CSE6154	Fuzzy Logic and Its Application
	24CSE6164	Computer Graphics

Professional Elective 2/Industry Elective

Slot	Course Code	Course Name
	24AIE6145	Computer Vision
	24AIE6155	Advanced Web Technologies
	24CSE625	Mobile Computing
	24CSE635	Parallel Algorithms
	24CSE645	Bioinformatics
	24CSE655	Principles of Programming Languages
	24CSE665	Secure Coding
	24CSE675	Social Networking and Security
	24CSE685	High Performance Computing
	24CSE695	IoT and Embedded Systems
	24CSE6115	Neural Networks and Fuzzy Logic
	24CSE6125	Internet of Things
	24CSE6135	Remote Sensing and Applications
	24CSI615	Software Testing*
	24CSI625	Blockchain Technology*

Professional Elective 3

Slot	Course Code	Course Name
C	24CSE713	Speech Processing
	24CSE723	Wireless and Mobile Communications
	24CSE733	Software Reliability*
	24CSE743	Evolutionary algorithms
	24CSE753	Parallel and Distributed Algorithms
	24CSE763	Big Data Analytics*
	24CSE773	Web Mining
	24CSE783	Advanced Social, Text and Media Analytics
	24CSE793	Digital Currency Programming*
	24CSE7103	Android programming*
	24CSE7113	Networks and Systems Security
	24CSE7123	Ethical Hacking*
	24CSE7133	GPU Architecture and Programming
	24CSE7143	Software Defined networks
	24CSE7153	AWS Cloud Computing*
	24CSE7163	Soft Computing

Professional Elective 4

Slot	Course Code	Course Name
A	24CSE831	Mobile Ad-hoc Networks
	24CSE841	Total Quality Management*
	24CSE851	Software Project Management*
	24CSE861	Swarm Intelligence
	24CSE871	Social Network Analytics
	24CSE881	Time Series Analysis and Forecasting
	24CSE891	Quantum Computing
	24CSE8101	Data Compression
	24CSE8111	Cloud security

	24CSE8121	Cyber Forensics*
	24CSE8131	IoT Security
	24CSE8141	Introduction to Devops*
	24CSE8151	Augmented and Virtual Reality
	24CSE8161	Human Computer Interaction

***Industry offered course**

Open Electives

Open Elective 1/ Industry Elective

Slot	Course Code	Course Name (in CS)	AI (include AI related Subjects)
D	24CSO714	Data Structures	Data Structures
	24CSO724	Introduction to Soft Computing	Introduction to Soft Computing
	24CSO734	Development of Mobile Apps	Development of Mobile Apps
	24CSO744	E-Commerce	E-Commerce
	24CSI714	Cyber Law & Ethics	Cyber Law & Ethics

Open Elective 2/MOOC

Slot	Course Code	Course Name
B	24CSO812	Computer Graphics
	24CSO822	Artificial Intelligence
	24CSO832	Python Programming
	24CSO842	Data Management and Analysis
	24CSO852	Mobile Computing

Open Elective 3/MOOC

Slot	Course Code	Course Name
C	24CSO813	Machine Learning
	24CSO823	Scripting Languages
	24CSO833	Database Management Systems

	24CSO843	Computer Architecture
	24CSO853	Big Data Analytics

MICRO SPECIALIZATION BUCKETS					
Bucket	**Course 1**		**Course 2**		**Prerequisite Course**
	Course Code	**Course Name**	**Course Code**	**Course Name**	
Ad-hoc and Sensor Networks	24CSE624	Wireless Sensor Networks	24CSE831	Mobile Ad-hoc Networks	Computer Networks
Mobile and Wireless Communication	24CSE625	Mobile Computing	24CSE723	Wireless and Mobile Communications	
Internet of Things	24CSE6125	Internet of Things	24CSE8131	IoT Security	
Agile Software Engineering	24CSE634	Agile Methodologies	24CSE851	Software Project Management	Software Engineering
Advanced Software Engineering	24CSE733	Software Reliability	24CSE841	Total quality Management	
Software Reliability	24CSI615	Software Testing	24CSE733	Software Reliability	
Object Oriented Software Engineering	24CSE684	Object Oriented System Design	24CSE851	Software Project Management	
Advanced Algorithmic approaches	24CSE644	Advanced Algorithms	24CSE753	Parallel and Distributed Algorithms	Design and Analysis of Algorithms
Optimization Algorithms	24CSE743	Evolutionary algorithms	24CSE861	Swarm Intelligence	
Big Data Analytics	24CSE654	Data Mining	24CSE763	Big Data Analytics	Introduction to Database Systems
Advanced Data Mining	24CSE773	Web Mining	24CSE871	Social Network Analytics	
Data Mining and Forecasting	24CSE763	Big Data Analytics	24CSE881	Time Series Analysis and Forecasting	
Blockchain and Digital Currency technology	24CSI625	Blockchain technology	24CSE793	Digital Currency Programming	
Database and Digital Currency technology	24CSE674	Advanced Database system	24CSE793	Digital Currency Programming	
Information Security	24CSE7113	Networks and Systems Security	24CSE8111	Cloud Security	Introductory cyber security
Cyber Security	24CSE7123	Ethical Hacking	24CSE8121	Cyber Forensics	
Secure Programming	24CSE665	Secure Coding	24CSE7123	Ethical Hacking	Advanced

					Programming
Advanced Computer Architecture	24CSE6114	Advanced Computer Architecture	24CSE7133	GPU Architecture and Programming	Computer organization
Software Automation	24CSE7153	AWS Cloud Computing	24CSE8141	Introduction to Devops	Advanced Programming and Cloud Computing
Software Development and Deployment	24CSE634	Agile Methodologies	24CSE8141	Introduction to Devops	

***Industry offered course**

MINOR BUCKETS				
SEMESTER	**BUCKET 1**		**BUCKET 2**	
	Specialization - Machine Learning		**Specialization - Software Engineering***	
	Course Code	**Course Name**	**Course Code**	**Course Name**
S3	24CSM309	Python for Machine Learning	24CSM310	Object Oriented Programming*
S4	24CSM409	Mathematics for Machine Learning	24CSM410	Software Engineering *
S5	24CSM509	Concepts in Machine Learning	24CSM510	Software Testing *
S6	24CSM609	Concepts in Deep Learning	24CSM610	Software Project Management*
S7	24CSM709	PROJECT IN MINOR	24CSM710	PROJECT IN MINOR

***Industry offered Course**

HONORS BUCKETS						
SEMESTER	**BUCKET 1**		**BUCKET 2**		**BUCKET 3**	
	Specialization - Data Structures and Algorithms		**Specialization - Systems Engineering**		**Specialization - Data Science**	
	Course Code	**Course Name**	**Course Code**	**Course Name**	**Course Code**	**Course Name**
S4	24CSH409	Computational Geometry	24CSH410	System Software	24CSH411	Data and Web Mining
S5	24CSH509	Advanced Data structures and Algorithms	24CSH510	Advanced Operating Systems	24CSH511	Business Analytics
S6	24CSH609	Parallel Algorithms	24CSH610	Advanced Database Management Systems	24CSH611	Social Network Analytics

S7	24CSH709	Evolutionary Algorithms	24CSH710	Advanced Computer Architecture	24CSH711	Time Series Analysis and Forecasting
S8	24CSH809	Project in Honors	24CSH809	Project in Honors	24CSH809	Project in Honors

SEMESTER I

24MAT101	CALCULUS and LINEAR ALGEBRA	L	T	P	J	S	C	Year of Introduction
		3	1	0	0	3	4	2024

Preamble:

The course enables the students to understand basic concepts and tools of Calculus and Linear Algebra. The topics like Multivariable Calculus and Applications, Multiple integrals and applications, Vector Differentiation, Vector Integration and Linear Algebra are included. This course helps the learners in modeling and analyzing physical phenomena involving continuous changes of variables or parameters and has applications across all engineering domains.

Prerequisite: Calculus of univariate functions and matrix theory.

CO: After the completion of the course the student will be able to

CO1	Apply the concept of partial derivatives to evaluate the extrema of two variable functions. [**Apply level**]
CO2	Use multiple integrals to find the area and volume of geometrical shapes, mass and center of gravity of plane laminas. [**Apply level**]
CO3	Utilize vector calculus techniques to solve problems related to vector fields in various disciplines. [**Apply level**]
CO4	Apply appropriate techniques such as Green's theorem, Stokes' theorem and divergence theorem to evaluate vector integrals for different types of regions and surfaces. [**Apply level**]
CO5	Use the Gauss elimination method to solve given systems of linear equations and to determine whether a matrix is diagonalizable. [**Apply level**]

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓				✓			✓
CO2	✓	✓			✓				✓			✓
CO3	✓	✓			✓				✓			✓
CO4	✓	✓			✓				✓			✓
CO5	✓	✓			✓				✓			✓

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse				
Evaluate				
Create				

Mark Distribution of CIA					
Course Structure [L-T-P-J]	**Attendance**	**Theory [L- T]**			**Total Marks**
		Assignment	**Test-1**	**Test-2**	
3-1-0-0	5	15	10	10	**40**

Total Mark distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	40	60	3 hours

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 1	10 Questions, each question carries 2 marks Marks: (2x10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x8 = 40 marks) Time: 3 hours	60
	Total Marks: 20	Total Marks: [5x8 = 40 marks]	

SYLLABUS

MODULE I (Multivariable Calculus and Applications)

Partial derivatives, Partial derivatives of functions of two variables, The partial derivative functions, Partial derivatives viewed as rates of change and slopes, Implicit partial differentiation, Partial derivatives of functions with more than two variables, Higher-order partial derivatives, Equality of mixed partials, Differentiability, Differentials, Local linear approximations, The chain rule, Chain rules for partial derivatives, Other versions of the chain rule, Implicit differentiation, Maxima and minima of functions of two variables - Extrema, Finding relative extrema, The second partials test.

MODULE II (Multiple integrals and applications)

Double integrals (Cartesian), Double integrals over nonrectangular regions, Reversing the order of integration, change of coordinates (Cartesian to polar), Finding area and volume using double integrals, Application of multiple integrals-mass and center of gravity of inhomogeneous laminas using double integral. Triple integrals, volume calculated as triple integral (exclude problems of intersection of solids), and triple integral in cylindrical coordinates.

MODULE III (Vector Differentiation)

Vector valued functions of single variable, derivative of vector function and geometrical interpretation, motion along a curve –velocity, speed and acceleration.

Concept of scalar and vector fields, Gradient and its properties, directional derivative, divergence and curl, Line integrals of vector fields, work as line integral, Conservative vector fields, independence of path and potential function (results without proof).

MODULE IV (Vector Integration)

Green's Theorem (for simply connected domains, without proof) and applications to evaluating line integrals and finding areas. Divergence theorem (without proof) and its applications to flux integrals, Stokes' theorem (without proof) and its applications to finding line integrals of vector fields and work done. Evaluation of Surface integral using Stokes' theorem.

MODULE V (Linear Algebra)

Systems of linear equations, Solution by Gauss elimination, row echelon form and rank of a matrix, fundamental theorem for linear systems (homogeneous and non-homogeneous, without proof), eigenvalues and eigenvectors, Properties of eigenvalues and eigenvectors, Diagonalization of matrices.

Text books

1. H. Anton, I. Biven,S.Davis, "Calculus", Wiley, 10th edition, 2015.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10thEdition, John Wiley & Sons, 2016.

Reference books

1. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9 th Edition, Pearson, Reprint, 2002.
3. Peter V. O'Neil, Advanced Engineering Mathematics, Cengage, 7th Edition, 2012
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.
6. Dr. Joydeep Dutta, Calculus of Several Real Variables, IIT Kanpur, [NPTEL], https://nptel.ac.in/courses/111104125 (Relevant sections)
7. Prof. Gilbert Strang, Linear Algebra [MITOPENCOURSEWARE]
8. https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/ (Relevant sections)

COURSE CONTENTS AND LECTURE SCHEDULE

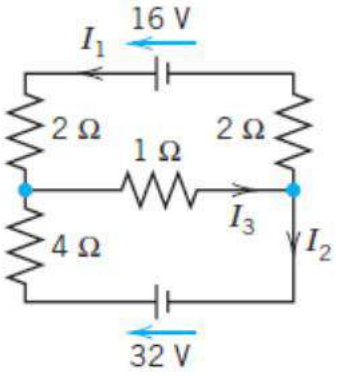
No.		No. of Hours (45)
	MODULE I (9 Hours)	
1.1	Partial derivatives, Partial derivatives of functions of two variables	1
1.2	Implicit partial differentiation, Partial derivatives of functions with more than two variables	1
1.3	Higher-order partial derivatives, Equality of mixed partials	1
1.4	Differentials	1
1.5	Local Linear approximations	1
1.6	Chain rule, Implicit differentiation	1
1.7	Total derivative	1

1.8	Maxima and minima of functions of two variables - Extrema, Finding relative extrema, The second partials test.	1
1.9	Maxima and minima of functions of two variables(continued)	1
MODULE II (10 Hours)		
2.1	Double integrals (Cartesian)-evaluation	1
2.2	Double integrals(continued)	1
2.3	Change of order of integration in double integrals	1
2.4	Change of coordinates (Cartesian to polar)	1
2.5	Finding areas and volumes	1
2.6	Finding areas and volumes(continued)	1
2.7	Mass and center of gravity of plane laminas	1
2.8	Triple integrals,	1
2.9	Volume calculated as triple integral (exclude problems of the intersection of solids)	1
2.10	Triple integral in cylindrical coordinates	1
MODULE III (9 Hours)		
3.1	Vector valued function of a scalar variable	1
3.2	Derivative of vector valued function of scalar variable - geometrical meaning	1
3.3	Motion along a curve-speed , velocity, acceleration	1
3.4	Gradient and its properties	1
3.5	Directional derivative	1
3.6	Divergent and curl	1
3.7	Line integrals with respect to arc length, line integrals of vector fields.	1
3.8	Work done as line integral	1
3.9	Conservative vector field, independence of path, potential function	1
MODULE IV (9 Hours)		
4.1	Green's theorem and its applications	1
4.2	Green's theorem and its applications(continued)	1
4.3	Green's theorem and its applications(continued)	1
4.4	Divergence theorem and applications	1
4.5	Divergence theorem and applications(continued)	1
4.6	Divergence theorem and applications(continued)	1
4.7	Stokes theorem and applications	1
4.8	Stokes theorem and applications(continued)	1
4.9	Stokes theorem and applications(continued)	1
MODULE V (8 Hours)		
5.1	Systems of linear equations, Solution by Gauss elimination	1
5.2	Row echelon form	1

5.3	Finding rank from row echelon form	1
5.4	Fundamental theorem for linear systems (homogeneous and non-homogeneous, without proof)	1
5.5	Eigenvalues and eigenvectors	1
5.6	Properties of eigenvalues and eigenvectors	1
5.7	Diagonalization of matrices	1
5.8	Diagonalization of matrices(continued)	1

CO Assessment Questions	
CO1	1. A manufacturer makes two models of an item, standard and deluxe. It costs Rs. 40 to manufacture the standard model and Rs. 60 for the deluxe. A market research firm estimates that if the standard model is priced at rupees x and the deluxe at rupees y , then the manufacturer will sell 500(y − x) of the standard items and 45,000 + 500(x − 2y) of the deluxe each year. How should the items be priced to maximize the profit? 2. Determine the dimension of the rectangular box open at the top, having a volume 32 cubic ft and requiring the least amount of material for its construction. 3. The temperature $T(x, y, z)$ at any point (x, y, z) in space is given by $T(x, y, z) = x^2 + y^2 + z^2$. Find the differential dT at a point (a, b, c), and use it to approximate the change in temperature when the coordinates change by small amounts δx, δy, and δz. 4. Use a CAS(MATLAB/SCILAB/Python) to generate a contour plot of $f(x, y) = 2y2x - yx2 + 4xy$ for −5 ≤ x ≤ 5 and −5 ≤ y ≤ 5, and use the plot to approximate the locations of all relative extrema and saddle points in the region. Check your answer using calculus, and identify the relative extrema as relative maxima or minima. 5. **Team Work** : Use the method of least squares(refer exercise 13.8 in text 1) to find the values of m and b in the regression line y=mx+b that best fits the data (x_1, y_1), (x_2, y_2), . . . , (x_n, y_n). The team has to make a presentation elaborating the solution and illustrating the method on any data set (using any programming language).
CO2	1. Consider a thin metal plate that occupies the triangular region R in the xy-plane with vertices at (0, 0), (2, 0), and (0, 3). The temperature on the plate is given by $T(x, y) = x^2 + y^2$, where x and y are the coordinates of a point. Find the average temperature over the region R. 2. A water tank has the shape of a hemisphere with a radius of 4 meters. The tank is filled with water up to a height of h meters. Find the total weight of the water in the tank using a double integral, assuming the density of water is constant. 3. Find the mass and centre of gravity of a triangular lamina with vertices

	(0,0), (2,1), (0,3) if the density function is $f(x, y) = x + y$. 4. Use a CAS(MATLAB/SCILAB/Python) to approximate the intersections of the curves y = sin x and y = x/2, and then approximate the volume of the solid in the first octant that is below the surface $z = \sqrt{1 + x + y}$ and above the region in the xy-plane that is enclosed by the curves. 5. **Team Work** : The following initial steps can be used to express a triple integral over a solid G as an iterated triple integral: First project G onto one of the coordinate planes to obtain a region R, and then project R onto one of the coordinate axes. Describe how you would use these steps to find the limits of integration. Illustrate your discussion with an example using any software. The team has to make a presentation elaborating the procedure.
CO3	1. A heat-seeking particle is located at the point (2, 3) on a flat metal plate whose temperature at a point (x, y) is $T(x, y) = 10 - 8x^2 - 2y^2$. Find an equation for the trajectory of the particle if it moves continuously in the direction of maximum temperature increase. 2. A vector field F(x, y, z) = (y, x, 2z) represents the velocity of a fluid flow in three-dimensional space. Determine the divergence and curl of F, and interpret the physical meaning of these vector operations. 3. A vector field $F(x, y, z) = (x^2, xy, yz)$ represents a force field in three-dimensional space. Show that F is conservative and find a potential function for F. Also, evaluate the work done by F along a curve C from point $A(1, 2, 0)$ to point $B(3, 1, 4)$. 4. Visualize any five vector fields relevant to your domain using CAS(MATLAB/SCILAB/Python). 5. **Team Work** : Suppose that C is a circle in the domain of a conservative nonzero vector field in the xy-plane whose component functions are continuous. Explain why there must be at least two points on C at which the vector field is normal to the circle. Also, illustrate using figures drawn in any software. Does the result remain true if the circle C is replaced by a square? Explain. The team has to make a presentation elaborating the solution.
CO4	1. Suppose we have a region R in the xy-plane bounded by a simple closed curve C. The temperature distribution in this region is given by the function $T(x, y) = 2x^2 - 3y^2$. Calculate the total heat flux across the boundary curve C using Green's theorem. 2. Find the outward flux of the vector field $F(x, y, z) = z\hat{k}$ across the sphere $x^2 + y^2 + z^2 = a^2$ using divergence theorem. 3. Calculate the work done by force field $F(x, y, z) = 2x\boldsymbol{i} + 3y\boldsymbol{j} + 4z\boldsymbol{k}$ where C is the curve defined by the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ in the counterclockwise direction using Stokes' Theorem.

	4. Use a CAS(MATLAB/SCILAB/Python) to verify Green's Theorem for the function $F = e^y\mathbf{i} + ye^x\mathbf{j}$ where (a) C is the circle $x^2 + y^2 = 1$ (b) C is the boundary of the region enclosed by $y = x^2$ and $x = y^2$. 5. **Team Work** : Explain with graphics how a rolling planimeter is used to calculate the area of a region. Describe the relationship between these devices and Green's Theorem. Illustrate an example. The team has to make a presentation elaborating the solution.
CO5	1. Using Kirchhoff's laws and showing the details, find the currents:  2. Find the growth rate in the Leslie model (see Example 3. Sec8.2 Text2) with the matrix as given $\begin{bmatrix} 0 & 3.45 & 0.60 \\ 0.9 & 0 & 0 \\ 0 & 0.45 & 0 \end{bmatrix}$ 3. A system is represented by the state equation $\begin{bmatrix} \frac{dx_1}{dt} \\ \frac{dx_2}{dt} \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -4 & -5 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u.$ Show that it is controllable. 4. In circuit theory a set of linear equations with electrical components such as resistance inductance capacitors current voltage etc. Identify a problem solved using matrix algebra and solve it using CAS(MATLAB/SCILAB/Python). 5. **Team Work** : Identify five application-oriented problems from your domain and its solution. Give a PPT illustrating the relevance of the problem.

24PYP102	ENGINEERING PHYSICS (FOR CIRCUIT BRANCHES)	L	T	P	J	S	C	Year of Introduction
		2	1	2	0	4	4	2024

Preamble: Enable the students to enhance the fundamental knowledge in physics and its applications relevant to various streams of Engineering and Technology. The topics like Oscillations and Wave Motion, Wave Optics, Quantum Mechanics for Engineers, Introduction to Electromagnetic Theory and Introduction to Solids are covered in the syllabus. This helps the learners to
explore the advanced concepts in physics and to do interdisciplinary research.

Prerequisite: Higher secondary level Physics and Mathematics.

CO: After the completion of the course the student will be able to

CO1	Interpret the characteristics of mechanical and electrical oscillators. **[Apply level]**
CO2	Demonstrate the concepts of interference and diffraction for the determination of wavelength of unknown sources. **[Apply level]**
CO3	Use the basic principles of quantum mechanics to determine the energy eigen values and eigen functions of particle in a box. **[Apply level]**
CO4	Apply the Maxwell's equations in estimating the speed of light. **[Apply level]**
CO5	Use low power lasers in doing optical and fibre optical experiments. **[Apply level]**

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓			✓	✓	✓		✓
CO2	✓	✓			✓			✓	✓	✓		✓
CO3	✓	✓			✓							✓
CO4	✓											
CO5	✓							✓	✓	✓		

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse				

Evaluate				
Create				

Assessment Pattern for Lab component

Bloom's Category	Continuous Assessment Tools	
	Class work	Test1
Remember		
Understand	✓	✓
Apply	✓	✓
Analyse		
Evaluate		
Create		

Mark Distribution of CIA

CourseStructure [L-T-P-J]	Attendance	Theory [L-T]			Practical [P]		Total Marks
		Assignment	Test-1	Test-2	Class work	Lab Exam	
2-1-2-0	5	10	12.5	12.5	10	10	**60**

Total Marks distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	60	40	2.5 hours

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 2		2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x 8 = 40 marks) Time: 2.5 hours	40
	Total Marks: 0	Total Marks:[5x8= 40 marks]	

SYLLABUS
MODULE I (Oscillations and Wave Motion)
Simple harmonic motion, damped and forced simple harmonic oscillator Damped harmonic oscillator: derivation of equation of motion and its solution, under damped oscillators; energy decay in damped harmonic oscillator, Quality factor (qualitative)- Forced harmonic oscillator: equation of motion and its solution (No derivation), Amplitude resonance - Electrical analogy of mechanical oscillators - Numerical problems. **Transverse waves in one dimension** Transverse and Longitudinal waves - Transverse waves on a stretched string; the wave equation on a string, derivation for the velocity and frequency of transverse vibrations on a stretched string- Numerical problems.
MODULE II (Wave Optics)
Interference of light by amplitude splitting Interference of reflected light in thin films; Interference in thin films (Cosine law); Derivation of the conditions of constructive and destructive Interference-Air Wedge; Determination of thickness of a thin wire - Antireflection coatings-Numerical problems. **Diffraction of light** Fresnel and Fraunhofer classes of diffraction - Diffraction grating -Grating equation-Rayleigh's criterion for limit of resolution - Resolving power of a grating with expression (no derivation), Comparison of interference and diffraction - Numerical problems.
MODULE III (Quantum Mechanics for Engineers)
Wave nature of particles and the Schrodinger equation Wave-Particle dualism; de Broglie hypothesis, de-Broglie wavelength – Wave function; Admissibility conditions, Physical significance, Probability density, Normalization condition - Time dependent Schrödinger wave equation - Time independent Schrödinger wave equation. **Applying the Schrodinger equation** Particle in a one-dimensional box; Energy Eigen values and normalized wave function, concept of quantum number, Quantum mechanical tunnelling (qualitative) - Numerical problems.
MODULE IV (Introduction to Electromagnetic Theory)
Physics of gradient, divergence and curl – Gauss's divergence theorem and Stoke's theorem- Equation of continuity, Deduction of Maxwell's equations in vacuum - Electromagnetic waves: Electromagnetic wave equation in free space, velocity of Electromagnetic waves in free space, Poynting's theorem (Qualitative) - Numerical problems.

MODULE V (Introduction to Solids)
Pauli's exclusion principle - Particle in a three-dimensional box; expression for Energy Eigen value and normalized wave function - Concept of quantum state and degeneracy - The density of states; Expression for density of states for a spinless particle, density of states for an electron. Effective mass concept (qualitative). Numerical problems.

Text books

1. M.N.Avadhanulu, P.G.Kshirsagar, TVS Arun Murthy "A Text book of Engineering Physics", S.Chand &Co., Revised Edition 2019.
2. H.K.Malik , A.K. Singh, "Engineering Physics" McGraw Hill Education,Second Edition 2017.

Reference books

1. Arthur Beiser, "Concepts of Modern Physics ", Tata McGraw Hill Publications, 6th Edition 2003.
2. D. .K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015.
3. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016.
4. Aruldhas G., "Engineering Physics", PHI Pvt. Ltd., 2015.
5. Ajoy Ghatak, "Optics", Mc Graw Hill Education, Sixth Edition, 2017.
6. Premlet B., "Advanced Engineering Physics", Phasor Books,11th edition,2021.
7. I. Dominic and. A. Nahari, "A Text Book of Engineering physics", Owl Books Publishers, Revised edition, 2016.
8. H.D Young and R.A Freedman, University Physics with Modern Physics 2020, 15th Edition, Pearson, USA.
9. Introduction to solid state devices, B Premlet, Phasor Books.
10. Griffiths "Introduction to Electrodynamics" 4th Edition, Pearson.

COURSE CONTENTS AND LECTURE SCHEDULE		
No.		No. of Hours (36)
MODULE I (7 Hours)		
1.1	Simple harmonic motion, damped and forced simple harmonic oscillator. Damped harmonic oscillator: derivation of equation of motion and its solution, under damped oscillators; energy decay in damped harmonic oscillator.	1
1.2	Quality factor (qualitative), Numerical problems.	1
1.3	Forced harmonic oscillator: equation of motion and its solution (No derivation).	1
1.4	Amplitude resonance, Numerical problems	1
1.5	Electrical analogy of mechanical oscillators- Numerical problems.	1

1.6	Transverse waves in one dimension Transverse and Longitudinal waves - Transverse waves on a stretched string; the wave equation on a string, derivation for the velocity and frequency of transverse vibrations on a stretched string.	1
1.7	Numerical problems.	1
MODULE II (7 Hours)		
2.1	Interference of light by amplitude splitting Interference of reflected light in thin films; Interference in thin films (Cosine law).	1
2.2	Derivation of the conditions of constructive and destructive Interference, Numerical problems	1
2.3	Air Wedge; Determination of thickness of a thin wire	1
2.4	Antireflection coatings - Numerical problems.	1
2.5	Diffraction of light Fresnel and Fraunhofer classes of diffraction -Diffraction grating -Grating equation.	1
2.6	Rayleigh's criterion for limit of resolution - Resolving power of a grating with expression (no derivation), Numerical problems.	1
2.7	Comparison of interference and diffraction, Numerical problems.	1
MODULE III (8 Hours)		
3.1	Wave nature of particles and the Schrodinger equation Wave Particledualism; de Broglie hypothesis, de- Brogliewavelength, Numerical problems.	1
3.2	Wave function; Admissibility conditions, Physical significance, Probability density, Normalization condition.	1
3.3	Time dependent Schrödinger wave equation.	1
3.4	Time independent Schrödinger wave equation (no derivation).	1
3.5	Applying the Schrodinger equation Particle in a one-dimensional box; Energy Eigen values and normalized wave function, Numerical problems.	1
3.6	Concept of quantum numbers.	1
3.7	Quantum mechanical tunnelling (qualitative).	1
3.8	Numerical problems.	1
MODULE IV (7 Hours)		
4.1	Physics of gradient, divergence and curl, Numerical problems.	1
4.2	Gauss's divergence theorem and Stoke's theorem-Equation of continuity.	1

4.3	Deduction of Maxwell's equations in vacuum (first two equations).	1
4.4	Deduction of Maxwell's equations in vacuum (third and fourth equations).	1
4.5	Electromagnetic waves: Electromagnetic wave equation in free space.	1
4.6	Velocity of Electromagnetic waves in free space, Numerical problems.	1
4.7	Poynting's theorem (Qualitative) - Numerical problems.	1
MODULE V (7 Hours)		
5.1	Pauli's exclusion principle.	1
5.2	Particle in a three-dimensional box.	1
5.3	Expression for Energy Eigen value and normalized wavefunction.	1
5.4	Concept of quantum state and degeneracy.	1
5.5	The density of states; Expression for density of states for a spinless particle.	1
5.6	Density of states for an electron.	1
5.7	Effective mass concept (qualitative). Numerical problems.	1

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Oscillations	4	1. Resonance phenomenon in mechanical oscillators. 2. LCR Circuit – Forced and damped harmonic oscillations.
2	Waves	4	1. Melde's string apparatus- Measurement of frequency in the transverse mode. 2. Melde's string apparatus- Measurement of frequency in the longitudinal mode.
3	Interference	4	1. Wave length measurement of a monochromatic source of light using Newton's Rings method. 2. Determination of diameter of a thin wire or thickness of a thin strip of paper using air wedge method.
4	Diffraction	4	1. Determination of resolving power of a plane transmission grating. 2. Determination of the wavelength of laser source using diffraction grating.

5	Quantum Mechanics	4	1. Determination of the particle size of lycopodium powder. 2. Numerical demonstration of the discrete energy levels and wavefunctions using Schrodinger equation. (e.g., Particle in a box problem)
6	Electromagnetic Theory	4	1. Determine the characteristics of EM waves using Hertz experiment. 2. Determination of Numerical aperture of optic fiber using Laser.
(Any 6 experiments to be completed)			

CO Assessment Questions	
CO1	1. Compute the frequency and Quality factor for an LCR circuit with L = 2mH, C = 5μF and R = 0.2Ω. 2. Frame any five numerical problems on oscillations with different difficulty levels and solve them. 3. Identify the applications of the theory of oscillations in the field of engineering and prepare a Power Point presentation on any one system which failed in applying the theory of damped or forced oscillation. (Eg: Failed due to damping, resonance etc.) 4. Determine experimentally the characteristics of an LCR oscillator.
CO2	1. Light of wavelength 6000A^{o} falls normally on a wedge-shaped film. The two plates touch at one and are separated at 10 cm from that end by awire. If the bandwidth of interference pattern is 0.05mm, find the diameter of the wire. 2. Design any three numerical problems on Interference and implement these using any one programming language and submit the source code and output. 3. Write a brief report on the limitations of any one optical instrument used in engineering systems. Determine experimentally the wavelength of a laser source using diffraction grating.
CO3	1. Apply the appropriate Schrodinger equation and compute the first three energy eigen values and wave functions of a particle trapped inside a well. 2. Make a video demonstrating any one Engineering System in which classical physics failed to give a perfect design and was designed with the aid of Quantum Mechanics.

CO4	1. Determine the velocity of Electromagnetic waves in free space using Maxwell's equations. 2. Create a quiz based on numerical problems from electromagnetic theory using appropriate tool.
CO5	1. Determine experimentally the wavelength of a standard laser source using diffraction grating arrangement. 2. Determine experimentally the NA of an optic fibre cable.

24EST103	ENGINEERING MECHANICS	L	T	P	J	S	C	Year of Introduction
		3	0	0	0	3	3	2024

Preamble:
This course aims to expose the students to the fundamental concepts of the mechanics of rigid bodies. It introduces students to the influence of applied force systems and the geometrical properties of rigid bodies. After this course, students can solve the mechanics problems in rigid bodies and respond accordingly.

Prerequisite: Nil

Course Outcomes:

CO	After the completion of the course, the student will be able to
CO1	Describe principles and theorems related to the mechanics of rigid bodies. **[Remember level]**
CO2	Identify the components of forces acting on a rigid body. **[Understand level]**
CO3	Apply the conditions of equilibrium to rigid bodies involving different force configurations. **[Apply level]**
CO4	Analyse linear, curvilinear, and rotary motion of rigid bodies. **[Apply level]**
CO5	Recognize the basic terminologies related to the mechanics of robots **[Understand level]**

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2	✓											
CO3	✓	✓	✓									
CO4	✓	✓										
CO5	✓					✓						

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse			✓	
Evaluate			✓	
Create			✓	

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Theory [L-T]			Total Marks
		Assignment	Test-1	Test-2	
3-0-0-0	5	15	10	10	40

Total Mark distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	40	60	3 Hours

End Semester Examination [ESE] Pattern

Pattern	Part A	Part B	ESE Marks
PATTERN 1	10 Questions, each question carries 2 marks Marks: (2×10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub-divisions. Each question carries 8 marks. Marks: (5×8 = 40 marks) Time: 3 hours	60
	Total Marks: 20	Total Marks: [5×8 = 40 marks]	

SYLLABUS

MODULE I (Forces and Torques)

Introduction to Engineering Mechanics, Forces, Concurrent coplanar forces, Composition, and Resolution of forces, Resultant, Methods of Projections. Equilibrant, Non-Concurrent coplanar forces, Varignon's Theorem of Moments, Parallel coplanar forces, couple, Resultant of parallel forces, Centre of parallel forces, Resultant of non-concurrent coplanar forces, Torques, Joint Torques, Reaction Torques, Centripetal and Coriolis Torques. Centroid, Moment, Moment of Inertia.

MODULE II (Statics)

Statics-Basic principles of statics, Equilibrium law, Principles of superposition and transmissibility, law of action and reaction, Static Equilibrium of Robotic Systems, Conditions for Static Equilibrium, Force and Torque Analysis, Free Body Diagrams, Force and Torque Balance.

MODULE III (Dynamics)

Kinetics vs. Kinematics, Degrees of Freedom, Mass and Inertia,Dynamic Equations of Motion, Newton-Euler Formulation, Rigid Body Dynamics, Forward Dynamics, Inverse Dynamics, Motion on horizontal and inclined surfaces, Motion of connected bodies.

MODULE IV (Kinematics)

Linear and Angular motion in Rigid Bodies. Velocities in Rigid Bodies: Angular Velocities & Twists, Forward Kinematics, Inverse Kinematics, Transformation Matrix, Jacobian Matrix, Singularity, Workspace, Degrees of Freedom, Homogeneous Coordinates.

MODULE V (Introduction to Robotics)

Introduction to Robotics, Overview of Robotic Systems and Components, Types of Robots (Industrial, Mobile, Humanoids, etc.).
Types of Robotic Joints -Revolute Joint, Prismatic Joint, Planar Joint.
Types of Links- Revolute Links, Prismatic Links, Cylindrical Links, Spherical Links, Rigid Links, Flexible Links. Actuator Forces: Linear Actuators, Rotary Actuators.
External Forces: Gravity, Friction, Contact Forces. Dynamic Models of Robots

Text Books:

1. Kevin M. Lynch and Frank C. Park, Modern Robotics Mechanics, Planning, and Control, Cambridge University Press.
2. Timoshenko and Young, Engineering Mechanics, McGraw Hill Publishers.

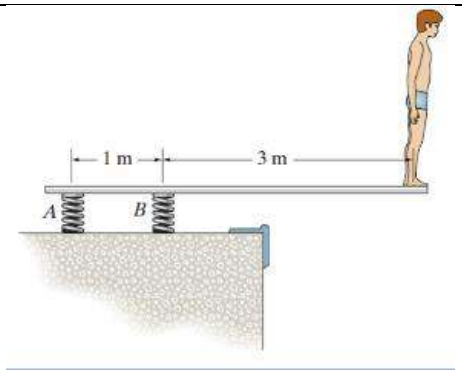
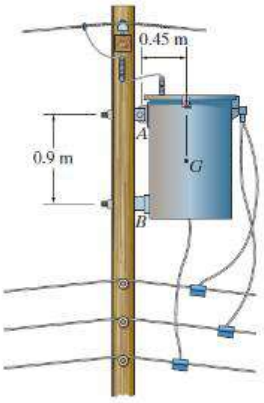
3. Shames, I. H., Engineering Mechanics - Statics and Dynamics, Prentice Hall of India.
4. R. C. Hibbeler and Ashok Gupta, Engineering Mechanics, Vol. I statics, Vol II Dynamics, Pearson Education.
5. John J Craig, Introduction to Robotics: Mechanics and Control, Pearson Education.

Reference Books:

1. 1.Merriam J. L and Kraige L. G., Engineering Mechanics - Vols. 1 and 2, John Wiley.
2. Tayal A K, Engineering Mechanics – Statics and Dynamics, Umesh Publications
3. Bhavikkatti, S.S., Engineering Mechanics, New Age International Publishers
4. F.P.Beer abd E.R.Johnston (2011), Vector Mechanics for Engineers, Vol.I-Statics, Vol.II-Dynamics, 9th Ed, Tata McGraw Hill
5. Rajasekaran S and Sankarasubramanian G, Engineerin Mechanics -Statics and Dynamics, Vikas Publishing House Pvt Ltd.

COURSE CONTENTS AND LECTURE SCHEDULE		
No		No. of Hours (36)
MODULE I (8 Hours)		
1.1	Introduction to Engineering Mechanics	1
1.2	Forces, Concurrent coplanar forces, Composition, and Resolution of forces, Resultant	1
1.3	Methods of Projections. Equilibrant. Non-Concurrent coplanar forces, Varignon's Theorem of Moments.	1
1.4	Parallel coplanar forces, couple, Resultant of parallel forces, Centre of parallel forces, Resultant of non-concurrent coplanar forces.	1
1.5	Torques Joint Torques, Reaction Torques,	1
1.6	Centripetal and Coriolis Torques, Moment	1
1.7	Centroid	1
1.8	Moment of Inertia	1
MODULE II (8 Hours)		
2.1	Statics-Basic principles of statics, Equilibrium law	1
2.2	Principles of superposition and transmissibility, law of action and reaction.	1
2.3	Static Equilibrium of Rigid Bodies	1
2.4	Conditions for Static Equilibrium,	1
2.5	Force, and Torque Analysis	1
2.6	Free Body Diagrams	1
2.7	Free Body Diagrams	1
2.8	Force and Torque Balance	1
MODULE III (8 Hours)		
3.1	Kinetics vs. Kinematics	1
3.2	Degrees of Freedom, Mass, and Inertia	1
3.3	Dynamic Equations of Motion, Newton-Euler Formulation	1
3.4	Rigid Body Dynamics	1
3.5	Forward Dynamics (Concept only)	1
3.6	Inverse Dynamics (Concept only)	1
3.7	Motion on horizontal and inclined surfaces	1
3.8	Motion of connected bodies	1
MODULE IV (6 Hours)		

4.1	Linear and Angular motion in Rigid Bodies. Velocities in Rigid Bodies:	1
4.2	Angular Velocities & Twists	1
4.3	Forward Kinematics, Inverse Kinematics (Concept only)	1
4.4	Transformation Matrix, Jacobian Matrix (Concept only)	1
4.5	Singularity, Workspace	1
4.6	Degrees of Freedom, Homogeneous Coordinates	1
MODULE V (6 Hours)		
5.1	Introduction to Robotics, Overview of Robotic Systems and Components, Types of Robots	1
5.2	Types of Robotic Joints -Revolute Joint, Prismatic Joint, Planar Joint.	1
5.3	Types of Links- Revolute Links, Prismatic Links, Cylindrical Links, Spherical Links, Rigid Links, Flexible Links.	1
5.4	Actuator Forces: Linear Actuators, Rotary Actuators.	1
5.5	External Forces: Gravity, Friction, Contact Forces.	1
5.6	Dynamic Models of Robots	1
CO Assessment Questions		
CO1	1. State and explain the principle of superposition of forces. 2. Explain D'Alembert's principle. 3. Explain Varignon's Theorem of Moments	
CO2	1. A robot is cleaning the horizontal floor. Identify all forces acting on the robot and draw its free-body diagram.  2. A car is resting on an inclined plane as shown in the figure. Identify all forces acting on the car and draw the free-body diagram of the car. 	
CO3	1. A boy stands out at the end of the diving board, which is supported by two springs A and B, each having a stiffness of k = 15 kN/m. In the position shown the board is horizontal. If the boy weighs 400 N, determine the angle of tilt that the board makes with the horizontal after he jumps off. Neglect the weight of the board and assume it is rigid.	

	 2. The 1500-N electrical transformer with center of gravity at G is supported by a pin at A and a smooth pad at B. Determine the horizontal and vertical components of reaction at the pin A and the reaction of the pad B on the transformer. 
CO4	1. A robot weighing 50 N pulls a toy weighing 10 N up an incline of 1 in 1000. The robot starts from rest and moves with constant acceleration against a resistance of 1 N/N. It attains a maximum speed of 2 kmph in a 10 m distance. Determine the tension in the coupling between the robot and toy and the traction force developed by the robot. 2. A right circular cylinder of mass m and radius r is suspended from a cord that is wound around its circumference. If the cylinder is allowed to fall freely, find the acceleration of its mass center and tension in the cord.
CO5	1. Explain the different types of joints in robots 2. Explain the different types of links in robots 3. Differentiate between actuator force and external forces

24ESP107	TECHNICAL ENGLISH FOR ENGINEERS	L	T	P	J	S	C	Year of Introduction
		2	0	2	0	4	3	2024

Preamble: This course enables the students to use the basic skills of communication such as reading, listening, writing and speaking. The topics like Use of Language in communication, Oral Presentation, Interview Skills, Formal Writing, Reading Comprehension and Listening skills are covered in this course. The course helps the learners to communicate with group, face interviews and prepare technical documents in an effective manner.

Prerequisite: NIL

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

CO1	Use vocabulary and language skills in professional communication. **[Apply level]**
CO2	Demonstrate technical presentation and speaking skills. **[Apply level]**
CO3	Make use of the interview skills in real life situation. **[Apply level]**
CO4	Create professional and technical documents precisely. **[Apply level]**
CO5	Use reading and listening techniques in an effective way. **[Apply level]**

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								✓	✓	✓		✓
CO2								✓	✓	✓		✓
CO3								✓	✓	✓		✓
CO4								✓		✓		✓
CO5								✓	✓	✓		✓

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test 1	Test 2	Other tools	
Remember	-	✓	✓	✓
Understand	-	✓	✓	✓
Apply	-	✓	✓	✓
Analyse			✓	
Evaluate			✓	
Create			✓	

Assessment Pattern for Lab component

Bloom's Category	Continuous Assessment Tools	
	Class work	Test1
Remember		
Understand	✓	✓
Apply	✓	✓

Analyse	✓	✓
Evaluate		
Create		

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Theory [L- T]			Practical [P]		Total Marks
		Assignment	Test-1	Test-2	Class work	Lab Exam/ Practice	
2-0-2-0	5	10	-	15	15	15	**60**

Total Marks distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	**60**	**40**	**2.5 Hours**

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 2		2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x 8 = 40 marks) Time: 2.5 hours	40
	Total Marks: 0	Total Marks: [5x8 = 40 marks]	

SYLLABUS
MODULE I (Use of Language in communication)
Significance of Technical communication- Technical vocabulary used in formal letters, emails, reports, misspelled words, synonyms, antonyms, and paraphrasing. Grammar- Subject-verb agreement, reported speech, active–passive voice, use of adjectives and adverbs, prepositions.
MODULE II (Oral Presentation)
Voice Modulation, tone, Intonation, pronunciation, presentation skills, public speaking skills, Types of presentations, the use of visuals in presentation, debate, G.D., brainstorming, body language, and audience analysis.
MODULE III (Interview Skills)
Interview skills: Objectives and types of interviews, preparing for interview, interview

etiquette, dress code, body language, online interview, panel interview, one-to-one interview, FAQ'S related to job interviews, and answering strategies.

MODULE IV (Formal Writing)

Formal Writing: Letter- Formal, informal, and semi-formal. Email, Job application letters, C.V., Resume, and Biodata, minutes preparation, different types of reports, common errors in writing, use of sequence words, and Statement of purpose.
Reference styling, IEEE format, bibliography, analytical and issue-based essay writing, plagiarism.

MODULE V (Reading Comprehension and Listening skills)

Reading, comprehension, and summarizing: Reading Styles, speed reading, critical reading, reading and comprehending longer and shorter technical articles from journals and newspapers, SQ3R method, PQRST method, identifying transitions of text, note taking.
Listening skills: Active and Passive listening, listening for general content, listening for specific information, developing effective listening skills, barriers to effective listening, listening to longer technical talks and classroom lectures, TED talks, taking notes while listening.

Text books / Reference books

1. Meenakshi Raman and Sangeetha Sharma, Technical Communication: Principles and Practice, 3rd edition, Oxford University Press, 2015
2. Anderson, P.V, Technical Communication, Thomas Wadsworth, Sixth edition, New Delhi, 2007
3. English for Engineers and Technologists (Combined edition, Vol,1 and 2), Orient Blackswann 2010
4. Seely, John, The Oxford Guide to Writing and Speaking, Oxford university Press, 1997
5. Ganguly, Anand, Success in Interview, RPH, Fifth edition, 2006
6. Effective Communication Skills. Kul Bhushan Kumar, Khanna Book Publishing, 2022.
7. Practical English Usage. Michael Swan. OUP. 1995.
8. Remedial English Grammar. F.T. Wood. Macmillan.2007
9. On Writing Well. William Zinsser. Harper Resource Book. 2001
10. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
11. Communication Skills. Sanjay Kumar and Pushplata. Oxford University Press. 2011.
12. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

NPTEL/SWAYAM Courses for reference:

1. English Language for Competitive Exams Prof. Aysha Iqbal IIT Madras
2. Technical English for Engineers Prof. Aysha Iqbal IITM

COURSE CONTENTS AND LECTURE SCHEDULE		
No.		No. of Hours (35)
MODULE I (8 Hours)		
1.1	Introduction, misspelled words	1
1.2	Synonyms and antonyms	1
1.3	Technical vocabulary in email and letters and reports	1
1.4	Paraphrasing	1
1.5	Subject-verb agreement	1
1.6	Reported Speech	1
1.7	Active and passive voice	1
1.8	Preposition, use of adjectives and adverbs	1
MODULE II (6 Hours)		
2.1	Presentation skills	1
2.2	Importance of voice modulation, tone, intonation	1
2.3	Use of visuals in presentation, public speaking skills	1
2.4	Debate and G.D – differences.	1
2.5	Body Language and audience analysis	1
2.6	Brainstorming	1
MODULE III (6 Hours)		
3.1	Objectives of Interview, types of Interviews	1
3.2	Preparation strategies for attending interview	1
3.3	Dress code and body language for interviews.	1
3.4	Interview Etiquettes	1
3.5	FAQs related to job interviews	1
3.6	Strategies for different types of interviews- Online interview, panel interview, one-to-one interview.	1
MODULE IV (9 Hours)		
4.1	Formal, informal, and semi-formal letters	1
4.2	Email Writing and etiquette	1
4.3	Application letter, email.	1
4.4	C.V, Resume, Biodata – introduction and differences	1
4.5	C.V, Resume, Biodata writing process	1
4.6	Minutes preparation	1
4.7	Types of reports, use of sequence words	1
4.8	Statement of purpose, referencing style, bibliography.	1
4.9	IEEE format, plagiarism, issue-based essay writing.	1

MODULE V (6 Hours)		
5.1	Reading Styles	1
5.2	Speed reading, critical reading	1
5.3	Comprehending longer and shorter technical articles from journals and newspaper	1
5.4	Reading methods, SQ3R and PQRST methods, identifying transitions in text	1
5.5	Active and Passive listening, Listening for general and specific Content	1
5.6	Barriers to effective listening.	1

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Difference between literary and technical writing style	1	Writing exercises for both creative and technical writing that highlight Grammatical and linguistic differences between two.
2	Presentation	3	Create and present a PPT based on a given topic.
3	Group Discussion	2	Group discussion and debate based on a given topic.
4	Voice modulation, tone, and intonation	1	Analyze a given video presentations of speakers, technocrats, and management experts based on the concepts learned.
5	Effects of body language in presentation and public speaking.		
6	Interview Skills	1	Mock Panel Interview
7	Interview body language and etiquette	1	Analyze the given videos of both mock/ original job interviews based on the concepts learned.
8	Report writing	1	Writing exercises for different types of reports.
10	Comprehension exercise	2	Comprehend articles from scientific journals.
			Comprehend articles from newspapers.
11	Listening exercise – 1	1	Answering the Question / Note Making from TED talks.

12	Listening exercise – 2	1	Write the subtitles and lyrics from the English movie clips and songs provided

CO Assessment Questions	
CO1	1. Find the word with the correct spelling from the following list a) Accommodate b) Acommodate c) Accomadate d) Acomodate 2. Which word in the following list is closest to the meaning of the word 'gloomy' a) Happy b) Sad c) Enthralled d) elated. 3. Select the most suitable preposition for the sentence from the following list I was born_____May (in / on / at) My friend lives_____Beach Road (in/on/at)
CO2	1. What is the significance of body language in presentation? 2. Explain the strategies to improve your Debate skills. 3. How important is visual aid for presentations? 4. As a student who presented a slide presentation, how will you respond to a disturbed audience?
CO3	1. Explain the significance of non- verbal communication in interviews. 2. What are the differences that you will make while attending an online interview instead of an off line interview. 3. How will you politely respond to a question asked to you in an interview to which you don't know the answer? 4. As a viewer of the mock interview conducted in the class, what were the do's and don'ts to be followed in an interview.
CO4	1. What are the differences between a C.V., Resume and Biodata? 2. Write an email to the manager of ABC Technologies asking for an opportunity to be included in their internship program 3. What are the different types of reports?
C05	1. What is critical reading? What are the advantages of critical reading over speed reading? 2. Write down the lyrics of the song as you hear it. 3. Write a synopsis of the journal article that you just read.

24MCP110	IDEA LAB	L	T	P	J	S	C	Year of Introduction
		2	0	2	0	4	1	2024

Preamble: This course enables the learners to understand the concepts of design, development and documentation tools under various domains in engineering. The various topics covered in this course are concepts of Microcontroller Programming, PCB Designing and Prototyping, Modelling, Slicing, Cutting, Routing, and Documentation & version control Tools. This course helps the students to design and develop real life applications using multidisciplinary engineering aspects.

Prerequisite: NIL

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

CO1	Develop project using appropriate Microcontroller Programming languages. **[Apply level]**
CO2	Develop product using PCB Design and Prototyping concepts. **[Apply level]**
CO3	Create 2D and 3D models using appropriate tools. [Apply level]
CO4	Create electronic documentation for the system/project using appropriate tools. **[Apply level]**
CO5	Build useful and standalone system/ project with enclosures. **[Apply level]**

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓	✓		✓	✓			✓
CO2	✓	✓	✓	✓	✓	✓		✓	✓			✓
CO3	✓	✓	✓	✓	✓	✓		✓	✓			✓
CO4	✓	✓	✓	✓	✓			✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓			✓

Assessment Pattern for Lab component

Bloom's Category	Continuous Assessment Tools	
	Class work	Test1
Remember		
Understand	✓	✓
Apply	✓	✓
Analyse	✓	✓
Evaluate	✓	
Create	✓	

Assessment Pattern for Project component

Bloom's Category	Continuous Assessment Tools		
	Evaluation 1	Evaluation 2	Report
Remember			
Understand	✓	✓	
Apply	✓	✓	
Analyse	✓	✓	

Evaluate		✓	
Create		✓	

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Theory [L- T]		Practical [P]		
		Assignment	Test-1	Lab work	Test 2	Total
2-0-2-0	5	10	20	45	20	**100**

* As part of their lab work, students are required to submit a Micro project. The total marks for the lab component in the idea lab are calculated as a cumulative sum of the continuous assessment of lab work, which carries 20 marks, and the micro project evaluation, which carries 25 marks. The micro project evaluation is further divided into three components: 10 marks for the intermediate evaluation of the micro project, 10 marks for the project presentation and demonstration, and 5 marks for the micro project report submitted at the end of the semester.

Total Marks distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	100	-	-

SYLLABUS

MODULE I (Introduction Microcontroller Programming)

Introduction to micro controller and embedded systems, Introduction to Arduino and its IDE Concept of digital and analog ports, registers, memory, timer, counter.
Embedded C programming: Arduino data types, operators, Array, Loop, Functions.

MODULE II (Microcontroller Programming)

Embedded C programming: Working with Serial Monitor, Pins Configuration as INPUT/OUTPUT, digitalRead(), digitalWrite(), Interrupts, delay(),Pull-up resistors. Interfacing a 8-bit LCD to Arduino, Running message display.
Sensor/Actuator Interface: Temperature Sensor, LDR based sensor, IR and Ultrasonic sensors, Relay, LED, Servomotor.

MODULE III (PCB Designing and Prototyping)

Introduction: PCB, pads, track, SMD, trough hole, via and its Design rules. Design any two simple circuit using Easy EDA/Eagle/Flat CAM, Routing and Generating GERBER file.
PCB Chemical etching Vs Milling techniques, PCB Chemical Etching/Milling

MODULE IV (Modelling, Slicing, Cutting, Routing)

3D modeling, Slicing, 3 D printing, 2D design using Inkscape, Laser CAD, Laser
Cutting, 2D modelling, CNC Routing, CNC Routing, Tool familiarization

MODULE V (Documentation and version control Tools)

Familiarization of Google Docs, Google Sheets, Google Slides, Google Drawings, Google Forms Google Sites, Creating Google sheets, Google slides, Google forms and Google sites Doxygen – Overview, Installation, Getting started, Documenting the code, Markdown support, Lists, Grouping, Including formulas, Including tables, Graphs and diagrams, Preprocessing, Output Formats, Searching, Customizing the output, Custom Commands, Linking to external documentation

Reference books

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), Khanna Book Publishing
2. All-in-One Electronics Simplified, A.K. Maini; 2021. ISBN-13: 978-9386173393, Khanna Book Publishing Company, New Delhi.
3. Simplified Q&A - Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Rajiv Chopra, ISBN: 978-9355380821, Khanna Book Publishing Company, New Delhi.
4. 3D Printing & Design, Dr. Sabrie Soloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi.
5. The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018. ISBN-13: 978-1681884325.
6. The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan (Author). Weldon Owen; 2017. ISBN-13: 978-1681881584.
7. Make: Tools: How They Work and How to Use Them. Platt, Charles. Shroff/Maker Media. 2018. ISBN-13: 978-9352137374
8. The Art of Electronics. 3rd edition. Paul Horowitz and Winfield Hill. Cambridge University Press. ISBN: 9780521809269
9. Practical Electronics for Inventors. 4th edition. Paul Sherz and Simon Monk. McGraw Hill. ISBN-13: 978-1259587542
10. Encyclopedia of Electronic Components (Volume 1, 2 and 3). Charles Platt. Shroff Publishers. ISBN-13: 978-9352131945, 978-9352131952, 978-9352133703
11. Building Scientific Apparatus. 4th edition. John H. Moore, Christopher C. Davis, Michael A. Coplan and Sandra C. Greer. Cambridge University Press. ISBN-13: 978-0521878586
12. Programming Arduino: Getting Started with Sketches. 2nd edition. Simon Monk. McGraw Hill. ISBN-13: 978-1259641633
13. Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards. Simon Monk and Duncan Amos. McGraw Hill Education. ISBN-13: 978-1260019193.
14. Pro GIT. 2nd edition. Scott Chacon and Ben Straub. A press. ISBN-13: 978-1484200773
15. Venuvinod, PK., MA. W., Rapid Prototyping – Laser Based and Other Technologies, Kluwer.

16. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010
17. Chapman W.A.J, "Workshop Technology", Volume I, II, III, CBS Publishers and distributors, 5th Edition,2002

COURSE CONTENTS AND LECTURE SCHEDULE		
No.		No. of Hours (19)
MODULE 1 (3 Hours)		
1.1	Introduction to micro controller and embedded systems,	1
1.2	Introduction to Arduino and its IDE Concept of digital and analog ports, registers, memory, timer, counter.	1
1.3	Embedded C programming: Arduino data types, operators, Array, Loop, Functions.	1
MODULE II (4 Hours)		
2.1	Embedded C programming: Working with Serial Monitor, Pins Configuration as INPUT/OUTPUT.	1
2.2	Embedded C programming: digitalRead(), digitalWrite(), Interrupts, delay(),Pull-up resistors.	1
2.3	Embedded C programming: Interfacing a 8 bit LCD to Arduino, Running message display	1
2.4	Sensor/Actuator Interface: Temperature Sensor, LDR based sensor, IR and Ultrasonic sensors, Relay, LED, Servomotor Introduction: PCB, pads, track, SMD, trough hole, via and its Design rules. Routing and Generating GERBER file	1
MODULE III (3 Hours)		
3.1	Introduction: PCB, pads, track, SMD, trough hole, via and its Design rules.	1
3.2	Routing and Generating GERBER file	1
3.3	PCB Chemical etching Vs Milling techniques, PCB Chemical Etching/Milling	1
MODULE IV (4 Hours)		
4.1	3D modeling, Slicing, 3 D printing	1
4.2	2D design using Inkscape, Laser CAD	1
4.3	Laser Cutting, 2D modelling, CNC Routing,	1
4.4	CNC Routing Tool familiarization	1
MODULE V (5 Hours)		
5.1	Familiarization of Google Docs, Google Sheets, Google Slides,	1
5.2	Google Drawings, Google Forms Google Sites	1
5.3	Doxygen – Overview, Installation, Getting started, Documenting the code, Markdown support, Lists,	1

5.4	Doxygen - Grouping, including formulas, Including tables, Graphs and diagrams, Preprocessing	1
5.5	Doxygen – Output Formats, Searching, Customizing the output, Custom Commands, Linking to external documentation	1

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Introduction to micro controller and embedded systems,	3	Simple Embedded C programs: Arduino data types, operators, Array, Loop, Functions
2	Introduction to Arduino and its IDE Concept of digital and analog ports, registers, memory, timer, counter.		
3	Embedded C programming: Arduino data types, operators, Array, Loop, Functions.		
4	Serial Monitor, Pins Configuration as INPUT/OUTPUT,digitalRead(), digitalWrite(), Interrupts, delay(),Pull-up resistors.	5	Embedded C programs to working with Serial Monitor, Pins Configuration as INPUT/OUTPUT, digitalRead(), digitalWrite(), Interrupts, delay(),Pull-up resistors. Implement : Water level control system. Distance measurement and Display unit. Home Automation system.
5	Introduction: PCB, pads, track, SMD, trough hole, via and its Design rules.	6	Design any two simple circuit using Easy EDA/ Eagle/ FlatCAM Routing and Generating GERBER file
6	PCB Chemical etching Vs Milling Techniques	2	Experiments with PCB Chemical Etching/Milling
7	3D modeling, Slicing, 3 D printing, 2D design using Inkscape, Laser CAD, Laser Cutting, 2D modelling, CNC Routing, CNC Routing, Tool familiarization	14	Machining of 3D geometry on soft material such as soft wood or modelling wax, 3D scanning of computer mouse geometry surface. 3D printing of scanned geometry. 2D profile cutting of press fit box/casing in acrylic (3 or 6

			mm thickness)/cardboard,D profile cutting on plywood /MDF (6-12 mm) for press fit Designs
8	Familiarization of Google Docs, Google Sheets, Google Slides, Google, Drawings, Google Forms Google Sites	2	Exercise for creating Google sheets, Google slides, Google forms and Google sites
9	Doxygen – Overview, Documenting the code, Markdown support, Lists, Grouping, Including formulas, Including tables, Graphs and diagrams, Preprocessing, Output Formats, Searching, Customizing the output, Custom Commands, Linking to external documentation.	4	Doxygen –Installation, Getting started Document the programs created for Raspberry pi and Arduino using Doxygen
	Familiarisation of Version control tools - GIT and GitHub	4	At least two programs in programming exercises must be done using GitHub

24HUL111	DESIGN THINKING	L	T	P	J	S	C	Year Of Introduction
		0	0	2	0	2	1	2024

Preamble: This course enables the students to understand the fundamentals of design thinking and use the basic tools, techniques & approaches. The various topics covered in this syllabus are: An Insight to Learning, Basics of design thinking, Being ingenious and fixing problems, Prototype and testing, Design thinking and customer centricity. This course helps the learners to apply design thinking approach while developing practical solutions for real world problems.

Prerequisite: NIL

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

CO1	Compare and classify the various learning styles and memory techniques and apply them in their engineering education.
CO2	Analyze emotional experience and inspect emotional expressions to better understand users while designing innovative products
CO3	Develop new ways of creative thinking and learn the innovation cycle of design thinking process for developing innovative products.
CO4	Propose solutions for real-world engineering problems by applying creative design thinking
CO5	Perceive individual differences and its impact on everyday decisions thereby lead and/or perform in a design team
CO6	Perform customer centric designing by intelligently accommodating customer requirements/challenges so as to eventually improve customer experience
CO7	Develop new designs for simple products using bio-mimicry to bring out new nature inspired designs
CO8	Solve practical engineering problem through innovative product design and creative solution

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓							✓	✓			✓
CO2				✓		✓		✓	✓	✓		✓
CO3	✓	✓	✓	✓		✓		✓	✓	✓		✓
CO4								✓	✓	✓		✓
CO5						✓		✓	✓	✓		✓
CO6	✓	✓	✓			✓		✓	✓	✓		✓
CO7	✓	✓	✓	✓		✓		✓	✓	✓		✓

Assessment Pattern

Bloom's Category	Continuous Assessment Tools	
	Class work	Test 1
Remember		
Understand	✓	✓
Apply	✓	✓

Analyse	✓	✓
Evaluate	✓	
Create	✓	

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Class work	Lab Exam/ Presentation	Total Marks
0-0-2-0	5	35	10	**50**

Total Mark distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
50	50	-	-

SYLLABUS

MODULE I (An Insight to Learning)

Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting. Remembering Memory - Understanding the Memory process, Problems in retention, Memory enhancement techniques, Emotions: - Experience & Expression, Understanding Emotions- Experience & Expression, Assessing Empathy, Application with Peers.

MODULE II (Basics of Design Thinking)

Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test. Being Ingenious & Fixing Problem - Understanding Creative thinking process, Understanding Problem Solving, Testing Creative, Problem Solving, Process of Product Design - Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, Assignment – Engineering Product Design

MODULE III (Prototyping & Testing)

What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, Sample, Example, Test Group Marketing, Celebrating the Difference - Understanding Individual differences & Uniqueness, Group Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences

MODULE IV (Design Thinking & Customer Centricity)

Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design, Feedback, Re-Design & Re-Create Feedback loop, Focus on User Experience, Address "ergonomic challenges, User focused design, rapid prototyping & testing, final product, Final Presentation – "Solving Practical Engineering Problem through Innovative
Product Design & Creative Solution".

Text books

1. YousefHaik, Sangarappillai Sivaloganathan, Tamer M. Shahin, Engineering Design Process, Cengage Learning 2003, Third Edition, ISBN-10: 781305253285,
2. Voland, G., Engineering by Design, Pearson India 2014, Second Edition, ISBN 9332535051

Reference books

1. Philip Kosky, Robert Balmer, William Keat, George Wise, Exploring Engineering, Fourth Edition: An Introduction to Engineering and Design, Academic Press 2015, 4th Edition, ISBN: 9780128012420.
2. Clive L. Dym, Engineering Design: A Project-Based Introduction, John Wiley & Sons, New York 2009, Fourth Edition, ISBN: 978-1-118-32458-5
3. Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers 2011, First Edition, ISBN: 978-1847886361
4. Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H., Engineering Design: A Systematic Approach, Springer 2007, Third Edition, ISBN 978-1-84628-319-2

Reference materials

1. Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School, https://www.amazon.in/Design-Thinking-Strategic-Innovation-Business/dp/8126572698/
2. Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability (3rd Edition), https://www.amazon.in/Dont-Make-Think-Revisited-Usability/dp/9332542864/
3. Design as Art (Penguin Modern Classics) https://www.amazon.in/Design-Art-Penguin-Modern-Classics/dp/0141035811/
4. Hooked: How to Build Habit-Forming Products ₹ 368 https://www.amazon.in/Hooked-How-Build-Habit-Forming-Products/dp/0241184835/
5. Emotional Design https://www.amazon.in/Emotional-Design-Don- Norman/dp/0465051367/
6. Value Proposition Design: How to Create Products and Services Customers Want https://www.amazon.in/Value-Proposition-Design-Products-Customers/dp/8126553073/
7. Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School, https://www.amazon.in/Design-Thinking-Strategic-Innovation-Business/dp/8126572698/
8. Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability (3rd Edition), https://www.amazon.in/Dont-Make-Think-Revisited-Usability/dp/9332542864/
9. Design as Art (Penguin Modern Classics) https://www.amazon.in/Design-Art-Penguin-Modern-Classics/dp/0141035811/
10. Hooked: How to Build Habit-Forming Products ₹ 368 https://www.amazon.in/Hooked-How-Build-Habit-Forming-Products/dp/0241184835/
11. Emotional Design https://www.amazon.in/Emotional-Design-Don- Norman/dp/0465051367/
12. Value Proposition Design: How to Create Products and Services Customers Want https://www.amazon.in/Value-Proposition-Design-Products-Customers/dp/8126553073/

13. The Art Of Creative Thinking , https://www.amazon.in/Art-Creative-Thinking-Rod-Judkins/dp/1444794485/
14. Lateral Thinking: A Textbook of Creativity, https://www.amazon.in/Lateral-Thinking-Creativity-Edward-Bono/dp/0241257549/
15. This is Service Design Thinking: Basics, Tools, Cases , https://www.amazon.in/This-Service-Design-Thinking-Basics/dp/1118156307/
16. The Design of Business, https://www.amazon.in/Design-Business-Roger-L-Martin/dp/1422177807/
17. The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses, and Ecosystems https://www.amazon.in/Design-Thinking-Playbook-Transformation-Businesses/dp/1119467470/
18. Thinking, Fast and Slow (Penguin Press Non-Fiction) https://www.amazon.in/Thinking-Fast-Penguin-Press-Non-Fiction/dp/0141033576/

LIST OF EXPERIMENTS	
No.	**Experiments**
1	Topic: An Insight to Learning, Remembering Memory, Emotions: Experience & Expression. 1. Group discussion/ Video presentation that addresses the concepts that shall be conveyed through the following questions. a) How learning happens? b) What are the main components of Kolb's cycle of experiential learning and examples? c) What is the memory process? d) What are the different memory enhancement techniques? e) What is the need for understanding emotions? f) Identify the different ways of assessing empathy and applying them among peers. g) Assume you got a chance to teach capitals of different countries in a UKG class. Illustrate what different memory enhancement techniques you will use through a role play. 2. Each team member of the group lists your positive and negative emotions. Among team members, discuss how each one of you manage each emotions. (Like finding happiness, escaping from sadness, managing anger, Facing fear, Overcoming shame etc you can put more questions). After the discussion did you get some technique to manage your emotion in a better way?

2	Topic: - An Approach to Introduce and Instill Design Thinking. – Class discussion based on the following questions and write down the conclusion in Work Book. a) What do you mean by designing something? What is design thinking and why it is needed? b) What are the different stages of design thinking process? c) How does the design thinking approach help engineers in creating innovative and efficient designs? d) How can the engineers arrive at better designs utilizing the iterative design thinking process (in which knowledge acquired in the later stages can be applied back to the earlier stages)? e) Describe the design thinking process using appropriate examples.
3	Topic: - Activities on becoming Ingenious to Apply Design Thinking to Solve Real-world Problems. Take up a real-world problem and apply creative thinking design to solve them. Make a video presentation based on your work that shall include the answer to following questions. a) What is creative thinking process? b) How can you describe the process of problem solving with examples? c) How creative thinking process helps in problem solving? d) How to test the efficacy of creative problem solving process?
4	Topic :- Perform Designing of an Innovative Product- i) Perform group discussion on following points a) How is engineering product design different from other kinds of design? b) Where and when do engineers perform product design? c) What are the different stages of product design? d) What are the different examples for best product designs and functions? ii) Based on the concepts learned, design an innovative product in your mind and give presentation
5	Topic: - Learn the Prototype Development Process and Testing. Illustrate the following concepts using appropriate tools. a) How to predict whether the design will function well or not? b) How do mathematics and physics become a part of the design process? c) What is Prototype? Why it is needed? d) What is rapid prototype development process? List the different methods in which the prototype of a product can be generated and tested.
6	Topic- Active Learning the Process of Divergent-Convergent Thinking and Designing in a Team: 1. Perform group discussion and/or other activities within a design team to refine and narrow down to the 'best design'. Create a report which specifies, how you identified and managed the following questions during the design.

	a) Describe how to create a number of possible designs and then how to refine and narrow down to the 'best design'? b) Why differences and uniqueness of individuals arise while designing in a team? c) How to manage conflicts in a design team? d) What is the need for different ways for communicating any design such as graphical, oral, written, presentation, models, prototypes, and so on?
7	Topic: - End User Feedback to Improve Design Synthesize End User Feedback to Improve Design Solution you identified in the exercise number 6.
8	Topic: - Develop Nature-inspired Designs utilizing Bio-mimicry, aesthetic , ergonomic and life cycle design approach: i) Class discussion to understand the following concepts a) What is the significance of Modular Design, Life Cycle Design Approaches in Design? b) How does the intelligence in nature inspire engineering designs? Give examples c) How do aesthetic and ergonomic challenges modify designs? d) How do concepts like value engineering, concurrent engineering and reverse engineering influence engineering designs? e) Based on the understanding you acquired through discussion develop new designs for simple products using bio-mimicry so as to bring out new nature inspired designs.
9	Topic: - Use Feedback to Improve Designs through Re-Design and Re-create. Get feedback of your any one of the earlier design exercises from the rest of the student groups and redesign accordingly. Also i) Answer the following questions a) How feedbacks can improve designs? How user experience helps the re-design? b) What is a typical feedback loop in design process? c) What is user focused design? d) What is the role of rapid prototyping & testing in developing the final design of products? ii) Make a presentation to show the process of redesigning of an existing product based on feedbacks.
10	Topic: - Applications of Design Thinking Make presentation to illustrate that it is possible to provide innovative solutions for practical problems through Design Thinking

BRANCH SPECIFIC 2
CREDIT COURSES
(SEMESTER I)

24AIT105	Introduction to Artificial Intelligence	L	T	P	J	S	C	Year of Introduction
		2	0	0	0	2	2	2024

Preamble: This course is designed to provide students with a robust understanding of AI principles, the functionality of intelligent agents, and various problem-solving techniques using search strategies. The curriculum also covers foundational concepts in Machine Learning and Neural Networks, equipping students with practical skills to develop, implement, and evaluate AI and ML models.

Prerequisite: NIL

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

CO1	Explain the foundational concepts of Artificial Intelligence, outline its historical evolution and discuss its practical applications. **(Understand Level)**
CO2	Examine the components and behavior of intelligent agents and assess the nature of their environments. **(Understand Level)**
CO3	Identify and distinguish the search strategies used in problem-solving within AI.**(Remember Level)**
CO4	Outline the fundamental concepts of machine learning models and explain performance measures used to evaluate them. **(Understand Level)**
CO5	Describe fundamental neural network structures and their components. **(Understand Level)**

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12
CO1	✓	✓				✓						✓
CO2	✓	✓	✓			✓						✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓									✓
CO5	✓	✓	✓									✓

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test2	Other tools	
Remember	✓	✓	✓	
Understand	✓	✓	✓	
Apply	✓	✓	✓	
Analyse				
Evaluate				
Create				

Mark Distribution of CIA					
Course Structure [L-T-P-J]	**Attendance**	**Theory [L- T]**			**Total Marks**
		Assignment	**Test-1**	**Test-2**	
2-0-0-0	5	35	30	30	**100**

Total Mark distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	100	-	-

SYLLABUS

MODULE I (Introduction)

Introduction to Artificial Intelligence(AI), Relationship to Human Brain, Approaches of AI, History of AI, Applications of AI, Types of AI - Narrow AI, General AI, and Superintelligent AI.

MODULE II (Intelligent Agents and Search strategies)

Intelligent Agents – Agents and Environments, Good behavior: The concept of rationality, Nature of Environments.

Search Strategies: Solving problems by searching, Problem solving Agents, Introduction to Uninformed search and Informed search strategy.

MODULE III (Towards Machine Learning)

Modelling problems - data classification, regression analysis and clustering, Modeling Input and Output.

Understanding Training- Supervised and Unsupervised Training, Stochastic and Deterministic Training, Splitting data (Train/Test/Validation), Concept of Overfitting and Underfitting

MODULE IV (Performance Evaluation)

Introduction to Linear Regression and Logistic Regression, Performance measures - Confusion matrix, Accuracy, Precision, Recall, Sensitivity, Specificity.

MODULE V (Neural Networks)

Introduction to neural networks - Single layer perceptrons, Multi Layer Perceptrons(MLPs), Activation functions - Sigmoid, Tanh, ReLU, Softmax, Loss function, Applications of neural networks.

Text books

1. Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, 4th Edition, Prentice Hall.
2. Artificial Intelligence For Humans, Volume 1: Fundamental Algorithms, Jeff Heaton.
3. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.

Reference books

1. Neural Networks and Deep Learning, Aggarwal, Charu C., c Springer International Publishing AG, part of Springer Nature 2018
2. Nilsson N.J., Artificial Intelligence - A New Synthesis, Harcourt Asia Pvt. Ltd.
3. Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms (1st. ed.). Nikhil Buduma and Nicholas Locascio.

2017. O'Reilly Media, Inc.

Suggested MOOC Course

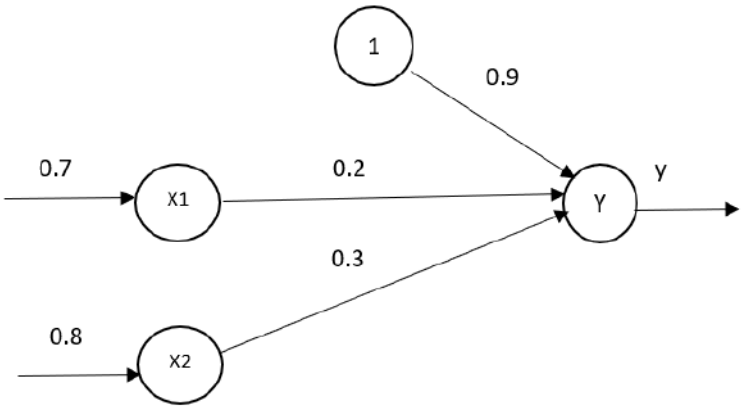
1. Fundamentals of Artificial intelligence by Prof. Shyamanta M. Hazarika, IIT Guwahati

COURSE CONTENTS AND LECTURE SCHEDULE		
No.		No. of Hours (23)
MODULE I (4 hours)		
1.1	Introduction to Artificial Intelligence (AI), Relationship to Human Brain	1
1.2	Approaches of AI-Think rationally, acting rationally, thinking humanly, acting humanly	1
1.3	History of AI, Application of AI	1
1.4	Types of AI - Narrow AI, General AI, and Superintelligent AI.	1
MODULE II (6 hours)		
2.1	Intelligent Agents – Agents and Environments	1
2.2	Good behavior: The concept of rationality	1
2.3	Nature of Environments	1
2.4	Search Strategies: Solving problems by searching	1
2.5	Problem solving Agents, Example problem – vacuum cleaner world	1
2.6	Introduction to Uninformed search strategy and uninformed search strategy	1
MODULE III (5 hours)		
3.1	Modelling problems - data classification, regression analysis, clustering	1
3.2	Modeling Input and Output- vectors and presenting pictures	1
3.3	Understanding Training- Supervised and Unsupervised Training, Stochastic and Deterministic Training	1
3.4	Splitting data – Explanation on Train/Test/Validation sets	1
3.5	Concept of Overfitting and Underfitting	1
MODULE IV (4 hours)		
4.1	Introduction to Linear Regression and Logistic Regression	1
4.2	Numerical Examples for linear and logistic regression	1
4.3	Performance measures - Confusion matrix, Accuracy, Precision, Recall, Sensitivity, Specificity.	1
4.4	Numerical Examples on Performance measures	1

MODULE V (5 hours)		
5.1	Introduction to neural networks - Single layer perceptrons, Multi Layer Perceptrons(MLPs)	1
5.2	Activation functions - Sigmoid, Tanh, ReLU, Softmax	1
5.3	Loss function – Sum of Squares, Mean Square, Root Mean square	1
5.4	Numerical Examples on Activation Functions and Loss Functions	1
5.5	Applications of neural networks	1

CO Assessment Questions	
CO1	1. Explain Turing Test approach and Cognitive modelling approach in terms of Artificial Intelligence. 2. To what extent are the following computer systems instances of artificial intelligence: i. Supermarket bar code scanners. ii. Web search engines. iii. Voice-activated telephone menus. 3. Discuss the milestones in the history of Artificial Intelligence.
CO2	1. For the following activities, give a PEAS description of the task environment and characterize it in terms of the task environment properties. i. Interactive English tutor ii. Performing a high jump. iii. Knitting a sweater. iv. Playing a tennis match 2. Identify the environment for an AI based on the following scenarios. Justify your answer. i. Self – Driving Car ii. Image Recognition iii. Playing chess 3. Distinguish between episodic and sequential environment.
CO3	1. State and explain the 5 components of a well-defined AI problem. Write the standard formulation for vacuum cleaner problem. 2. Explain why problem formulation must follow goal formulation. 3. Give a complete problem formulation for the following. “Using only four colors, you have to color a planar map in such a way that no two adjacent regions have the same color.” 4. Differentiate between informed and uninformed search strategies.
CO4	1. Suppose a computer program for recognizing dogs in photographs identifies 8 dogs in a picture containing 12 dogs and some cats. Of the 8 dogs identified, 5 are dogs, while the rest are cats. Compute the precision and recall of the computer program. 2. Calculate the regression coefficient, intercept value and obtain the lines of regression for the following data

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

CO5	1. For the network shown below, calculate the output of the neuron Y when the activation function is: i. Sigmoid ii. tanH iii. ReLu  2. Explain the role of an activation function in a neural network. Give the basic equation and draw the graphical representation of any three activation functions.

24ESP106	Programming Frameworks for AI	L	T	P	J	S	C	Year of Introduction
		1	0	2	0	3	2	2024

Preamble: This course equips students with the essential programming skills required for data science, focusing on the use of Python as the primary language. Students will explore Python's versatile frameworks and libraries, which are fundamental tools in the field of data science. This course not only prepares students to effectively use Python in data science but also lays the groundwork for advanced studies and professional work in the broader field of computer science and engineering.

Prerequisite:NIL

CO: After the completion of the course the student will be able to

CO1	Identify the necessary packages and set up a programming development. **[Understand Level]**
CO2	Apply data manipulation techniques to perform complex data transformations and analyses using advanced data structures, enhancing the efficiency and accuracy of data-driven insights. [**Understand Level]**
CO3	Apply fundamental data preprocessing techniques, including data cleaning, transformation, and feature engineering, to prepare datasets for analysis and improve the quality and interpretability of data-driven results. **[Understand Level]**
CO4	Customize different types of plots to visualize data and communicate insights effectively. **[Understand level]**
CO5	Apply basic statistical methods for data analysis, and use NLP techniques to process and analyze text data, including performing sentiment analysis to extract insights from textual information. **[Understand Level]**

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓			✓				✓
CO2	✓	✓			✓			✓				✓
CO3	✓	✓			✓			✓				✓
CO4	✓	✓			✓			✓				✓
CO5	✓	✓			✓			✓				✓

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test2	Other tools	
Remember		✓		
Understand		✓		
Apply				
Analyse				
Evaluate				
Create				

Assessment Pattern for Lab component

Bloom's Category	Continuous Assessment Tools	
	Class	Test1

	work	
Remember		✓
Understand		✓
Apply		
Analyse		
Evaluate		
Create		

Mark Distribution of CIA							
Course Structure [L-T-P-J]	**Attendance**	**Theory [L- T]**			**Practical [P]**		**Total Marks**
		Assignment	**Test-1**	**Test-2**	**Class work**	**Lab Exam**	
1-0-2-0	5	10	20		25	40	**100**

Total Mark distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	100	-—	—-

SYLLABUS

MODULE I (Setting Up Python for Data Analytics)

Introduction to Python and its relevance in data analytics. Lists, Tuples, and Dictionaries: Overview, operations, and applications in data analytics. Introduction to Python Libraries: Overview of Python's ecosystem for data analytics.

MODULE II (Data Structures and Data Manipulation)

Introduction to NumPy: Arrays, Array Operations, and Mathematical Functions. Introduction to Pandas: Series, DataFrames, Data Manipulation, and Operations.

MODULE III (Data Cleaning and Preparation)

Data Cleaning Techniques: Importance of data cleaning, Handling Missing Data, Removing Duplicates. Data Transformation: Scaling, Normalization, and Encoding. Feature Engineering: Creating New Features, Dimensionality Reduction. Data Merging and Aggregation: Merging Datasets, Grouping Data, and Aggregate Functions.

MODULE IV (Data Visualization)

Introduction to Matplotlib: Basic Plots (Line, Bar, Histogram), Customization (Titles, Labels, Legends). Advanced Visualization with Seaborn: Distribution Plots, Pair Plots, Heatmaps. Best Practices in Data Visualization: Choosing the Right Plot, Data Storytelling

MODULE V (Introduction to Statistical Analysis and Text Data Analytics)

Basic Statistical Analysis: Descriptive Statistics (Mean, Median, Mode, Variance), Correlation, and Covariance. Introduction to Natural Language Processing (NLP) with NLTK: Tokenization, Stemming, Lemmatization, and Simple Text Analytics. Sentiment Analysis: Basics of Sentiment Analysis Using Text Data

Text books

1. Wes McKinney, Python for Data Analysis, 2nd edition, O'Reilly Media, 2018.

Reference books

1. Steven Bird, Ewan Klein, and Edward Loper, Natural Language Processing with Python, 1st edition, O'Reilly Media, 2009.
2. Jake VanderPlas, Python Data Science handbook, O'Reilly Media, 2017.
3. Dipanjan Sarkar, Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from Your Data, Apress, 2016.

COURSE CONTENTS AND LECTURE SCHEDULE

No.		No. of Hours (12)
	MODULE 1 (2 Hours)	
1.1	Introduction to Python and its relevance in data analytics. Lists, Tuples, and Dictionaries: Overview, operations, and applications in data analytics	1
1.2	Introduction to Python Libraries: Overview of Python's ecosystem for data analytics.	1
	MODULE II (2 Hours)	
2.1	Introduction to NumPy: Arrays, Array Operations, and Mathematical Functions	1
2.2	Introduction to Pandas: Series, DataFrames, Data Manipulation, and Operations.	1
	MODULE III (3 Hours)	
3.1	Data Cleaning Techniques: Importance of data cleaning, Handling Missing Data, Removing Duplicates.	1
3.2	Data Transformation: Scaling, Normalization, and Encoding. Feature Engineering: Creating New Features, Dimensionality Reduction	1
3.3	Data Merging and Aggregation: Merging Datasets, Grouping Data, and Aggregate Functions.	1
	MODULE IV (2 Hours)	
4.1	Introduction to Matplotlib: Basic Plots (Line, Bar, Histogram), Customization (Titles, Labels, Legends).	1
4.2	Advanced Visualization with Seaborn: Distribution Plots, Pair Plots, Heatmaps. Best Practices in Data Visualization: Choosing the Right Plot, Data Storytelling	1
	MODULE V (3 Hours)	
5.1	Basic Statistical Analysis: Descriptive Statistics (Mean, Median, Mode, Variance), Correlation, and Covariance	1
5.2	Introduction to Natural Language Processing (NLP) with NLTK: Tokenization, Stemming, Lemmatization, and Simple Text Analytics.	1
5.3	Sentiment Analysis: Basics of Sentiment Analysis Using Text Data	1

LIST OF EXPERIMENTS

NO	EXPERIMENTS	No. of Hours
1	**Setting up the environment**	
	1. Install Anaconda, Jupyter Notebook, Spider and necessary packages like NumPy, Pandas, Matplotlib, Seaborn, scikit-learn, NLTK, etc	2
2	**List, Tuple & Dictionary**	
	1. Write a Python program to perform the following tasks : Create a list of integers, append a new value to the list, sort the list in ascending order and print the maximum, minimum, and average values in the list. 2. Write a Python program to perform the following tasks: Create a list of integers. Use a list comprehension to generate a new list of squared values from the original list, filter out the even numbers from the original list using a list comprehension. 3. Write a Python program to create a list of words from a given sentence and convert them to uppercase 4. Write a Python program to perform the following tasks: Given a list of words, create a dictionary to count the occurrences of each word, identify and print the most frequent word along with its count. Remove words that occur only once from the dictionary and print the updated dictionary. 5. Write a Python program to perform the following tasks: Create a tuple containing the names of five different cities. Access and print the first and last city in the tuple. Attempt to change one of the cities in the tuple and observe the result.	2
3	**Data structures with Library functions**	
	1. Create Numpy arrays for Integer, Float, String, Boolean, and Complex data types. 2. Perform Reshape, Join and Split operations in the arrays. 3. Perform Search and Sort operations in Numpy arrays 4. Use random module to generate random numbers, 1-D and 2-D random arrays, shuffle and make a choice of random element from them. 5. Generate the following distributions using random module and visualize them using seaborn module: Normal, Binomial, Poisson, Uniform, Logistic, Exponential, Chi-Square, etc.	2
4	**Data processing**	
	1. Create a Pandas Series and Dataframes from Dictionary 2. Use pandas to read a CSV file and store it in a DataFrame and display the information about the data with sample 5 top and bottom rows 3. Remove Empty data items, make data formats uniform, and remove the duplicates in it.	2
5	**Data Cleaning & Preparation**	
	1. Create a Pandas DataFrame with some missing values (NaN) in different columns.	6

	Print the original DataFrame. Demonstrate different techniques for handling missing data: ● Drop rows with missing values. ● Fill missing values with a specified constant. ● Fill missing values using forward fill and backward fill methods. Print the DataFrame after each operation. 2. Create a Pandas DataFrame with numerical columns representing different features. Use Scikit-learn to scale the data using: ● StandardScaler (mean=0, variance=1). ● MinMaxScaler (scaling values between 0 and 1). Apply normalization to the data and print the transformed DataFrame. 3. Create a Pandas DataFrame with categorical data columns. Convert categorical data into numerical data using: Label Encoding and One-Hot Encoding. 4. Write a Python program using Scikit-learn to perform the following tasks: Create a dataset with multiple features (at least 5) using Pandas. Apply Principal Component Analysis (PCA) to reduce the dataset to 2 principal components.Print the transformed dataset with the reduced dimensions. 5. Create two separate Pandas DataFrames with a common key column and Merge the DataFrames using: Inner join, Left join, Right join 6. Create a Pandas DataFrame with multiple columns, including a categorical column for grouping. Group the data by the categorical column and perform aggregation operations: ● Calculate the mean of numerical columns for each group. ● Count the number of occurrences in each group. ● Calculate the sum of numerical columns for each group	
6	**Data Visualization**	
	1. Generate a simple graph using Matplotlib. Also add titles and labels to the graph. 2. Generate a bargraph using matplotlib which shows the comparison of girls and boys opting for higher studies abroad over the last five years. 3. Using matplotlib generate a histogram to classify the population according to their age into five different bins. 4. Generate a piechart with matplotlib which shows the household expenses for a month. 5. Take any two plots from above exercises and plot it in a single figure using subplot function. 6. Find the co-relation among the features in Data and interpret	4

	it with proper messages 7. Use Scatterplot and histogram to describe the DataFrame Graphically	
7	**Statistical Analysis and Text Data Analytics** 1. Write a Python program using Pandas and NumPy to load a dataset, calculate and print the mean, median, mode, variance, and standard deviation for a numerical column, and compute and print the correlation and covariance matrices for the numerical columns 2. Write a Python program using NLTK to import a sample text, tokenize it into words and sentences using NLTK's word and sentence tokenizers, and print the list of tokens. 3. Write a Python program using NLTK to import a sample text, tokenize it into words, apply Porter Stemming and WordNet Lemmatization 4. Write a Python program using NLTK to import a sample text, tokenize it into words, calculate the frequency distribution using `FreqDist`, identify and plot the top 10 most common words. 5. Write a Python program using NLTK to import a text dataset, preprocess it by tokenizing and removing stop words, analyze sentiment using NLTK's VaderSentiment or another sentiment analyzer, classify each text as positive, negative, or neutral based on sentiment scores, and print the results along with the overall sentiment distribution percentages. 6. Write a Python program using Pandas, NLTK, and Seaborn to load a text dataset with sentiment labels, preprocess it by tokenizing, stemming, and lemmatizing, perform sentiment analysis with NLTK's sentiment analyzer, visualize the sentiment distribution using a Seaborn bar plot.	6

CO Assessment Questions	
CO1	1.Create a conda development environment installed with necessary packages for the development of an application dealing with Student data.
CO2	1.Write a NumPy program to compute the mean, standard deviation, and variance of a given array along the second axis. 2.Write a NumPy program to compute the covariance matrix of two given arrays. 3.Given a CSV file emp.csv with following columns (empno, name, designation, salary) of n employees. Write commands to do the following using pandas library. a) Read and display the content of emp.csv file b) Display the top 10 rows c) Display the list of all employees in the order of name d) Display the maximum salary and average salary
CO3	1.Given a dataset with missing values, duplicate entries, and a mix of numerical and categorical variables: 1. **Data Cleaning:**

	i. Load the dataset and handle missing values by filling them with the median value for numerical columns and the mode for categorical columns. ii. Remove any duplicate rows from the dataset. 2. **Data Transformation:** i. Normalize the numerical features to a range between 0 and 1. ii. Apply one-hot encoding to the categorical variables. 3. **Feature Engineering:** i. Create a new feature that represents the interaction between two existing numerical features. ii. Apply Principal Component Analysis (PCA) to reduce the dataset to 3 principal components.
CO4	1. You are a data analyst working for an e-commerce company. The company has provided you with a dataset that includes monthly sales data, customer demographics, and product categories. Your task is to analyze and visualize the data to uncover key insights that can guide business decisions. 1. **Data Visualization:** i. Create a line plot to visualize the trend of monthly sales over the past two years. ii. Generate a bar plot to compare the total sales across different product categories. 2. **Customization:** i. Customize the line plot by adding a title that reflects the sales trend, appropriate axis labels (e.g., "Months" and "Sales"), and a legend to indicate different sales channels (e.g., online and offline). ii. Customize the bar plot by applying a color palette that distinguishes each product category, adding data labels on the bars to display exact sales figures, and adjusting the bar width to enhance readability. 3. **Advanced Plotting:** i. Create a scatter plot to analyze the relationship between customer age and total spending, and add a trendline to visualize the correlation. ii. Generate a heatmap to display the correlation matrix between numerical variables, such as customer age, total spending, and frequency of purchases.
CO5	1. Write a Python program that loads a dataset of article ratings and reader comments, calculates basic statistics and correlations for the ratings, preprocesses the comments with NLTK (including tokenization, stop word removal, and stemming or lemmatization), performs sentiment analysis to classify the comments as positive, negative, or neutral, and prints the results

SEMESTER II

24MAP211	Probability and Statistics	L	T	P	J	S	C	Year of Introduction
		3	1	2	0	5	5	2024

Preamble: This course introduces the concept of discrete, continuous probability distributions, estimation, confidence interval and testing of hypothesis. The concepts discussed here are widely used in the modeling and analysis of a wide range of physical phenomena and has got application across all branches of engineering. After completing this course, students will acquire the ability to utilize the above concepts for solving mathematical problems more efficiently.

Prerequisite: A basic course in probability

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

CO1	Apply the concept and properties of discrete probability distributions in evaluating the required probabilities **(Apply level).**
CO2	Apply properties and important models of continuous random variables to analyze suitable random phenomena **(Apply level).**
CO3	Understand the concept of two dimensional random variables and apply them to solve different class of practical problems [**Apply level**]
CO4	Apply key statistical estimation techniques including point estimation, interval estimation and correlation, to analyze and interpret data effectively. [**Apply level**]
CO5	Perform statistical inferences concerning characteristics of a population based on attributes of samples drawn from the population **(Apply level).**

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓				✓			✓
CO2	✓	✓			✓				✓			✓
CO3	✓	✓			✓				✓			✓
CO4	✓	✓			✓				✓			✓
CO5	✓	✓			✓				✓			✓

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse				
Evaluate				
Create				

Assessment Pattern for Lab component

Bloom's Category	Continuous Assessment Tools	
	Class work	Test1
Remember	✓	✓
Understand	✓	✓
Apply	✓	✓
Analyse		
Evaluate		
Create		

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Theory [L- T]			Practical [P]		Total Marks
		Assignment	Test-1	Test-2	Class work	Lab Exam	
3-1-2-0	5	10	12.5	12.5	10	10	**60**

Total Marks distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	60	40	2.5 hours

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 2		2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x 8 = 40 marks) Time: 2.5 hours	40
	Total Marks: 0	Total Marks: [5x8 = 40 marks]	

SYLLABUS

MODULE I (Discrete probability distributions)

Introduction to probability, Conditional probability, Bayes' Theorem, Random variables, Discrete random variables, Probability distributions and Probability mass function, Cumulative distribution function, Mean and variance, Discrete probability distributions, Binomial distribution, Poisson distribution, Mean and variance of Binomial and Poisson distributions.

MODULE II (Continuous probability distributions)

Continuous random variables, Probability distributions and Probability density function, Cumulative distribution function, Continuous probability distributions, Uniform distribution, Mean and variance of uniform distributions, Normal distribution, Exponential distribution.

MODULE III (Joint Probability distributions)

Joint Probability distributions, Joint probability mass function, Joint probability density function, Marginal probability distributions, Marginal probability density function, Conditional probability distribution, Conditional probability density function, Independence of random variable, Covariance and Correlation, Multinomial probability distribution.

MODULE IV (Estimation of parameters)

Introduction to Estimation, Point estimation, Sampling distribution and Central limit theorem, Unbiased estimators, Variance of a point estimator, Minimum variance unbiased estimator(MVUE), Standard error, Method of point estimation,

Method of Maximum likelihood estimator(MLE), Interval estimation, Confidence interval on the means of a normal distribution-variance known, Confidence interval on the means of a normal distribution-variance unknown.

MODULE V (Test of Hypothesis)

Population and samples, Statistical hypothesis, Test of Hypothesis, One sided and two sided hypothesis, Large sample test for single mean and single proportion, Test on difference in mean variance known and difference in mean variance unknown, Small sample t-tests for single mean of normal population, Difference of means (for independent samples from two normal populations with equal variance).

Text books

1. Douglas C. Montgomery & George C. Runger, Applied Statistics and Probability for Engineers, 6th edition, Wiley, 2017.

Reference books

1. Jay L. Devore, Probability and Statistics for Engineering and the Sciences, 8th edition, Cengage, 2012.
2. J. E Freund & M. Miller, John E. Freund's Mathematical Statistics with Applications 8e. Pearson Education India, 2013.
3. Hossein Pishro-Nik, Introduction to Probability, Statistics and Random Processes, Kappa Research, 2014
4. Sheldon M. Ross, Introduction to probability and statistics for engineers and scientists, 4th edition, Elsevier, 2009.
5. T. Veera Rajan, Probability, Statistics and Random processes, Tata McGraw-Hill, 2008

COURSE CONTENTS AND LECTURE SCHEDULE

No.		No. of Hours (46)
	MODULE I (9 Hours)	
1.1	Introduction to probability, Conditional probability, Bayes' theorem	1
1.2	Discrete random variables and their probability distributions	1
1.3	Expectation, mean and variance	1
1.4	Binomial distribution-mean and variance	1
1.5	Problems on Binomial distribution	1
1.6	Problems on Binomial distribution (continued)	1
1.7	Poisson distribution- Poisson approximation to binomial	1
1.8	Poisson distribution- mean and variance	1
1.9	Problems on Poisson distribution	1
	MODULE II (9 Hours)	
2.1	Continuous random variables and their probability distributions	1
2.2	Expectation, mean and variance	1

2.3	Expectation, mean and variance(continued)	1
2.4	Uniform distribution – derivation of mean and variance	1
2.5	Problems on Uniform distribution	1
2.6	Normal distribution	1
2.7	Problems on Normal distribution	1
2.8	Problems on Normal distribution(continued)	1
2.9	Central limit theorem	
MODULE III (9 Hours)		
3.1	Jointly Distributed Random Variables-Two Discrete Random Variables	1
3.2	Marginal probability mass function of discrete random variable	1
3.3	Two continuous Random Variables	1
3.4	Marginal probability density function of continuous random variable	1
3.5	Marginal probability density function of continuous random variable(continued)	1
3.6	Independent Random Variables	1
3.7	Conditional distribution	1
3.8	Covariance and Correlation	1
3.9	Multinomial probability distribution.	
MODULE IV (9 Hours)		
4.1	Introduction to Estimation, Point estimation	1
4.2	Sampling distribution and Central limit theorem	1
4.3	Unbiased estimators	1
4.4	Variance of a point estimator, Minimum variance unbiased estimator(MVUE)	1
4.5	Standard error, Method of point estimation	1
4.6	Method of Maximum likelihood estimator(MLE)	1
4.7	Interval estimation	1
4.8	Confidence interval on the means of a normal distribution-variance known.	1
4.9	Confidence interval on the means of a normal distribution-variance unknown.	1

MODULE V (10 Hours)		
5.1	Population and samples, Statistical hypothesis	1
5.2	Test of Hypothesis, One sided and two sided hypothesis	1
5.3	Large sample test for single mean	1
5.4	Large sample test for single proportion	1
5.5	Test on difference in mean variance known	1
5.6	Test on difference in mean, variance unknown	1
5.7	Small sample t-tests for single mean of normal population	1
5.8	Small sample t-tests for single mean of normal population	1
5.9	Difference of means (for independent samples from two normal populations with equal variance).	1
5.10	Difference of means (for independent samples from two normal populations with equal variance).	1

LESSON PLAN FOR LAB COMPONENT (using R programming)

No.	Topic	No. of Hours	Experiment
1	Visualizing data	2	Creating tables,charts and plots.
2	Mean and variance	2	Finding mean, variance
3	Probability distributions	2	Set operations, simulation of various properties.
4	Binomial and poisson distribution	2	Demonstration of CDF and PMF of binomial and poisson distribution
5	Uniform, normal and exponential distribution.	2	Demonstration of CDF and PDF of Uniform, normal and exponential distribution.
6	Sampling distribution of sample mean (both large and small sample)	4	Solving problems related to sampling distribution of sample mean
5	Introduction to Estimation, Unbiased and Consistent Estimation, Maximum Likelihood Estimation (MLE) Interval Estimation and Confidence Interval	2	By loading a dataset, Compute the sample mean and sample variance of the variable. Check if the sample mean and sample variance are unbiased estimators of the population mean and variance for the wt (weight) variable.
		2	Fit a normal distribution to the given data and estimate the parameters (mean and

			standard deviation) using Maximum Likelihood Estimation.
		2	Calculate a 95% confidence interval for the mean of a particular variable in the dataset.
6	Correlation and Linear Regression	4	Fit a linear regression model to predict mpg using hp as the predictor. Summarize the model. Plot the fitted regression line along with the data points

CO Assessment Questions	
CO1	1. A certain hospital usually admits 50 patients per day. On the average 3 patients in 100 require special facilities found in special rooms. On the morning of a certain day it is found that there are three such rooms available. Assuming that 50 patients will be admitted find the probability that more than 3 patients will require such special rooms. 2. Using CAS, determine the probability of rolling a sum of 7 or 11 when rolling two fair six-sided dice? Calculate the mean and variance of the probability distribution, generate random samples, and visualize the probability mass function. 3. **Team Work:** Determine the probability of obtaining at least two heads when tossing a fair coin three times. Once the team has solved this problem, explore variations such as the probability of obtaining at least two heads when tossing the coin four times, or when using a biased coin with a 70% chance of heads and a 30% chance of tails. Explore these variations as a team and discuss the changes in probabilities.
CO2	1. A manufacturer knows from experience that the resistance of resistors he produces is normal with mean $\mu = 150\Omega$ and standard deviation $\sigma = 5\Omega$. What percentage of the resistors will have resistance between $148\,\Omega$ and $152\,\Omega$? Between $140\,\Omega$ and $160\,\Omega$? 2. A spinner selects a number X randomly from the interval $[0,2\pi)$. The probability of selecting any number between 0 and x is proportional to the length of the interval $[0, x]$. Find the density function of X. What is the probability that the spinner selects a number between 2 and 3? Verify the answer using CAS. 3. **Team Work:** Calculate the probability that a normally distributed random variable with a mean of 75 and a standard deviation of 10 falls between 70 and 80? Additionally, generate random samples from this distribution and visualize the probability density function using CAS.
CO3	1. An investor is analyzing the relationship between the daily closing price P of a particular stock and its trading volume V over a year. Where **Stock Price** P is Normally distributed with mean \$100 and standard deviation \$10 and **Trading Volume** V is Exponentially distributed with a rate parameter λ=0.1. Suppose the joint density function of P and V is

	$f_{P,V}(p,v) = \frac{0.1}{100}\exp\left(-\frac{(p-100)^2}{200}\right)\exp(-0.1v)$. Find the marginal density function of P and Calculate the probability that the trading volume V is less than 50 given that the stock price P is between 95 and 105. Verify the results using CAS 2. A hospital records the number of admissions A and the average wait time W for patients each day. **Number of admissions** A follows a Poisson distribution with mean 20. And **Average wait time** W follows a Normal distribution with mean 10+0.5A and standard deviation 2 hours. Find the marginal distribution of W and compute the probability that the average wait time W is more than 30 hours given that there are 25 admissions 3. **Team Work:** A company collects data on daily temperature T (in °C), which is normally distributed with a mean of 25°C and a standard deviation of 5°C, and daily ice cream sales S, which follows a Poisson distribution with a mean rate of 2T; given this setup, find the marginal distribution of S, the conditional distribution of S given T=30, calculate the probability that S>20 given 20<T<30, and determine whether S and T are independent.
CO4	1. A sample of 20 students who had recently taken elementary statistics yielded the following information on the brand of calculator owned (T Texas Instruments, H Hewlett Packard, C Casio, S Sharp): T T H T C T T S C H S S T H C T T T H T Estimate the true proportion of all such students who own a Texas Instruments calculator 2. Psychological tests of intelligence and of engineering ability were applied to 10 students. Here is a record of ungrouped data showing intelligence ratio (1.R.) and engineering ratio (E.R.). Calculate the co-efficient of correlation Student A B C D E F G H I J IR 105 104 102 101 10 99 98 96 93 92 ER 101 103 100 98 95 96 104 92 97 94 3. **Team Work:** The article "Gas Cooking, Kitchen Ventilation, and Exposure to Combustion Products" reported that for a sample of 50 kitchens with gas cooking appliances monitored during a one-week period, the sample mean CO2 level (ppm) was 654.16, and the sample standard deviation was 164.43. Calculate and interpret a 95% (two-sided) confidence interval for true average CO2 level in the population of all homes from which the sample was selected.
CO5	1. A manufacturer of nickel-hydrogen batteries randomly selects 100 nickel plates for test cells, cycles them a specified number of times, and determines that 14 of the plates have blistered. Does this provide compelling evidence for concluding that more than 10% of all plates blister under such circumstances? State and test the approximate hypothesis using a significance level of 0.05. 2.The mean produce of a sample of 100 fields is 200 lbs per acre with standard deviation of 10 lbs. Another sample of 150 fields gives the mean of 220 lbs with a standard deviation 12 lbs. Can the two

	samples be considered to have been take from the same population whose standard deviation is 11 lbs? Use 5% level of significance. Solve the problem using CAS and verify your answer. 3. **Team Work:** Using CAS, perform a hypothesis test to determine if there is a significant difference in the mean blood pressure between a control group and a treatment group. The datasets 'group1' and 'group2' represent the blood pressure measurements of the respective groups. Assume that the data follows a normal distribution and use a significance level of 0.05. Write CAS code to conduct the hypothesis test, calculate the test statistic, p-value, and provide a conclusion regarding the null hypothesis. Collaborate with your team members, execute the code, and interpret the results. Present your findings, discussing the hypothesis testing procedure and any notable observations made during the activity.

24CYP203	ENGINEERING CHEMISTRY (Circuit Branches)	L	T	P	J	S	C	Year of Introduction
		2	1	2	0	4	4	2024

Preamble: Enable the students to build a solid foundation in fundamentals of chemistry, to correlate theoretical concepts with their industrial/engineering applications and to get hands-on laboratory experience on the principles discussed in theory sessions. The course imparts knowledge on various important topics like atomic and molecular structure, electrochemistry, etc., as they apply to the field of engineering and to familiarize the students with different application-oriented topics like spectroscopy, molecular electronics, nanomaterials, etc. It helps the learners to prepare them for advanced concepts in chemistry and to do interdisciplinary research.

Prerequisite: Higher secondary level Chemistry

CO **:** After the completion of the course the student will be able to

CO1	Illustrate molecular orbital energy level diagram of diatomic molecules **[Understand level]**
CO2	Identify the suitable spectroscopy technique for the characterization of engineering materials and interpret spectral data. **[Apply level]**
CO3	Design electrochemical cells, compare the working of different electrochemical energy storage devices and describe corrosion control methods **[Understand level]**
CO4	Use the basic concepts of conducting polymers to design polymer based electronic devices [**Apply level**]
CO5	Recognize proper synthetic methods and describe applications of nanomaterials in science and engineering **[Apply level]**
CO6	Interpret molecular/system properties, gain skills to synthesize materials and carryout quantitative chemical analysis **[Apply level]**

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											✓
CO2	✓	✓			✓				✓	✓		✓
CO3	✓	✓							✓	✓		✓
CO4	✓	✓							✓	✓		✓
CO5	✓	✓			✓		✓		✓	✓		✓
CO6	✓	✓			✓			✓	✓	✓		✓

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse				
Evaluate				
Create				

Assessment Pattern for Lab component		
Bloom's Category	**Continuous Assessment Tools**	
	Class work	**Test1**
Remember		
Understand	✓	✓
Apply	✓	✓
Analyse		
Evaluate		
Create		

Mark Distribution of CIA							
Course Structure [L-T-P-J]	**Attendance**	**Theory [L- T]**			**Practical [P]**		**Total Marks**
		Assignment	**Test-1**	**Test-2**	**Class work**	**Lab Exam**	
2-1-2-0	5	10	12.5	12.5	10	10	60

Total Marks distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	60	40	2.5 hours

End Semester Examination [ESE]: Pattern			
PATTERN	**PART A**	**PART B**	**ESE Marks**
PATTERN 2		2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x 8 = 40 marks) Time: 2.5 hours	40
	Total Marks: 0	Total Marks: [5x8 = 40 marks]	

SYLLABUS

MODULE I (Atomic and Molecular Structure)

Atomic and molecular orbitals - Postulates of molecular orbital theory - Linear Combination of Atomic Orbitals (LCAO) - Molecular orbitals of diatomic molecules - Molecular orbital energy level diagrams of N_2 and O_2 - Metallic bonding - Limitations of Valence Bond Theory (VBT) - Introduction to Crystal Field Theory (CFT) – Band structure of solids and the role of doping on band structures.

MODULE II: (Spectroscopic Techniques and Applications)

Introduction to spectroscopy - Beer Lambert's law (Numericals)- UV-vis spectroscopy (introduction, various electronic transitions and applications)- Vibrational spectroscopy (introduction, Number of vibrational modes of CO_2 and

H_2O, applications) - Surface characterization techniques: introduction and applications of X-ray photoelectron spectroscopy (XPS) and Auger electron spectroscopy (AES) - Diffraction: introduction and applications of X-Ray Diffraction (XRD)

MODULE III (Electrochemistry and Corrosion)

Introduction - Differences between electrolytic and electrochemical cells - Daniel cell - Redox reactions - Cell representation - Construction and working of Calomel electrode - Electrochemical series and its applications - Nernst Equation (Derivation not required) - Single electrode and cell (Numericals) – Applications - Primary cells and secondary cells with examples - Construction and working of Lithium-ion cell - Introduction to fuel cell - Mechanism of electrochemical corrosion - Galvanic series - Cathodic protection.

MODULE IV (Molecular Electronics)

Charge transport carriers - soliton, polaron, bipolaron - Conducting polymers - intrinsically and extrinsically conducting polymers - Polyaniline, Polyacetylene, Poly (p-phenlylene) and Polypyrrole – Preparation, properties and applications - OLED - Principle, construction and advantages - Photoresist for electronics – Introduction to molecular devices based on conducting polymers (Field-effect transistor, Biosensors)

MODULE V (Nanomaterials)

Nanomaterials - Definition - Unique characteristics - Top-down and bottom-up approach for synthesis (Brief explanation) - Chemical methods of preparation - Hydrolysis, Reduction, Chemical vapor deposition (CVD) - Characterization techniques – Principle and instrumentation (block diagram) of Scanning electron Microscope (SEM) and Transmission electron microscope (TEM)- - Introduction and applications of Graphene, Carbon nanotube, Quantum dots, MXenes, Metal organic framework.

Text books

1. AICTE's Prescribed Textbook: Chemistry – I with Lab Manual, Khanna Book Publishing.
2. Engineering Chemistry, by Manisha Agrawal.
3. University chemistry, by B. H. Mahan.
4. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane.
5. Fundamentals of Molecular Spectroscopy, by C. N. Banwell.
6. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan.
7. Physical Chemistry, by P. W. Atkins.
8. A Textbook of Engineering Chemistry, Shashi Chawla
9. NANO: The Essentials: Understanding Nanoscience and Nanotechnology, by T. Pradeep

Reference books

1. Muhammed Arif, Annette Fernandez, Kavitha P. Nair, Engineering Chemistry, Owl Books, 2019.

2. Ahad J., Engineering Chemistry, Jai Publication, 2019.
3. Roy K. Varghese, Engineering Chemistry, Crownplus Publishers, 2019.
4. Soney C. George & Rino Laly Jose, Text Book of Engineering Chemistry, S. Chand & Company Pvt Ltd, 2019.
5. Jain and Jain, Engineering Chemistry, DhanpatRai Publishers, 17th Edition, 2018.
6. Wiley India, Engineering Chemistry, ISBN 9788126543205

COURSE CONTENTS AND LECTURE SCHEDULE		
No.		No. of Hours (36)
MODULE 1 (8 Hours)		
1.1	Atomic and molecular orbitals - Postulates of molecular orbital theory	1
1.2	Linear Combination of Atomic Orbitals (LCAO)	1
1.3	Molecular orbitals of diatomic molecules- Molecular orbital energy level diagrams of N_2	1
1.4	Molecular orbital energy level diagrams of O_2	1
1.5	Metallic bonding - Limitations of Valence Bond Theory (VBT)	1
1.6	Introduction to Crystal Field Theory (CFT)	1
1.7	Band structure of solids	1
1.8	Role of doping on band structures	1
MODULE II (7 Hours)		
2.1	Introduction to spectroscopy	1
2.2	Beer Lambert's law (Numericals), UV-vis spectroscopy - introduction	1
2.3	Various electronic transitions – applications	1
2.4	Vibrational spectroscopy - introduction,	1
2.5	Number of vibrational modes of CO_2 and H_2O – applications	1
2.6	Surface characterization techniques: introduction and applications of X-ray photoelectron spectroscopy (XPS) and Auger electron spectroscopy (AES)	1
2.7	Diffraction: introduction and applications of X-Ray Diffraction (XRD)	1
MODULE III (7 Hours)		
3.1	Introduction - Differences between electrolytic and electrochemical cells - Daniel cell - Redox reactions	1
3.2	Cell representation - Construction and working of Calomel electrode	1
3.3	Electrochemical series and its applications	1
3.4	Nernst Equation (derivation not required) - Single electrode and cell (Numericals) – Applications	1

3.5	Primary cells and secondary cells with examples - Construction and working of Lithium-ion cell	1
3.6	Introduction to fuel cell - Mechanism of electrochemical corrosion	1
3.7	Galvanic series - cathodic protection.	1
MODULE IV (7 Hours)		
4.1	Charge transport carriers - soliton, polaron, bipolaron	1
4.2	Conducting polymers - intrinsically and extrinsically conducting polymers	1
4.3	Polyaniline, Polyacetylene, Poly (p-phenlylene) and Polypyrrole – Preparation, properties and applications	1
4.4	OLED - Principle, construction and advantages	1
4.5	Photoresist for electronics	1
4.6	Introduction to molecular devices based on conducting polymers	1
4.7	Field-effect transistor, Biosensors	1
MODULE V (7 Hours)		
5.1	Nanomaterials - Definition - Unique characteristics	1
5.2	Top-down and bottom-up approach for synthesis (brief explanation) - Chemical methods of0 preparation - Hydrolysis	1
5.3	Chemical methods of preparation - Reduction, Chemical vapor deposition (CVD)	1
5.4	Characterization techniques – Principle and instrumentation (block diagram) of Scanning electron Microscope (SEM	1
5.5	Principle and instrumentation (block diagram) of Transmission electron microscope (TEM)	1
5.6	Introduction and applications of Graphene, Carbon nanotube	1
5.7	Introduction and applications of Quantum dots, MXenes, Metal organic framework	1

LESSON PLAN FOR LAB COMPONENT
(Any 7 experiments to be conducted)

No.	Topic	No. of Hours	Experiment
1	Electrochemistry	10	Experiment 1: Estimation of iron from iron ore/alloy Experiment 2: Determination of cell constant and conductivity of solutions Experiment 3: Potentiometric redox titration Experiment 4: Calibration of pH meter and determination of pH of solutions Experiment 5: Determination of pKa of weak acid using pH meter

2	Spectroscopy	4	Experiment 6: Analysis of IR spectra (minimum 3 spectra) Experiment 7: Analysis of XPS, AES, XRD spectra (minimum 3 spectra)
3	Synthesis of polymer and nanomaterial	8	Experiment 8: Synthesis of urea-formaldehyde Experiment 9: Synthesis of polyaniline Experiment 10: Synthesis of silver nanoparticles using chemical reduction method Experiment 11: Biogenic Synthesis of Silver Nanoparticles using plant extract
4	Water Chemistry	6	Experiment 12: Estimation of hardness of water by EDTA method Experiment 13: Determination of chloride content of water. Experiment 14: Determination of total alkalinity of water sample
5	Others	8	Experiment 15: Estimation of copper in brass Experiment 16: Identification of components in a mixture using TLC Experiment 17: Chemical analysis of a salt. Experiment 18: Chemical oscillations- Iodine clock reaction.

CO Assessment Questions	
CO1	1. Illustrate why the molecular orbital energy level diagram for O_2 is different from N_2
CO2	1. Choose a molecule. Find its IR spectrum from the web using any one of the following sources (i)AIST: Spectral Database for Organic Compounds (SDBS), https://sdbs.db.aist.go.jp/sdbs/cgi-bin/cre_index.cgi (ii) NIST chemistry webbook, https://webbook.nist.gov/chemistry/ (iii)Sigma Aldrich, https://www.sigmaaldrich.com/IN/en (iv) KnowItAll, https://www.knowitallanyware.com/#search. Interpret the spectrum in your own words highlighting how you can elucidate the structure of the molecule of your choice from the spectrum. a. Compare XPS and AES techniques and identify when each testing method is used.
CO3	1. Write the cell reactions of the following cell. $Cd/CdSO_4(0.01)//CuSO_4(0.5M)/Cu$. Sketch the electrochemical cell. a) Prepare a presentation on the topic “Energy storage devices; past, present and future” b) Write a report on the topic “Corrosion Control in Industry”

CO4	1. Prepare a table comparing various charge transport carriers in polymers 2. Prepare a power point presentation on conducting polymer-based biosensors
CO5	1. Compare top-down and bottom-up methods for nanomaterial synthesis. 2. Write a report on the role of nanotechnology in your branch of engineering 3. Group discussion on "can nanotechnology offer solutions to environmental issues"
CO6	1. Estimate the amount of iron from iron ore using volumetric and potentiometric titrations, compare the results and identify which technique is more accurate. 2. Collect water from three different sources. Measure their conductivity and pH and interpret the results.

24ESP204	PROBLEM SOLVING AND PROGRAMMING	L	T	P	J	S	C	Year of Introduction
		3	0	2	0	5	4	2024

Preamble: This course enables students to acquire problem solving and programming skills to solve computational problems. This course covers Basics of Computer Hardware and Software, C Programming basics, arrays, strings, structure, union, functions, pointers and files. This course helps the learners to think logically, computationally and creatively to solve real world problems.

Prerequisite: Nil

CO **:** After the completion of the course the student will be able to

CO1	Formulate simple algorithms/flowcharts for arithmetic and logical problems using appropriate tools. [Apply level]
CO2	Implement conditional branching, iteration and recursion.[Understand level]
CO3	Use arrays, pointers and structures to formulate algorithms and implement programs. [Understand level]
CO4	Decompose a problem into functions and synthesize a complete program using divide and conquer approach. [Understand level]
CO5	Develop readable C programs with files for reading input and storing output. [Understand level]
CO6	Test and execute the programs by correcting syntax and logical errors. [Understand level]

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓			✓				✓
CO2	✓	✓						✓				✓
CO3	✓	✓						✓				✓
CO4	✓	✓						✓				✓
CO5	✓	✓						✓				✓
CO6	✓	✓						✓				✓

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse			✓	
Evaluate				
Create				

Assessment Pattern for Lab component		
Bloom's Category	**Continuous Assessment Tools**	
	Class work	**Test1**
Remember		
Understand	✓	✓
Apply	✓	✓
Analyse	✓	✓
Evaluate	✓	
Create	✓	

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Theory [L- T]			Practical [P]		Total Marks
		Assignment	Test-1	Test-2	Class work	Lab Exam	
3-0-2-0	5	15	12.5	12.5	10	10	**60**

Total Marks distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	60	40	2.5 Hours

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 2		2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x 8 = 40 marks) Time: 2.5 hours	40
	Total Marks: 0	Total Marks: [5x8 = 40 marks]	

SYLLABUS

MODULE I (Basics of Computer Hardware and Software)

Basics of Computer Architecture: Processor, Memory, Input& Output devices. Application Software & System software: Compilers, interpreters, High level and low level languages, Introduction to structured approach to programming, Flow chart, Algorithms, Pseudo code (bubble sort, linear search - algorithms and pseudocode).

MODULE II (Program Basics)

Basic structure of C program: Character set, Tokens, Identifiers in C, Variables and Data Types, Constants, Console IO Operations, printf and scanf. Operators

and Expressions: Expressions and Arithmetic Operators, Relational and Logical Operators, Conditional operator, size of operator, Assignment operators and Bitwise Operators, Operators Precedence. Control Flow Statements: If Statement, Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue statements.(Simple programs
covering control flow).

MODULE III (Arrays and strings)

Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array. String processing: In built String handling functions (strlen, strcpy, strcat and strcmp, puts, gets). Linear search program, bubble sort program, simple programs covering arrays and strings.

MODULE IV (Working with functions)

Introduction to modular programming, writing functions, formal parameters, actual parameters, Pass by Value, Recursion, Arrays as Function Parameters structure, union, Storage Classes, Scope and life time of variables, simple programs using functions.

MODULE V (Pointers and Files)

Basics of Pointer: Declaring pointers, accessing data though pointers, NULL pointer, array access using pointers, pass by reference effect. File Operations: open, close, read, write, append. Sequential access and random access to files: In built file handling functions (rewind() ,fseek(), ftell(), feof(), fread(), fwrite()), simple programs covering pointers and files.

Text books

1. Schaum's Outline of Programming with C, Byron Gottfried, Jitender Chhabra Tata McGraw Hill, 2005.
2. Programming in ANSI C, E. Balagurusamy, Mcgraw Hill, 2019.
3. Programming in C, Asok N Kamthane, Pearson Education, 2015.
4. Computer Fundamentals, Anita Goel, Pearson Education.

References

1. Computer fundamentals and Programming in C, Anita Goel and Ajay Mittal, Pearson Education, 2016.
2. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, Pearson Education, 2015
3. Computer Basics and Programming in C, Rajaraman V, PHI, 2007.
4. Let us C, Yashavant Kanetkar, BPB Publications, 2016.

NPTEL/SWAYAM Courses

1. Introduction To Programming In C, Prof. Satyadev Nandakumar IIT Kanpur.
2. Problem Solving Through Programming In C, Prof. Anupam Basu IIT Kharagpur.

COURSE CONTENTS AND LECTURE SCHEDULE		
No.		No. of Hours (36)
MODULE I (7 Hours)		
1.1	Basics of Computer Architecture: Processor	1
1.2	Basics of Computer Architecture: Memory	1
1.3	Basics of Computer Architecture: Input& Output devices	1
1.4	Application Software & System software: Compilers, interpreters, High level and low level languages	1
1.5	Introduction to structured approach to programming, Flow chart	1
1.6	Algorithms, Pseudo code	1
1.7	Bubble sort, linear search - algorithms and pseudocode	1
MODULE II (8 Hours)		
2.1	Basic structure of C program: Character set, Tokens, Identifiers in C	1
2.2	Basic structure of C program: Variables and Data Types , Constants, Console IO Operations, printf and scanf	1
2.3	Operators and Expressions: Expressions and Arithmetic Operators, Relational and Logical Operators.	1
2.4	Operators and Expressions: Conditional operator, size of operator, Assignment operators and Bitwise Operators. Operators Precedence	1
2.5	Control Flow Statements: If Statement, Unconditional Branching using goto statement.(Simple programs covering control flow)	1
2.6	Control Flow Statements: Switch Statement, Break statement.(Simple programs covering control flow)	1
2.7	Control Flow Statements: While Loop, Do While Loop (Simple programs covering control flow)	1
2.8	Control Flow Statements: For Loop, Continue statement.(Simple programs covering control flow)	1
MODULE III (7 Hours)		
3.1	Arrays Declaration and Initialization, 1-Dimensional Array, Simple programs covering 1 – Dimensional Array	1
3.2	Arrays Declaration and Initialization, 2-Dimensional Array , Simple programs covering 2 – Dimensional Array	1
3.3	Arrays -2- Programs covering 1 and 2 – Dimensional Arrays	1
3.4	String processing: In-built String handling functions(strlen, strcpy, strcat and strcmp, puts, gets)	1
3.5	Linear search program- Implementation	1

3.6	Bubble sort program- Implementation	1
3.7	Simple programs covering arrays and strings	1
MODULE IV (7 Hours)		
4.1	Introduction to modular programming - writing functions	1
4.2	Writing functions with formal parameters and actual parameters	1
4.3	Writing functions with Pass by Value and Recursion	1
4.4	Writing functions with arrays as Function Parameters	1
4.5	Structure and union	1
4.6	Storage Classes, Scope and life time of variables	1
4.7	Simple programs using functions	1
MODULE V (7 Hours)		
5.1	Basics of Pointers: declaring pointers	1
5.2	Pointers: accessing data though pointers, NULL pointer, simple Programs	1
5.3	Pointers: Array access using pointers, pass by reference effect, simple programs	1
5.4	File Operations: open, close, read, write, append	1
5.5	Programs using file operations	1
5.6	Sequential access and random access to files: In built file handling functions (rewind() ,fseek(), ftell(), feof(), fread(), fwrite()),	1
5.7	Sequential access and random access to files: Simple programs	1

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Basics of Computer Architecture: Processor, Memory, Input& Output devices	1	Familiarization of Hardware Components of a Computer
2	Application Software & System software: Compilers, interpreters, High level and low level languages	1	Familiarization of Linux environment – How to do Programming in C with Linux
3	Introduction to structured approach to programming, Flow chart	2	Familiarization of Tools - Flowgorithm and Raptor. Develop flowcharts and algorithms for a set of given Problems

4	Basic structure of C program: Character set, Tokens, Identifiers in C, Variables and Data Types , Constants, Console IO Operations, printf and scanf	1	Familiarization of console I/O and operators in C i) Display “Hello World” ii) Read two numbers, add them and display their sum iii) Read the radius of a circle, calculate its area and display it iv) Evaluate the arithmetic expression ((a -b / c * d + e) * (f +g)) and display its solution. Read the values of the variables from the user through console.
5	Operators and Expressions: Expressions and Arithmetic Operators, Relational and Logical Operators, Conditional operator, sizeof operator, Assignment operators and Bitwise Operators. Operators Precedence	1	i) Read 3 integer values and find the largest among them. ii) Read a Natural Number and check whether the number is prime or not iii) Read a Natural Number and check whether the number is Armstrong or not
6	Control Flow Statements: If Statement, Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue statements.	1	
7	Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array	1	i) Read n integers, store them in an array and find their sum and average ii) Read n integers, store them in an array and search for an element in the array using an algorithm for Linear Search iii) Read n integers, store them in an array and sort the elements in the array using Bubble Sort Algorithm
	Linear search program, bubble sort program	1	
8	String processing: In built String handling functions(strlen, strcpy, strcat and strcmp, puts, gets)	2	i) Read a string (word), store it in an array and check whether it is a palindrome

			word or not. ii) Read two strings (each one ending with a $ symbol), store them in arrays and concatenate them without using library functions iii) Read a string (ending with a $ symbol), store it in an array and count the number of vowels, consonants and spaces in it.
9	Introduction to modular programming, writing functions, formal parameters, actual parameters	2	i) Find the factorial of a given Natural Number n usingrecursive and non recursive functions ii) Read a string (word), store it in an array and obtain its reverse by using a user defined function. iii)Write a menu driven program for performing matrix addition, multiplication and finding the transpose. Use functions to (a) read a matrix, (b) find the sum of two matrices, (c) find the product of two matrices, (d) find the transpose of a matrix and (e) display a matrix.
10	Pass by Value, Recursion, Arrays as Function Parameters	2	
	Structure, union, Storage Classes, Scope and life time of variables, simple programs using functions	2	i) Read two input each representing the distances between two points in the Euclidean space, store these in structure variables and add the two distance values. ii) Using structure, read and print data of n employees (Name, Employee Id and Salary) iii) Declare a union containing

			5 string variables (Name, House Name, City Name, State and Pin code) each with a length of C_SIZE (user defined constant). Then, read and display the address of a person using a variable of the union.
11	Basics of Pointers: declaring pointers, accessing data though pointers, NULL pointer, array access using pointers, pass by reference effect	3	i) Do the following using pointers (a) add two numbers (b)swap two numbers using a user defined function ii) Input and Print the elements of an array using pointers iii)Compute sum of the elements stored in an array using pointers and user defined function.
12	File Operations: open, close, read, write, append	2	i) Create a file and perform the following (a)Write data to the file (b)Read the data in a given file & display the file content on console (c)append new data and display on console ii) Open a text input file and count number of characters, words and lines in it; and store the results in an output file.
13	Sequential access and random access to files: In built file handlingfunctions (rewind() ,fseek(), ftell(), feof(), fread(), fwrite())	2	

CO Assessment Questions	
CO1	1. Write an algorithm and draw flowchart (using Flowgorithm/Raptor) a) To find the roots of a quadratic equation b) To check whether largest of 3 natural numbers is prime or not c) To sort a set of numbers
CO2	1. Develop a C program a) To process a set of n natural numbers and to find the largest even number and smallest odd number from the given set of numbers. The program should not use division and modulus operators.

	b) To find the value of a mathematical function f which is defined as follows. f(n) = n! / (sum of factors of n), if n is not prime and f(n) = n! / (sum of digits of n), if n is prime. c) To evaluate the series $x - x^2/2! + x^3/3! - \ldots$ n terms , for a given values of x and n.
CO3	1. Write a C program a) To sort a set of n integers and to find the number of unique numbers and the number of repeated numbers in the given set of numbers. Use a function which takes an integer array of n elements, sorts the array using the Bubble Sorting Technique and returns the number of unique numbers and the number of repeated numbers in the given array. b) To read and multiply two matrices using pointers c) To process the marks obtained by n students of a class and prepare their rank list based on the sum of the marks obtained. There are 3 subjects for which examinations are conducted and the third subject is an elective where a student is allowed to take any one of the two courses offered.
CO4	2. Write a menu driven program to a) Read a matrix, display a matrix, add two matrices, multiply two matrices, check symmetry and transpose a matrix. b) To read the details of a set of students, display the details of all students, sort the details based on roll number, search for a student using name
CO5	1. Write a C program to a) Process a text file and to print the Palindrome words into an output file. b) Store the details of books in a library using a file and perform updation, deletion and insertion of a book from on the file based on title
CO6	1. Test and execute the above programs using a C Complier.

24EST206	ENGINEERING GRAPHICS	L	T	P	J	S	C	Year of Introduction
		2	2	0	0	4	4	2024

Preamble: Practicing Engineers require conversion of ideas and design into new products or in interpreting information from existing drawings. The course in Engineering Graphics deals with orthographic / pictorial projections, dimensioning and specifications, sectional views, isometric projection, development of surfaces and use of CAD software in preparing drawings. It enables the students to acquire basic knowledge about Engineering drawing and prepare themselves for a career in Engineering.

Prerequisite : Nil

CO **:** After the completion of the course the student will be able to

CO1	Generate orthographic projections of lines inclined to one or both reference planes, ensuring accurate representation of their true length and orientation.
CO2	Construct orthographic projections of solids with axes inclined to one or both reference planes, demonstrating an understanding of their spatial orientation and dimensions.
CO3	Create sectional views of various solids, including prisms, pyramids, cones, and cylinders when cut by different section planes.
CO4	Create developed surfaces of solids that have been cut by different section planes.
CO5	Prepare pictorial drawings using the principles of isometric projection to visualize objects in three dimensions and convert isometric views to orthographic views.
CO6	Prepare multi-view orthographic projections of 3D solids using CAD tools by visualizing them in different positions.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2	✓											
CO3	✓											
CO4	✓											
CO5	✓									✓		✓
CO6	✓				✓					✓		✓

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse				
Evaluate				
Create				

Assessment Pattern for Lab component		
Bloom's Category	**Continuous Assessment Tools**	
	Class work	**Test1**
Remember		
Understand	✓	✓
Apply	✓	✓
Analyse		
Evaluate		
Create		

Mark Distribution of CIA					
Course Structure [L-T-P-J]	**Attendance**	**Theory [L- T]**			**Total Marks**
		Assignment	**Test-1**	**Test-2**	
2-2-0-0	5	10	12.5	12.5	**40**

Total Marks distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	40	60	3 hrs

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 3		2 questions will be given from each module, out of which 1 question should be answered. Each question carries 12 marks. Marks: (5x 12 = 60 marks) Time: 3 hours	60
	Total Marks: 0	Total Marks: [5x12 = 60 marks]	

SYLLABUS

MODULE I (Introduction to Engineering Drawing & Orthographic Projections)

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Dimensioning. Principles of Orthographic Projections-Conventions - Projections of Points and projection of lines parallel to/inclined to both reference planes. Traces of lines.

MODULE II (Projections of Regular Solids)

Projection of solids-Prisms, pyramids, solids of revolution-cone, cylinder. Solids with axis parallel to/ inclined to both the reference Planes- Auxiliary Views.

MODULE III (Sections and Sectional Views of Right Angular Solids)

Sections of Solids: Sections of Prisms, Pyramids, Cone, Cylinder with axis in

vertical position and cut by different section planes. True shape of the sections. Also locating the section plane when the true shape of the section is given.

MODULE IV (Development of Surfaces)

Development of Surfaces: Development of surfaces of the Prisms, Pyramids, Cone, Cylinder with axis in vertical position, development of surfaces of solids cut by different section planes. Shortest distance between two points on the surface.

MODULE V (Isometric Projections & 2D Drafting using software)

Isometric Projection: Isometric View and Projections of Prisms, Pyramids, Cone , Cylinder, Frustum of Pyramid, Frustum of Cone, Sphere, Hemisphere and their combinations. Conversion of Isometric Views to Orthographic Views.

AutoCAD (Internal Evaluation only)

Demonstrating knowledge of a 2D drafting software - Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Prepare orthographic views of 3 D objects from their isometric views.

Text books

1. P. I. Varghese, Engineering Graphics, Tata McGraw Hill Education
2. Prof. J Benjamin, Engineering Graphics, Pentex Publishers

Reference books

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House
2. https://nptel.ac.in/courses/112/103/112103019 (MOOC Course)

COURSE CONTENTS AND LECTURE SCHEDULE

No.		No. of Hours (44)
	MODULE I (10 Hours)	
1.1	Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Dimensioning	1
1.2	Principles of Orthographic Projections-Conventions - Projections of Points	1
1.3	Projections of Points (Problems on projection of points)	1
1.4	Projection of lines parallel to/inclined to one reference plane.	1
1.5	Projection of lines inclined to both reference planes. Line rotation method	1
1.6	Problem on lines inclined to both planes	1
1.7	Problem on lines inclined to both planes when apparent lengths are given.	1
1.8	Traces of lines using line rotation.	1
1.9	Problems on Lines using plane rotation method	1
1.10	Problems on Lines when traces are given.	1

MODULE II (12 Hours)		
2.1	Projection of solids- Prisms, pyramids - simple position	1
2.2	Projection of solids- Cylinder, cone - simple position	1
2.3	Projection of solids-Prisms and cylinder inclined to one plane.	1
2.4	Projection of solids-pyramid and cones inclined to one plane.	1
2.5	Projection of solids-Prisms inclined to both the reference Planes	1
2.6	Projection of solids-Pyramids inclined to both the reference Planes	1
2.7	Projection of solids-Cone inclined to both the reference Planes	1
2.8	Projection of solids-Cylinders inclined to both the reference Planes	1
2.9	Problems on projection of solids inclined to both planes.	2
2.10	Solids resting on VP	2
MODULE III (7 Hours)		
3.1	Introduction to section- Types of section planes - Sectional orthographic view of Prism when section plane perpendicular to VP inclined to HP	1
3.2	Sectional orthographic view of Pyramid when section plane perpendicular to VP inclined to HP	1
3.3	Sectional orthographic view of prism and Cylinder when section plane perpendicular to VP inclined to HP	1
3.4	Sectional orthographic view of Cone when section plane perpendicular to VP inclined to HP	1
3.5	Sectional orthographic view of above solids when section plane perpendicular to HP inclined to VP	1
3.6	Problems on Sectional orthographic view of above solids when true shape of the section is given	2
MODULE IV (7 Hours)		
4.1	Development of surfaces of Right Regular Solids – Prism.	1
4.2	Development of surfaces of Pyramid.	1
4.3	Problems on development of Prism and Pyramid for sectional solids.	2
4.4	Development of surfaces of Right Regular Solid- Cone and Cylinder.	1
4.5	Problems on development showing shortest path.	2
MODULE V (8 Hours)		
5.1	Principles of Isometric Projection-Isometric Scale-Isometric view	1
5.2	Isometric view of simple solids (Pyramids and Prisms)	1
5.3	Isometric view of simple solids (Cylinder and Cone)	1

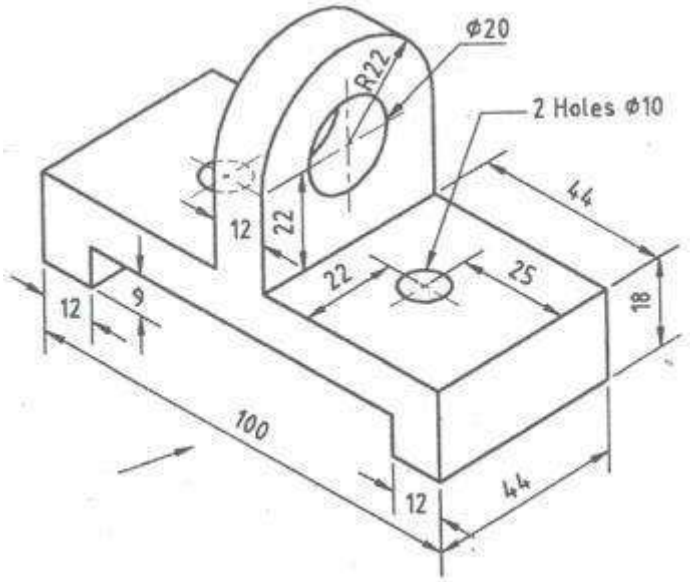
5.4	Isometric projection of above solids	1
5.5	Isometric projection of Compound solids.	2
5.6	Conversion of Isometric Views to Orthographic Views.	2

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Familiarization with AutoCAD commands and tools	2	Auto CAD drawing of Simple geometries
2	Dimensioning, conversion of isometric views in to orthographic views using AutoCAD	2	Conversion of simple components to orthographic views

CO Assessment Questions	
CO1	1. A line AB inclined at 40^0 to HP has its ends 50mm and 20mm above the HP. The length of its elevation is 65mm and its VT is 10 mm above the VP. Determine the true length of AB, its inclination with HP and its HT. How far the point HT from the X-Y line. 2. The end P of a line PQ is 30mm in front of VP and 40 mm above HP, while Q is behind VP and 10 mm above HP. The distance between projectors is 70mm. if the line joining the top views makes an angle of 45^0 with the XY line. Draw the projections and find (i) True length (ii) True inclinations (iii) locate the traces. 3. Two LED lights are to be fixed on a badminton court. The lights are 1m and 6 m away from a fixed vertical wall and 6m and 5m above the floor respectively. The distance between the lights measured parallel to the wall is 7m. Draw the projections assuming the wall as VP and the floor as HP. Also, find the actual length of the wire required to connect the two LED lights. Use a suitable scale.
CO2	1. A square prism of base side 30mm and length 50mm has a base edge on HP, axis inclined at 35^0 to HP. The base edge on which it rests is inclined 45^o to VP. Draw the projections of solid. 2. A hexagonal pyramid having a base with a 30mm side and a 50mm long axis rests on one of its base corners on the ground with axis inclined at 45^0 to the HP. Draw the projections when the vertical plane containing the axis and the corner makes 30^0 with the VP. 3. The trophy to be given to the winners of the football tournament has a frustum of a hexagonal pyramid with the base hexagon of 30mm side,

	top hexagon of 20mm side and height 80mm. the frustum is placed on top of a square prism of 100mm side and height 20mm. a sphere of radius 28mm is placed centrally on top of the frustum. Draw the plan and elevation of the trophy.
CO3	1. A square prism having a base of 40mm side and 60mm long axis rests on its base on the HP such that one of the vertical faces makes an angle of 30^{o} with the VP. A section plane perpendicular to the VP, inclined at 45^{o} to the HP and passing through the axis at a point 20mm from its top end, cuts the prism. Draw the front view, sectional top view and true shape of the section. 2. A cube with 45mm long edges rests on HP with vertical faces equally inclined to the VP. It is cut by a section plane perpendicular to the VP so that the true shape of the section is a regular hexagon. Draw the sectional top view and the true shape of the section. Determine the inclination of the section plane with the HP.
CO4	1. A cone with a 50 mm base diameter and 70 mm long axis rests on its base on the HP. Draw the development of its lateral surface when it is cut by an auxiliary inclined plane bisecting the axis and inclined at 45^{0} to the HP. 2. A hexagonal prism having base with a 30mm side and a 70mm axis is resting on its base on the ground with a side of base inclined at 45^{0} to the VP. It is cut by an auxiliary inclined plane making an angle of 45^{0} with the HP and passing through a point 15 mm below the top end of the axis. Obtain the development of the lateral surface of the truncated prism. 3. A sugar jar is in the form of a right circular cone of base diameter 60 mm and height 90 mm and it rests on HP. An ant starts moving from extreme left and of its base, returns to its starting point, after moving around it. Find geometrically the length of the shortest path the ant can take. Show this in both front and top views.
CO5	1. A hemisphere of diameter 80mm is resting on the ground with its flat surface facing upwards. A square pyramid having side of base 40mm and axis 60mm is resting on the base centrally on the top of the hemisphere. Draw the isometric view of the combination of solids. 2. A waste basket is of the shape of a frustum of a hexagonal pyramid with base side 30 cm, top side 50 cm and height 100 cm. Draw the isometric projection of the basket which is standing vertically with smaller hexagonal base on the ground. 3. Using any free software (2D drafting software), prepare the three orthographic views of the machine component shown in figure, following the ISO standards.

	 ISOMETRIC VIEW
CO6	1. Design a simple pen stand for your study table and draw the three orthographic views of the product using AutoCAD software, following the ISO standards of Engineering drawing and print it on A4 size paper and submit your design. 2. Design a small ornament box and draw the three orthographic views of the product using AutoCAD software, following the ISO standards of Engineering drawing and print it on A4 size paper and submit your design.

24ESL207	MANUFACTURING PRACTICES	L	T	P	J	S	C	Year of Introduction
		0	0	4	0	4	2	2024

Preamble: To enable the student to familiarize various tools, measuring devices, practices and different methods of manufacturing processes employed in industry for fabricating components. Topics that give exposure to the hands-on experience on various basic engineering practices in Mechanical, Electrical and Electronics Engineering are included. This helps the learners to apply this experience while developing product/project for the benefit of society.

Prerequisite: NIL

CO **:** After the completion of the course the student will be able to

CO1	Identify different manufacturing processes which are commonly employed in the industry to fabricate components **[Understand level]**
CO2	Use appropriate tools and instruments with respect to the mechanical workshop trades and fabricate components as per the design **[Apply level]**
CO3	Identify the tools used for electrical wiring, accessories, wires, cables, batteries and standard symbols. Execute wiring for simple circuits. **[Understand level]**
CO4	Develop the schematics and execute simple wiring circuits for domestic buildings.**[Apply level]**
CO5	Identify and test various electronic components. Fabricate electronic circuits on printed circuit boards and its testing. **[Understand level]**

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓	✓							✓	✓		✓
CO3	✓	✓							✓	✓		✓
CO4	✓								✓	✓		✓
CO5	✓								✓	✓		✓

Assessment Pattern

Bloom's Category	Continuous Assessment Tools	
	Class work	Test1
Remember		
Understand	✓	✓
Apply	✓	✓
Analyse	✓	✓
Evaluate	✓	
Create	✓	

Mark Distribution of CIA				
Course Structure [L-T-P-J]	**Attendance**	**Class work**	**Lab Exam**	**Total Marks**
0-0-4-0	5	55	40	**100**

Total Mark distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
	100	0	-

SYLLABUS- DETAILS OF EXPERIMENTS

- Manufacturing Methods- Moulding and casting, and sheet metal
- Conventional Machining (turning, drilling and shaping), CNC Machining
- Fitting operations, Welding (Arc, gas and brazing)
- Carpentry & power tools, Plumbing, Plastic moulding and glass cutting
- Electrical engineering - Study of tools, accessories and safety rules, batteries and earthing, Electrical machines and Transformer. Wiring exercises for simple circuits
- Electronics Engineering – Study of electronic components, instruments, testing of electronic devices. Soldering exercises on PCB and electronic circuits

Text books

1. Veerana D. K., Workshop / Manufacturing Practices, ISBN 9391505333
2. Robert L.Boylestad' " Electronic Devices and Circuit Theory", Prentice Hall of India, 2007
3. D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2010

Reference books

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai**.**
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.
6. https://archive.nptel.ac.in/courses/112/107/112107219/mooc
7. Bernard Grob, "Basic Electronics", Tata McGraw Hill, 2000

LIST OF EXPERIMENTS

Mechanical –– 24 Hours	
No.	**Experiments**
1	Study and Exercise on foundry. Preparation of mould and making the cast of a given component
2	Study and Exercise on sheet metal. Make the box/can/tray with metal sheet as per the design
3	Study and Exercise on fitting and joining. Prepare the joints and weld together as per the drawing
4	Study and Exercise on Machining Prepare the model as per the drawing using turning, shaping and drilling operations.
5	Study and Exercise on Carpentry. Make simple wooden products like box, rack, etc using power tools.
6	Study and Exercise on plumbing. Do the pipeline assembly as per the sketch
7	Study on CNC Machine, Injection moulding machine, Glass cutting (Demo only)
8	Study on Electric devices and wiring. Exercise on simple wiring for lighting, fan, etc as per the design
9	Study on electronic components and soldering. Exercise on soldering the PCB and circuits as per the given design.

ELECTRICAL WORKSHOP -12 Hours	
1	• Introduction to the precautionary steps adopted for Electrical shocks. • Identify the Tools used for Electrical Wiring • Study of Electrical Circuit Symbols and familiarization of wiring Accessories.
2	Prepare an estimate and Wire-up: A circuit having one light and fan point.
3	Prepare an estimate and Wire-up: A light/fan circuit using two-way switches. (Staircase wiring)
4	Prepare an estimate and Wire-up: A circuit having fluorescent lamp and socket outlet (6A).
5	Prepare an estimate and Wire-up: A Distribution board with one light point and one power outlet (16A) as sub circuits.
6	i) Demonstration of inverter wiring ii) Demonstration of Earthing Schemes. iii) Demonstration of Earth resistance measurement using equipment.

ELECTRONICS WORKSHOP -12 Hours	
1	Familiarization and identification of active and passive electronic components (Resistor, Capacitor, Inductor, diode, transistor, sensing

	elements, transformer) ● Calculation of values, Usage of Data Sheets to find various specifications of Components.
2	Familiarization of Electronic Equipments (Fixed and Variable Power Supply, Function Generator, CRO, Ammeter, Voltmeter etc.) ● Generation of Periodic waveforms using function generator and measuring various parameters. (Peak Value, Peak to Peak Value, RMS Value, Frequency etc.) ● Testing of Diode and Transistors ● Measurement of Current and Voltage in Series and Parallel resistor
3	Implementation of Circuits in bread board ● Connecting LED from supply (Application of Resistor). ● LED Connection using capacitor (Charge Storage application of Capacitor). ● Application of Sensing Element (LDR). ● Full wave Bridge Rectifier Circuit
4	Soldering Practice ● Full Wave Bridge Rectifier
5	Introduction to Electronic Simulation tools- LT SPICE ● Voltage and current through Series and Parallel passive components for AC and DC inputs. ● Simulation of rectifier circuits.

CO Assessment Questions	
CO1	Identify the best suitable manufacturing processes for a given product/design
CO2	A team work to fabricate the component as per the given design using available manufacturing methods and submit the report
CO3	Identify the components in the electric system shown in the drawing and complete the wiring as per the drawing to get the required result
CO4	Identify the electronic components in the given figure and assemble the component on a circuit board to enable the required function

24MCT210	SPORTS AND WELLNESS	L	T	P	J	S	C	Year of Introduction
		2	0	0	0	2	1	2024

Preamble: Sports and wellness enable the students

- To understand the importance of sound health fitness principles as they relate to better health.
- To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.
- To create a safe, progressive, methodical and efficient activity-based plan to enhance improvement and minimize risk of injury.
- To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health.

Prerequisite:

CO **:** After the completion of the course the student will be able to

CO1	Explain health related fitness components: cardio respiratory endurance, flexibility and body composition etc.
CO2	Apply first aid in real situation.
CO3	Apply physiological principles related to exercise and training.
CO4	Identify opportunities for participation in sports and games activities.
CO5	Practice physical activities and yoga for flexibility, relaxation and quality life style.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								✓	✓	✓		✓
CO2								✓	✓	✓		✓
CO3								✓	✓	✓		✓
CO4								✓	✓	✓		✓
CO5								✓	✓	✓		✓

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse			✓	
Evaluate				
Create				

Mark Distribution of CIA					
Course Structure [L-T-P-J]	**Attendance**	**Theory [L- T]**			**Total Marks**
		Assignment	**Test-1**	**Test-2**	
2-0-0-0	5	35	30	30	**100**

Total Mark distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	100	0	0

SYLLABUS

MODULE I (Physical Fitness, Wellness and Exercise Programmes)

- Meaning and importance of physical fitness and wellness.
- Components of health-related fitness and sports related fitness
- How to start an exercise programme.
- How to select proper exercises.
- Exercise for improving speed, strength, endurance, and flexibility and co ordinative abilities.
- Exercises to prevent back pain, tennis elbow, shoulder injury and knee pain, neck pain.
- Fitness test for health-related fitness components.
- Importance of weight training.
- Importance of warming up and cooling down.
- How to deal with every day stress.

MODULE II (First Aid)

- First aid and principles of first aid
- First aid measure for the following –
  Bleeding through Nose, Snakebite, Dog Bite, Electric Shock, Burns and Drowning
- Common injuries and their management
  Wounds, Cuts, Sprain, Strain, Fracture and Dislocation.
- Cardio pulmonary resuscitation. (CPR)
- How to prevent muscle cramps and its management.
- How to carry an injured person.

MODULE III (Fundamentals of Anatomy and Physiology in Physical Education and Postures)

- Define Anatomy, physiology and its importance.

- Effects of exercise on the functioning of various body system (Cardio respiratory system, muscular system and digestive system)
- Posture and its importance.
- Common Postural Deformities-Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis.
- Corrective Measures for Postural Deformities.
- Exercise and happy hormones.
- Substance abuse.

MODULE IV (Sports and Games)

- Following subtopics related to anyone game/sport of choice of student out of Football, Shuttle badminton, Volleyball, Basketball, Tennis and cricket
- Specification of play fields and related sports equipments
- Sports and games for recreation.

Latest general rule of the game / sports.

MODULE V (Lifestyle and Yoga)

- Balanced diet, mal nutrition and Deficiency disease.
- Healthy diet plan.
- Hydration and its importance.
- Personal hygiene.
- Rest and recovery.
- Importance of sleep.
- Meaning & importance of Yoga.
- Introduction-Asanas, Pranayama, Meditation.
- Relaxation Techniques in yoga
- Asanas to prevent life style disease.

Text books

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

Reference books

1. Physiological aspects of sports training and performance by Jay Hoffman.
2. Periodization theory and methodology of training by Tudor O Bompa and G Grisgery Haff.
3. Essential of strength training and conditioning by Thomas Baechle E R, Roger W Earle.
4. A practice guide to emergency first aid, safety injuries, illnesses by Montreal.

COURSE CONTENTS AND LECTURE SCHEDULE		
No.		No. of Hours (24)
MODULE I (6 Hours)		
1.1	• Meaning and importance of physical fitness and wellness. • Components of health-related fitness and sports related fitness.	1
1.2	• How to start an exercise programme. • Exercise for improving speed, strength, endurance, and flexibility and co ordinative abilities. • How to select proper exercises.	1
1.3	• Exercises to prevent back pain, tennis elbow, shoulder injury and knee pain, Neck pain.	1
1.4	• Fitness test for health-related fitness components.	1
1.5	• Importance of weight training. • Importance of warming up and cooling down.	1
1.6	• How to deal with every day stress.	1
MODULE II (4Hours)		
2.1	• First aid and principles of first aid • First aid measure for the following – Bleeding through Nose, Snakebite, Dog Bite, Electric Shock, Burns and Drowning.	1
2.2	• Common injuries and their management Wounds, Cuts, Sprain, Strain, Fracture and Dislocation.	1
2.3	• Cardio pulmonary resuscitation. (CPR)	1
2.4	• How to prevent muscle cramps and its management. • How to carry an injured person	1
	MODULE III (4 Hours)	
3.1	• Define Anatomy, physiology and its importance. • Effects of exercise on the functioning of various body system (Cardio respiratory system, muscular system and digestive system)	1
3.2	• Posture and its importance.	1
3.3	• Common Postural Deformities-Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis. • Corrective Measures for Postural Deformities.	1

3.4	• Exercise and happy hormones. • Substance abuse.	1
MODULE IV (6 Hours)		
4.1	Football	1
4.2	Shuttle badminton	1
4.3	Volleyball	1
4.4	Basketball	1
4.5	Cricket	1
4.6	Tennis • Sports and games for recreation. Latest general rule of the game / sports. Specification of play fields and related sports equipment	1
	Module V (4 Hours)	
5.1	• Balanced diet, mal nutrition and Deficiency disease. • Healthy diet plan • Hydration and its importance.	1
5.2	• Personal hygiene. • Rest and recovery. • Importance of sleep.	1
5.3	• Meaning & importance of Yoga. • Introduction-Asanas, Pranayama, Meditation.	1
5.4	• Relaxation techniques in yoga. • Asanas to prevent life style disease.	1

CO Assessment Questions	
CO1	What are the types of Asanas for improving strength and flexibilities?
CO2	What are the physiological changes to cardio respiratory system during exercise?
CO3	What are the first aid to sprains and strains?
CO4	How to develop cardio respiratory fitness?
CO5	Which are the seventeen laws in football?
CO6	Which are the exercises to prevent back and shoulder pain?

24HUT211	Universal Human Values-II	L	T	P	J	S	C	Year of Introduction
		2	1	0	0	3	3	2024

Preamble: This course helps the students to appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings. The topics covered in this course are the concepts of self exploration, values and skills, happiness and prosperity, harmony in family and society, harmony in the nature and society, and ethical values needed for the life and profession of an individual. This course enables the learners to develop a holistic perspective towards life and profession & towards happiness and prosperity based on a correct understanding of the human reality and the rest of existence.

Prerequisite: Universal Human Values I (Student Induction Program)

CO: After the completion of the course the student will be able to

CO1	Evaluate the significance of value inputs in formal education and start applying them in their life and profession. **[Apply level]**
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual. **[Analyse level]**
CO3	Demonstrate the value of harmonious relationship based on trust and respect in their life and profession. **[Analyse level]**
CO4	Examine the role of a human being in ensuring harmony in society and nature. **[Analyse level]**
CO5	Use the understanding of ethical conduct to formulate the strategy for ethical life and profession. **[Apply level]**

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						✓	✓	✓	✓	✓		✓
CO2						✓	✓	✓	✓	✓		✓
CO3						✓	✓	✓	✓	✓		✓
CO4						✓	✓	✓	✓	✓		✓
CO5						✓	✓	✓	✓	✓		✓

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse				
Evaluate				
Create				

Mark Distribution of CIA					
Course Structure [L-T-P-J]	**Attendance**	**Theory [L- T]**			**Total Marks**
		Assignment	**Test-1**	**Test-2**	
2-1-0-0	5	15	10	10	**40**

Total Mark distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	40	60	3 hours

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 1	10 Questions, each question carries 2 marks Marks: (2x10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x8 = 40 marks) Time: 3 hours	60
	Total Marks: 20	Total Marks: [5x8 = 40 marks]	

SYLLABUS

MODULE I (Introduction to Value Education)

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

MODULE II (Harmony in the Human Being)

Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

MODULE III (Harmony in the Family and Society)

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

MODULE IV (Harmony in the Nature/Existence)

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, Holistic Perception of Harmony in Existence.

MODULE V (Implications of the Holistic Understanding – a Look at Professional Ethics)
Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models- Typical, Strategies for Transition towards Value-based Life and Profession.

Text books

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019.

Reference books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book). Annie Leonard, Publisher: Free Press (February 22, 2011), ISBN13: 9781451610291
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

COURSE CONTENTS AND LECTURE SCHEDULE

No.		No. of Hours (36)
MODULE I (8 Hours)		
1.1	Understanding Value Education	1
1.2	Tutorial 1- Sharing about Oneself	1
1.3	Self-exploration as the Process for Value Education	1
1.4	Continuous Happiness and Prosperity – the Basic Human Aspirations	1
1.5	Tutorial 2 - Exploring Human Consciousness	1
1.6	Happiness and Prosperity – Current Scenario	1
1.7	Method to Fulfill the Basic Human Aspirations	1
1.8	Tutorial 3 - Exploring Natural Acceptance	1
MODULE II (8 Hours)		
2.1	Understanding Human being as the Co-existence of the Self and the Body	1
2.2	Distinguishing between the Needs of the Self and the Body	1
2.3	Tutorial 1 - Exploring the difference of Needs of Self and Body	1
2.4	The Body as an Instrument of the Self and Understanding Harmony in the Self	1
2.5	Tutorial 2 - Exploring Sources of Imagination in the Self	1

2.6	Harmony of the Self with the Body	1
2.7	Programme to ensure self-regulation and Health	1
2.8	Tutorial 3 - Exploring Harmony of Self with the Body	1
MODULE III (8 Hours)		
3.1	Harmony in the Family – the Basic Unit of Human Interaction	1
3.2	'Trust' – the Foundational Value in Relationship	1
3.3	Tutorial 1 - Exploring the Feeling of Trust	1
3.4	'Respect' – as the Right Evaluation	1
3.5	Tutorial 2 - Exploring the Feeling of Respect	1
3.6	Other Feelings, Justice in Human-to-Human Relationship	1
3.7	Understanding Harmony in the Society and Vision for the Universal Human Order	1
3.8	Tutorial 3 - Exploring Systems to fulfill Human Goal	1
MODULE IV (5 Hours)		
4.1	Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature	1
4.2	Tutorial 1 - Exploring the Four Orders of Nature	1
4.3	Realizing Existence as Co-existence at All Levels	1
4.4	The Holistic Perception of Harmony in Existence	1
4.5	Tutorial 2 - Exploring Co-existence in Existence	1
MODULE V (7 Hours)		
5.1	Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct	1
5.2	Exploring Ethical Human Conduct	1
5.3	A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Professional Ethics	1
5.4	Exploring Humanistic Models in Education	1
5.5	Holistic Technologies, Production Systems and Management Models-Typical Case Studies	1
5.6	Strategies for Transition towards Value-based Life and Profession	1
5.7	Exploring Steps of Transition towards Universal Human Order	1

CO Assessment Questions	
CO1	1. What does a fulfilling life mean for you? List out the top five points that occur to you when you think of a fulfilling life. While making the list, please consider your entire life, not just the present stage of your life (youth, middle age, old age, etc.). 2. Choose any five things that you consider as human values. Now write all the basic guidelines, and check if you they satisfy the basic guidelines.

(Hint: Someone may say Trust is a human value. Now check if it satisfies the basic guidelines.]

3. List your activities throughout a typical day in your life. Categorize these activities as activity for developing right understanding, activity for fulfillment in relationship and activity for physical facility (see table, below).

Activity	**This activity has time and effort for**		
	Right understanding	Fulfillment in relationship	Physical facility
Exercise, playing games (2 hrs/day)	?	?	2 hrs (for health of body)
Talking with friends	?	3 hrs (for relationship)	?
Studying	1 hr (studying for values)	?	6 hrs (studying for skills)
Sleeping			
This is just a sample list. Please make your own list			
Total Time and Effort	Max 24 hrs		

Find out what percentage of your time and effort is being spent for each of these three. What do you conclude from this exercise?

CO2

Find out if the following are naturally acceptable to you.

Statement	**My present thinking (beliefs) about the statement**	**Naturally Acceptable?**
I want to be happy		
I want to make others happy		
I want to be healthy		
I want to live in relationship		
I want to have more than others		
I want to have more than what I really need		
Feeling of respect in relationship	Only if you have money, people respect you	Feeling of respect is naturally acceptable in relationship

Can you observe that when you really try, you can refer to your natural acceptance? Note any five things that appear naturally acceptable to you. Now, verify for yourself that your 'natural acceptance' does not change with time or place. It does not depend on your beliefs and past conditionings and that it is always there. If not, would you still call it your natural acceptance? And if not, what can it be termed as in place of natural

	acceptance? e.g., eating sweets. It may appear naturally acceptable. Now explore, whether it changes with time, place and individual or not. You will see that sometimes you like eating sweets, while sometimes; you do not feel like eating sweets. Same thing happens with place. And not everyone wants to eat sweets. Thus, it does not fulfill the criterion. It is not your 'natural acceptance'. Then what is your natural acceptance? Find it out (here, while eating sweets is your liking, nurturing your Body is the natural acceptance).
CO3	1. "The pleasures that we derive from sensations are short lived and the efforts to extend them lead to misery" -Examine and illustrate this statement with an example. 2. Explain the activities of imaging, analyzing and selecting/tasting with a diagram. With the help of an example, show how are they related. 3. "If I trust everyone, people would take undue advantage of me." Do you agree? Explain. 4. "When we are assured of the intention of the other and find that the competence is lacking, we become a help to the other. When we doubt the intention of the other, we get into opposition." Explain.
CO4	1. What in your opinion, is an effective way of ensuring prosperity in the family? What programs can you undertake in this respect? 2. Indicate a few feasible steps to promote harmony in the society and co-existence with nature. 3. "Other than human order, the three orders are mutually fulfilling to each other." Explain with examples. Why does human order fail to be mutually fulfilling to itself and to the other orders?
CO5	1. How does right understanding provide the basis for ethical human conduct? Give two examples. 2. What are the values in interaction of human beings with the material things? Give one example of each. 3. Visualize a framework for humanistic education for children. Suggest a few ways to modify present day school education. 4. Choose any one dimension (education, heath, production, justice, exchange) of human endeavor in a society. Suggest what role can you play in the chosen dimension through the orientation you are going to have through your professional education.