TKM COLLEGE OF ENGINEERING

(Government Aided and Autonomous)

celebrating 60 years of excellence

ELECTRICAL & ELECTRONICS ENGINEERING

B. Tech Curriculum 2023

&

First & Second Semester Syllabus

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

Abstract

TKMCE- Academics- B.Tech Curriculum 2023 & first year (S1 & S2) Syllabus of Electrical & Electronics Engineering - orders issued

No: ACU3/660/2023

Date: 12/06/2023

Order

Read:

1. UGC order Ref: F. 22-1/2022(AC) dated 26th May 2022
2. U.O. No. KTU/ASST11(ADMIN)/3212/2022 dated 2nd September 2022
3. ACU3/1010/2022 dated 16th September 2022

The TKM College of Engineering was conferred with autonomous status by the UGC on May 26, 2022, vide Ref: 1, and the same was notified by the APJ Abdul Kalam Technological University, on September 2, 2022, vide ref. 2.

The first meeting of the Governing Body after the notification of autonomous status was held on September 15, 2022, and authorized the Principal to constitute the Academic Council as per the UGC (Conferment of Autonomous Status upon Colleges and Measures for Maintenance of Standards in Autonomous Colleges) Regulations, 2018. As per the resolution of the Governing Body, the Principal has constituted the Academic Council on September 16, 2022, vide ref. 3.
The third academic council meeting held on June 12, 2023, approved the B.Tech Electrical & Electronics Engineering Curriculum 2023 and First Year (S1 & S2 semester) syllabus to be followed for the academic year 2023-24 onwards.

Principal

PRINCIPAL
THANGAL KUNJU MUSALIAR
COLLEGE OF ENGINEERING
KOLLAM-5

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 163 credits, of which 160 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 and innovation, and developing entrepreneurial abilities.

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 they have learned. Additionally, there are basic science courses with lab components, core courses without practical components, 4-hour lab courses, as well as 1/2-hour theory courses and 2-hour lab courses to provide breadth wise knowledge in the area of recent technological trends. These variety of courses ensures that students receive a well-rounded education and have the flexibility to customize their own learning experience according to their interests and career goals. In addition to these core subjects, students will 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 gain valuable experience. The students can opt for MOOC courses corresponding to Professional Elective and Open Elective Courses during their 8th semester, which will give them flexibility in 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 by TKM College of Engineering to ensure that students not only excel academically but also develop important life skills that will help them in their future careers.

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, carried out during all weeks of the semester, is considered one Instructional Unit or one Credit. The same goes for a tutorial (T) or a project (J) that is 60 minutes long per week and carried out during all weeks of the semester.

In addition, a minimum of 120 minutes 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 160 academic credits and 3 additional pass/fail credits that can be gained through 100 activity points. It is expected that the program will accommodate courses from other disciplines so that students have multi-disciplinary exposure. Additionally, the program should provide sufficient opportunities for students to enhance their communication, soft skills, managerial skills, and technical skills. Depending on the program, the courses should fall under engineering, basic science, humanities science, and management categories. The structure of the UG program should essentially have the following categories of courses with the breakup of credits as given:

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 [IEC] [MS]	12
6	Open Electives – Electives from other technical and /or emerging areas	OEC	9
7	Project work, seminar and internship in industry or elsewhere	PROJ	15
8	Mandatory Courses	MC	
9	*Mandatory Student Activities*	SA	* 3
	Total Academic/Learning credits		**160**
	Optional Specialization		
10	Honors	HR	20
11	Minor	MR	20
	Total Academic/Learning credits with optional specialization		**180**

**Not included in the calculation of Total Academic/Learning credits*

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 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 indicate the number of hours students are expected to spent for activities that should be completed outside the class defined by the faculty handling courses, and for the activities to support learning, initiated by the students themselves without guidance or direction from course faculty. For each course, Self-learning hour 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 credits delivered as Lecture (L), Tutorial (T), Practical (P), Project (J), Self-study hours (S) and the total instructional delivery indicated as Credits (C).

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

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 Semester Examination [ESE]
2	2-0-0-0	2	2	
3	2-0-2-0	4	3	Theory course embedded with practical
4	2-1-0-0	2	3	Theory course embedded with tutorial
	3-1-0-0	3	4	
5	3-0-0-0	3	3	Theory course
6	3-1-2-0	5	5	Theory course embedded with practical and tutorial
7	2-1-2-0	4	4	

8	1-0-2-0	3	2	Theory course embedded with practical without ESE
9	3-0-2-0	5	4	Theory course embedded with practical
10	2-0-2-2	5	5	Project based course
11	0-0-2-0	2	1	Practical course without ESE
12	0-0-4-0	4	2	Practical course
13	0-0-6-0	6	3	Seminar
14	0-0-12-0	12	6	Final year Project
Mandatory Courses (Pass / Fail)				
15	2-0-0-0 3-0-0-0	2 3	0	Theory Courses
16	2-0-2-2	5	0	Theory course embedded with project
17	0-0-0-2	1	0	Socially Relevant Project
Minor/ Honors Course				
18	4-0-0-0	4	4	Theory course
19	0-0-0-4	2	4	Project only course

Course Code:

In general, the curriculum of each program consists of courses that are grouped 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 required for students to complete in order to be eligible for the degree. PCC courses 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 of 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. By taking 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. The ultimate aim of an engineering student is to resolve problems by applying theoretical knowledge, and PBC courses can be a great way to achieve this goal. Doing multiple projects can also help students develop a range of skills, from project management and teamwork to 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 that they have chosen as their major specialization. These courses are typically more focused and specialized than program core courses, and can help students develop expertise in a particular area of their field.

PEC courses provide students with the flexibility to tailor their education to their interests and career goals, while also ensuring that they have a strong foundation in the core concepts and skills of their field.

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 or to choose not to specialize in a particular area 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 thematic 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 can take alongside their primary area of study. These courses are designed to give students greater flexibility and control over their curriculum, allowing them to pursue their interests and passions. Open Electives also promote cross-disciplinary and multidisciplinary learning, as students have the freedom to choose courses from different streams. This can be a great way to broaden the knowledge and skills and to explore new areas of interest.

Research based Mini Project:

Focuses on strengthening the understanding of student's fundamental concepts through the application of theoretical concepts and to boost their skills and widen the horizon of their thinking in research by implementing/working a recent research paper in the domain of study.

Project:

The research-based project in the seventh semester shall be continued as the project in the eighth semester.

Minor and Honours courses: The Minor in Engineering program allows students to gain interdisciplinary experience and exposure to concepts and perspectives that may not be part of their degree programs.

- 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 be acquired through 2 MOOCs.

This program gives a great opportunity for students to broaden their understanding of the engineering profession and gain exposure.

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Seminar

Seminars are given to provide opportunities for students to present 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. By participating in seminars, students can gain valuable experience and develop the skills they need to succeed in their future careers.

Honors

Honors is intended for a student to gain expertise/specialise in an area inside his/her B.Tech discipline and to enrich knowledge in emerging/advanced areas in the branch of engineering concerned. Upon completion of Honors, a student will be better equipped to perform research in her/his 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 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 a minimum of 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 throughout 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.

Socially Relevant Projects

The main purpose of Socially Relevant Projects is to link the institution 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 and emerge as a socially responsible institution.

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 provide a great opportunity for students to gain exposure to the industry and prepare for their future work environment. As per the guidelines of the institution, all B.Tech students are required to undergo a minimum of six to eight weeks of internship in a reputed industry or research organization at another institute of higher learning and repute (Academia).This can be done any time after their first year of study and before the seventh semester. Students can avail this training in a single stretch or in piece-meal basis with each stretch shall be of not less than two weeks. The organization for doing internship shall be selected/decided by the students in consultation with the senior faculty advisor.

For students who have completed a 6-to-8-week internship at a reputed organization or a 3-to-5-month duration internship leading to placement can convert their work during internship to project work in the eighth semester, subject to approval from the concerned department.

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 - Course Category Code C- Course Delivery Mode, S – Semester Number (it can have a number from 1 to 8) NN- Course Sequence Number

For eg: 23CET303- is a theory course offered by the civil engineering department in the third semester of the 2023 scheme.

23MEL408 - is a laboratory course offered by the mechanical engineering department in the fourth semester of the 2023 scheme.

23CSP607 - is a laboratory course offered by the mechanical engineering department in the sixth semester of 2023 scheme.

Year of Regulation YY	Course category XX	Course delivery mode C	Semester Number S	Serial No. of course NN
23 for 2023 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 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 EMBEDDED WITH PRACTICAL COURSE L- LABORATORY COURSE J - THEORY EMBEDDED 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	01 2 03 etc.	01 02 03 etc.

Assessment

In each semester, candidates 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 course faculty. The faculty member(s) concerned should carry out the CIA for the courses allotted to him/her and should perform the learning assessments 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 for carrying out experiments, such as observations, collection of data, analysis, interpretation of results, inferences and also timely submission of record work done would all 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 following 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	15	10	-	20	10	-	-	-	60
3-1-2-0	5	15	10	10	20					60

2-1-2-0	5	10	10	10	15	10	-	-	-	60
3-0-2-0	5	15	10	10	10	10	-	-	-	60
$ 2-0-2-2	5	10	10		15		5	10	5	60
*2-0-2-2	5	15		10	20		10	20	20	100
& 0-0-4-0	5				55	40				100
$ For PBC course only, ***** For Idea lab only **&** For Manufacturing Practices only										

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	
Project Based Course	2-0-2-2	5	
Theory Course	2-1-0-0	3	One assessment per module, best of FOUR shall be considered for the calculation of CIA.
	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	

Evaluation Type, CIA & ESE Mark Distribution:

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

Evaluation Type	Course Category	L-T-P-J	Credit	CIA Marks	ESE Marks
CIA only	Theory Course	1-0-0-0	1	50	-
		2-0-0-0	2	100	
	Theory Embedded 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/ Honors]	0-0-0-4	4		
	Project	0-0-12-0	6		
CIA + ESE	Theory Course	2-1-0-0	3	40	60
		3-0-0-0	3		
		3-1-0-0	4		
		4-0-0-0	4		
	Theory Embedded with Practical	2-0-2-0	3	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 final examination should have learning assessments from the following perspectives with respect to all courses:

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

Based on the ESE marks [60/40], separate evaluation pattern should be followed and is 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		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]	

Pass minimum for 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 his/her mark 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 and no ESE, a minimum of 50% of CIA mark is required.

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 against the courses the student has registered. Semester grade card give 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 Grade point and Grade 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 – 2.5		

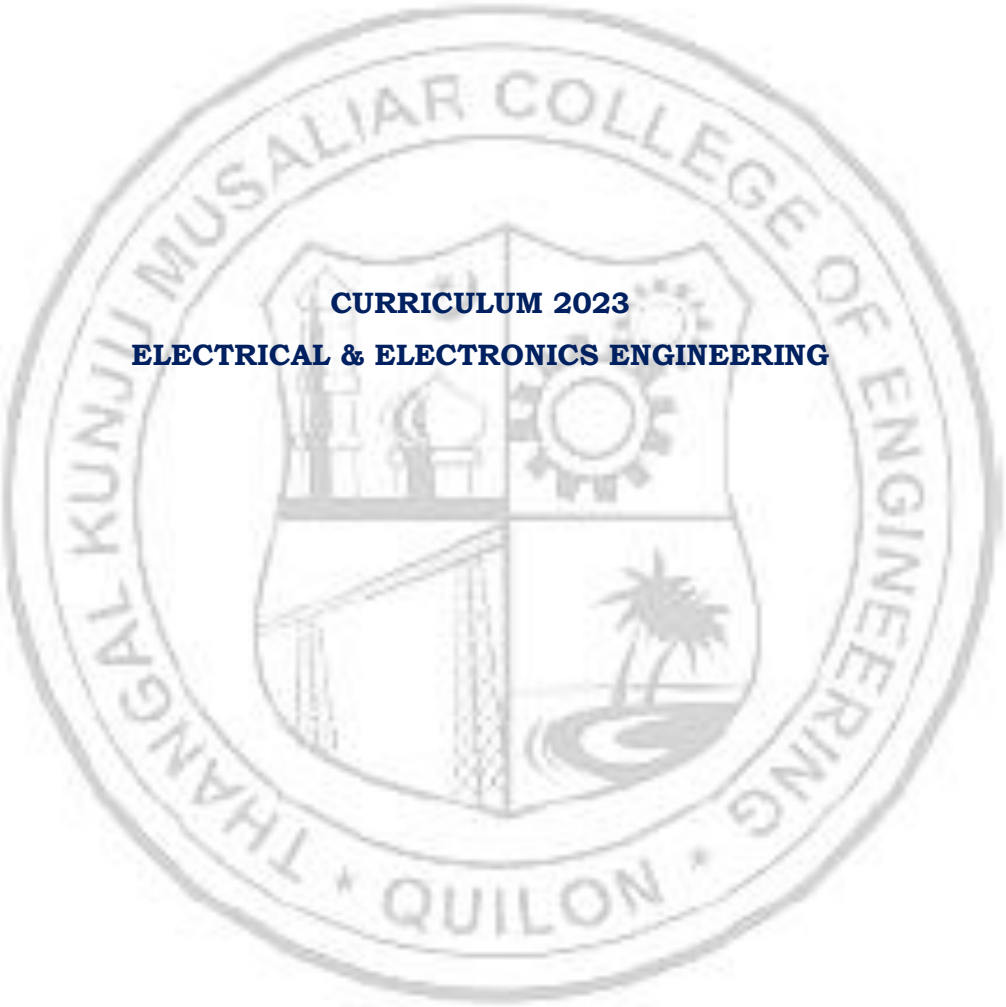
Allotted and Cumulative Credits

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

Semester	Circuit branches [CS, EC, EE &ER]		Non-Circuit branches [CE, ME &CH]	
	Allotted Credits	Cumulative Credits	Allotted Credits	Cumulative Credits
First	19	-	22	-
Second	22	41	20	42
Third	24	65	23	65
Fourth	21	86	21	86
Fifth	20	106	20	106
Sixth	19	125	19	125
Seventh	20	145	20	145
Eighth	15	160	15	160

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

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



CURRICULUM 2023

ELECTRICAL & ELECTRONICS ENGINEERING

FIRST SEMESTER													
Sl No	Slot	Code	Category	Title	L	T	P	J	S	Hours	Credits	Total Marks	
												CIA	ESE
1	A	23MAT101	BSC	Calculus and Linear Algebra	3	1	0	0	3	4	4	40	60
2	B	23PYP102	BSC	Engineering Physics	2	1	2	0	4	5	4	60	40
3	C	23EST105	ESC	Fundamentals of Electronics Engineering	3	0	0	0	3	3	3	40	60
4	E	23ESP107	ESC	Technical English for Engineers	2	0	2	0	4	4	3	60	40
5	N	23MCJ110	MC	IDEA Lab Workshop	2	0	2	2	5	6	0	100	
6	O	23HUL111	HSMC	Design Thinking	0	0	2	0	2	2	1	50	
7	J	23EST117	ESC	Basics of Electrical Engineering	2		0	0	2	2	2	100	
8	I	23EST119	ESC	Basic Mechanical Engineering	2	0	0	0	2	2	2	100	
TOTAL									25	28	19		

SECOND SEMESTER													
Sl No	Slot	Code	Category	Title	L	T	P	J	S	Hours	Credits	Total Marks	
												CIA	ESE
1	A	23MAP200	BSC	Ordinary Differential Equations and Transforms	3	1	2	0	5	6	5	60	40
2	B	23CYP203	BSC	Engineering Chemistry	2	1	2	0	4	5	4	60	40
3	C	23ESP204	ESC	Problem solving and Programming	3	0	2	0	5	5	4	60	40
4	D	23ESP208	ESC	Engineering Graphics	3	0	2	0	5	5	4	60	40
5	G	23ESL209	ESC	Manufacturing Practices	0	0	4	0	4	4	2	100	
6	K	23MCT210	MC	Sports and Yoga	2	0	0	0	2	2	0	100	
7	F	23HUT212	HSMC	Universal Human Values-II	2	1	0	0	2	3	3	40	60
TOTAL									27	30	22		

THIRD SEMESTER													
Sl No	Slot	Code	Category	Title	L	T	P	J	S	Hours	Credits	Total Marks	
												CIA	ESE
1	A	23MAP301	BSC	MATHEMATICS III	3	1	2	0	5	6	5	60	40
2	K	23EST302	ESC	Basic Engineering Mechanics	2	0	0	0	2	2	2	100	
3	B	23EEJ303	PBC	Digital Electronics and Logic Design	2	0	2	2	5	6	5	60	40
4	C	23EEP304	PCC	Measurements & Instrumentation	2	1	2	0	4	5	4	60	40
5	D	23EET305	PCC	Circuit Theory	2	1	0	0	2	3	3	40	60
6	E	23HUT306	HSMC	Professional Ethics and Life Skills for Engineers	3	0	0	0	3	3	3	40	60
7	I	23EEP311	PCC	Fundamentals of Electrical Power Systems	1	0	2	0	3	3	2	100	
8	M / R	23EEM309	MR/ RL	MINOR / REMEDIAL	4	0	0	0			4/0	40	60
TOTAL									**24**	**28**	**24**		

FOURTH SEMESTER													
Sl No	Slot	Code	Category	Title	L	T	P	J	S	Hours	Credits	Total Marks	
												CIA	ESE
1	A	23EET401	PCC	Signals and Systems	3	1	0	0	2	4	4	40	60
2	B	23EET402	PCC	Electromagnetic Theory	2	1	0	0	2	3	3	40	60
3	C	23EEP403	PCC	DC Machines and Transformers	2	1	2	0	4	5	4	60	40
4	D	23EEJ404	PBC	Solid State Electronic Devices and Circuits	2	0	2	2	5	6	5	60	40
5	E	23HUT405	HSMC	Finance and Accounting	3	0	0	0	3	3	3	40	60
6	F	23MCT406	MC	Environmental Sciences	3	0	0	0	3	3	0	40	60
7	I	23ESP410	ESC	Probability distributions and numerical techniques	1	0	2	0	3	3	2	100	
8	M/ H/ R	23EEM309 /23EEH309	MR/ HR/ RL	MINOR/HONORS REMEDIAL	4	0	0	0			4/ 4/ 0	40	60
TOTAL									**22**	**27**	**21**		

FIFTH SEMESTER														
Sl No	Slot	Code	Category	Title	L	T	P	J	S	Hours	Credits	Total Marks	
												CIA	ESE
1	A	23EET501	PCC	Control System Engg	2	1	0	0	2	3	3	40	60
2	B	23EEJ502	PBC	Embedded System Design and IoT	2	0	2	2	5	6	5	60	40
3	C	23EET503	PCC	Power Electronics	2	1	0	0	2	3	3	40	60
4	D	23EEP504	PCC	AC machines	2	1	2	0	4	5	4	60	40
5	E	23HUT505	HSMC	Industrial Engineering and Management	3	0	0	0	3	3	3	40	60
6	F	23MCT506	MC	Constitution of India	3	0	0	0	3	3	0	40	60
7	I	23ESP510	ESC	Introduction to Machine Learning	1	0	2	0	3	3	2	100	
8	M/H/R	23EEM508/ 23EEH508	MR/HR/RL	MINOR/HONORS/ REMEDIAL	4	0	0	0			4/4/0	40	60
TOTAL									22	26	20		

SIXTH SEMESTER													
Sl No	Slot	Code	Category	Title	L	T	P	J	S	Hours	Credits	Total Marks	
												CIA	ESE
1	A	23EET601	PCC	Electric vehicle Technology	2	1	0	0	2	3	3	40	60
2	B	23EEP602	PBC	Power Semiconductor Drives	2	0	2	0	4	4	3	60	40
3	C	23EEP603	PCC	Digital Signal Processing	2	0	2	0	4	4	3	40	60
4	D	23EEE6**X**4	PEC	Professional Elective-1	3	0	0	0	3	3	3	40	60
5	E	23EEE6X5/ 23EEI6X5	PEC/ IEC	Professional Elective-2/Industry Elective	3	0	0	0	3	3	3	40	60
6	F	23EES606	SR	Seminar	0	0	4	0	4	4	2	100	
7	U	23SPJ607	MC	Socially Relevant Project	0	0	0	2	1	2	0	100	
8	I	23EEL611	PCC	AI and Control Lab	0	0	4	0	4	4	2	60	40
9	M/H/R	23EEM609/ 23EEH609	MR/HR/RL	MINOR/HONORS/REMEDIAL	4	0	0	0			4/4/0	40	60
TOTAL									25	27	19		

SEVENTH SEMESTER														
Sl No	Slot	Code	Category	Title	L	T	P	J	S	Hours	Credits	Total Marks	
												CIA	ESE
1	A	23EEP701	PCC	Power System Analysis	2	1	2	0	4	5	4	60	40
2	B	23EEP702	PCC	Electrical System Design	2	1	2	0	4	5	4	60	40
3	C	23EEE7**X**3	PEC	Professional Elective-3	3	0	0	0	3	3	3	40	60
4	D	23EEO7X4/ 23EEI7X4	OEC /IEC	Open Elective 1/ Industry Elective	3	0	0	0	3	3	3	40	60
5	U	23EER705	RMP	Research Based Mini Project	0	0	12	0	12	12	6	100	
6	M/ H/R	23EEM709/ 23EEH709	PRM /HR /RL	PROJECT IN MINOR/HONORS/ REMEDIAL	0	0	0	4			4/ 4/ 0	100	
TOTAL									**26**	**28**	**20**		

EIGHTH SEMESTER													
Sl No	Slot	Code	Category	Title	L	T	P	J	S	Hours	Credits	Total Marks	
												CIA	ESE
1	A	23EEE8X1	PEC	Professional Elective-4 /MOOC	3	0	0	0	3	3	3	40	60
2	B	23EEO8X2	OEC	Open Elective-2 /MOOC	3	0	0	0	3	3	3	40	60
3	C	23EEO8X3	OEC	Open Elective-3/MOOC	3	0	0	0	3	3	3	40	60
4	U	23EED804 / 23EEN804	PR/ IP	PROJECT/INTERNSHIP/	0	0	12	0	12	12	6	100	
5	H/R	23EEH809	PRH /RL	PROJECT IN HONORS/ REMEDIAL	0	0	0	4			4/ 0		
TOTAL									**21**	**21**	**15**		

List of Professional Electives

Semester	Course Code	Course Name	Microspecialisation
S6 –PEC I	23EEE604	Electric Power Utilization and Illumination	Power and Energy Systems
	23EEE614	Insulation and High Voltage Engineering	
	23EEE624	Renewable and Distributed Energy Sources	
	23EEE634	Computer Organization and Architecture	Computing and AI
	23EEE644	Probability and Random Process	
	23EEE654	Data Structure and Algorithm	
	23EEE664	Advanced Electro-mechanics	Electric Vehicle Technology
	23EEE674	E-Mobility	
	23EEE684	Electric Drives and Control	
	23EEE694	Medical Instrumentation	Instrumentation & Control
	23EEE6A4	Digital Control Systems	
	23EEE6B4	Biology for Engineers	
S6 – IE	23EEE6P5	Industry Elective :Power system Communication and SCADA (KSEB)	Power and Energy Systems
	23EEE6V5	Electric Vehicle System Design (BoSCH)	Electric Vehicle Technology
S6 – PEC II	23EEE605	Electrical Power Quality and Reliability	Power and Energy Systems
	23EEE615	Smart Grid Technology	
	23EEE625	High Voltage Transmission	
	23EEE635	Object Oriented Programming	Computing and AI
	23EEE645	Embedded Systems	
	23EEE655	Multimedia Design and Development	
	23EEE665	Generalized Theory of Electrical Machines	Electric Vehicle Technology
	23EEE675	Modelling and Simulation of EHV	
	23EEE685	Autonomous Vehicles	
	23EEE695	Modern Control Systems	Instrumentation & Control
	23EEE6A5	VLSI Circuits and Systems	
S7- PEC III	23EEE703	Switchgear and Protective Relays	Power and Energy Systems
	23EEE713	Power Electronics for Renewable Energy Systems	
	23EEE723	HVDC and Flexible AC Transmission Systems	
	23EEE733	Operating Systems	Computing and AI
	23EEE743	Introduction to Artificial Intelligence with Python	
	23EEE753	Fuzzy Logic and Neural Networks	
	23EEE763	Advanced Electrical Drives	Electric Vehicle Technology
	23EEE773	Dynamics and Control of EVs	
	23EEE783	Automotive Diagnostics	
	23EEE793	Multivariable Control Theory	

	23EEE7A3	Advanced control systems	Instrumentation & Control
S8- PEC IV	23EEE801	Operation and Planning of Power Distribution Systems	Power and Energy Systems
	23EEE811	Grid Integration of Renewable Energy Systems	
	23EEE821	Energy Storage Systems	
	23EEE831	Networks and Systems Security	Computing and AI
	23EEE841	Pattern Recognition and Machine Learning	
	23EEE851	Automotive Embedded Systems	Electric Vehicle Technology
	23EEE861	In Vehicle Networking	
	23EEE871	Testing and Certification of Electric and Hybrid Vehicles	
	23EEE881	Industrial Instrumentation	Instrumentation & Control
	23EEE891	Autonomous Systems	

List of Open Electives

23EEI704 - Renewable Energy Systems (Industry Elective - ANERT)

23EEO802 - Engineering Applications of Block Chain Technology

23EEO812 - Energy Conservation and Management

23EEO803 - Artificial Intelligence with Python

23EEO813 - Introduction to Electric and hybrid vehicles

Minors

SEMESTER	BASKET-1		BASKET-2	
	Specialization – **Energy Management**		Specialization - **Electrical Vehicle Technology**	
	COURSE CODE	**COURSE NAME**	**COURSE CODE**	**COURSE NAME**
S3	23EEM309	ELECTRICAL ENERGY SYSTEM	23EEM310	ELECTRICAL MACHINES
S4	23EEM409	DISTRIBUTED GENERATION	23EEM410	POWER ELECTRONIC CONVERTERS
S5	23EEM509	SMART GRID	23EEM510	BATTERY TECHNOLOGY
S6	23EEM610	ENERGY MANAGEMENT & AUDITING	23EEM611	THERMAL MANAGEMENT OF ELECTRIC VEHICLES
S7	23EEM706	PROJECT IN MINORS	23EEM707	PROJECT IN MINORS

SEMESTER	HONOURS	
	Specialization – **Smart Grids**	
	Course No.	**Course Name**
S4	23EEH409	NETWORK ANALYSIS AND SYNTHESIS
S5	23EEH509	LINEAR INTEGRATED CIRCUITS
S6	23EEH609	ADVANCED CONTROL THEORY
S7	23EEH706	MICRO GRID AND NANO GRID
S8	23EEH805	PROJECT IN HONOUR

SEMESTER-I

SYLLABUS

23MAT101	CALCULUS and LINEAR ALGEBRA [Circuit branches]	L	T	P	J	S	C	Year of Introduction
		3	1	0	0	3	4	2023

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.

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

CO 1	Apply the concept of partial derivatives to evaluate the extrema of two variable functions. [**Apply level**]
CO 2	Use multiple integrals to find the area and volume of geometrical shapes, mass and center of gravity of plane laminas. [**Apply level**]
CO 3	Utilize vector calculus techniques to solve problems related to vector fields in various disciplines. [**Apply level**]
CO 4	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**]
CO 5	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
CO 1	✓	✓			✓				✓			✓
CO 2	✓	✓			✓				✓			✓
CO 3	✓	✓			✓				✓			✓
CO 4	✓	✓			✓				✓			✓
CO 5	✓	✓			✓				✓			✓

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**	
	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)
(Text 1: Relevant topics from sections 13.3, 13.4, 13.5, 13.8) 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)
(Text 1: Relevant topics from sections 14.1, 14.2, 14.3, 14.5, 14.6, 14.8) 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)
(Text 1: Relevant topics from sections 12.1,12.2,12.6,13.6,15.1,15.2,15.3) 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)
(Text 1: Relevant topics from sections 15.4,15.7,15.8) 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)
(Text 2: Relevant topics from sections 7.3, 7.4, 7.5, 8.1,8.3,8.4) 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), Eigen values and Eigen vectors, Properties of Eigen values and Eigen vectors, 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

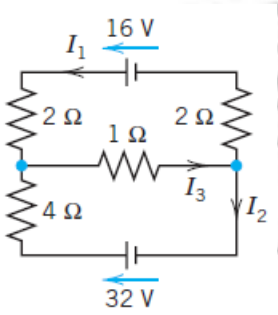
No.		No. of Hours [45 hours]
	MODULE 1 [9 hours]	
1.1	Partial derivatives, Partial derivatives of functions of two variables	1
1.2	Implicit partial differentiation, Partial derivatives of functions with more than two variables	1
1.3	Higher-order partial derivatives, Equality of mixed partials	1
1.4	Differentials	1
1.5	Local Linear approximations	1
1.6	Chain rule, Implicit differentiation	1
1.7	Total derivative	1
	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 integralv	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	Eigen values and Eigen vectors	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	
1	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 $\delta x, \delta y$, and δz. 4. Use a CAS(MATLAB/SCILAB) to generate a contour plot $of\ f(x,y) = 2y2x - yx^2 + 4xy$ 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).
2	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) 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.
3	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). 5. **Team Work**: Suppose that C is a circle in the domain of a conservative non zero 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.
4	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) to verify Green's Theorem for the function $F = e^y\mathbf{i} + ye^x\mathbf{j}$ were 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.
5	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). 5. **Team Work**: Identify five application-oriented problems from your domain and its solution. Give a PPT illustrating the relevance of the problem.

23PYP102	ENGINEERING PHYSICS (FOR CIRCUIT BRANCHES)	L	T	P	J	S	C	Year of Introduction
		2	1	2	0	4	4	2023

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.

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

CO 1	Interpret the characteristics of mechanical and electrical oscillators. [Apply level]
CO 2	Demonstrate the concepts of interference and diffraction for the determination of wavelength of unknown sources. [Apply level]
CO 3	Use the basic principles of quantum mechanics to determine the energy eigen values and eigen functions of particle in a box. [Apply level]
CO 4	Apply the Maxwell's equations in estimating the speed of light. [Apply level]
CO 5	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
CO 1	✓	✓			✓			✓	✓	✓		✓
CO 2	✓	✓			✓			✓	✓	✓		✓
CO 3	✓	✓			✓							✓
CO 4	✓				✓							
CO 5	✓							✓	✓	✓		

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]	Theory [L- T]				Practical [P]		
	Attendance	Assignment	Test-1	Test-2	Class work	Lab Exam	Total Marks
2-1-2-0	5	10	10	10	15	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 (7 hours)

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 (7 hours)

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 (8 hours)

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 (7 hours)

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 (7 hours)

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 1: Oscillations and Wave Motion (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: Wave Optics (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: Quantum Mechanics for Engineers (8 hours)		
3.1	Wave nature of particles and the Schrodinger equation Wave-Particle dualism; de Broglie hypothesis, de-Broglie wavelength, 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: Introduction to Electromagnetic Theory (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: Introduction to Solids (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 wave function.	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	
1	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.
2	1) Light of wavelength 6000A° falls normally on a wedge-shaped film. The two plates touch at one and are separated at 10 cm from that end by a wire. 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. 4) Determine experimentally the wavelength of a laser source using diffraction grating.
3	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.
4	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.
5	1) Determine experimentally the wavelength of a standard laser source using diffraction grating arrangement. 2) Determine experimentally the NA of an optic fibre cable.

23EST105	FUNDAMENTALS OF ELECTRONICS ENGINEERING	L	T	P	J	S	C	Year of Introduction
		3	0	0	0	3	3	2023

Preamble: The aim of this course is to provide a fundamental idea about electronic devices, circuits and communication systems. The course covers the basics of electronic circuits, integrated circuits, instrumentation system and communication systems.

Prerequisite: Nil

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

CO 1	Explain the physics, structure and working of different electronic devices.
CO 2	Illustrate the working of basic circuits using diodes and BJTs.
CO 3	Implement Boolean functions using logic gates
CO 4	Explain basic op-amp circuits
CO 5	Describe the principle of operation of transducers and basic measuring instruments.
CO 6	Discuss about the fundamental principles of various communication systems.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓							✓	✓	✓		
CO 2	✓	✓			✓							✓
CO 3	✓				✓							✓
CO 4	✓											
CO 5	✓											
CO 6	✓							✓	✓	✓		

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: (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 : Electronic Components & Devices(8 hours)

Classification of materials based on conductivity: Conductors, Semiconductors and Insulators. Intrinsic and extrinsic semiconductors. Active Components: PN junction diodes- structure, working, Current equation, VI characteristics, Zener diode: Avalanche breakdown and Zener breakdown and characteristics. Bipolar Junction Transistor: structure, working. Comparison of the three transistor configurations and their applications. N channel enhancement mode MOSFET: Structure and working. Comparison of BJT and MOSFET

MODULE II : Electronic Circuits(6 hours)

Block diagram and basic elements of DC power supply. Diode Circuits: Half wave and Full wave Rectifiers – working and comparison of parameters. Capacitor Filter. Zener voltage regulator. BJT Circuits: Transistor as a switch, Transistor as an amplifier. Relay vs Transistor switch

MODULE III : Integrated Circuits. (6 hours)

Concept of integrated circuit, scales of integration, Types of ICs – Digital & Analog ICs Operational Amplifier: Ideal characteristics, inverting and non-inverting amplifiers, comparator.Digital Circuits: Boolean algebra, De-Morgan's theorem, Basic logic gates and universal gates, Minimization of logic expressions using Boolean algebra and realization using gates

MODULE IV : Electronic Instrumentation(6 hours)

Block diagram of electronic instrumentation system

Sensors and Transducers: Sensors and Transducers: Active and Passive transducers-, photoelectric transducer (Photodiode, Solar Cell), Piezoelectric transducer, accelerometer, Force sensor (Strain gauge), Displacement sensor (LVDT), Temperature sensor (Thermistor), light sensor (LDR) and their applications.

MODULE V : Communication Systems(8 hours)

Introduction, need for modulation, frequency bands used for various communication systems. Radio communication: principle of AM, FM, comparison of AM & FM. Radio Receiver: Block diagram of AM super heterodyne receiver

Mobile Communication: Basic principles of cellular communications, principle and block diagram of GSM, concept of frequency reuse, hand off – soft and hard hand off.

Pulse Code Modulation, Various Digital Modulation Techniques-ASK, PSK, FSK

Basics of Networking, Network Topologies-Bus, Ring, Star and hybrid topology, Classifications of Computer Networks- LAN, MAN, WAN

Text books

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson, 11th Ed., 2015.
2. John M Yarbrough, Digital Logic Applications & Design, Cengage Learning India, 1st edition, 2009.
3. David A. Bell, Electronic Instrumentation and Measurements, Oxford, 3rd edition.
4. **Wayne Tomasi, Electronic Communications System : Fundamentals Through Advanced Pearson education, 5th edition, 2008.**

Reference books

1. David A Bell, Electronic Devices & Circuits, Oxford, 5th edition,2017.
2. Chinmoy Saha, Arindam Halder, Debarati Ganguly, Basic Electronics Principles & Applications, Cambridge University Press, 2018
3. Millman, Halkias& Parikh, Integrated Electronics, Mc Graw Hill, 2nd Edition, 2012.
4. S. Sedra and K. C. Smith, Microelectronic Circuits, Oxford University Press, 6th edition
5. Anil K Maini, Varsha Agarwal, Electronic Devices & Circuits, John Wiley & Sons, 2020.
6. Bhargava, Basic Electronics and Linear circuits, Mc Graw Hill Education, 2nd edition, 2017.
7. Data Communication and Networking, Behrouz A Forouzan, McGraw-Hill Education

COURSE CONTENTS AND LECTURE SCHEDULE

No.		No. of Hours
	MODULE 1	
1.1	Introduction, Classification of materials based on conductivity: Conductors, Semiconductors and Insulators, conductivity range.	1
1.2	Intrinsic and extrinsic semiconductors – doping, concept of majority and minority carriers.	1
1.3	Active Components: PN junction diode - Structure, Unbiased diode - Depletion layer and Barrier potential, Principle of operation with forward biasing and reverse biasing, VI Characteristics	1
1.4	Active Components: Zener diode - Avalanche breakdown and Zener breakdown and Zener characteristics.	1
1.5	Active Components: Bipolar Junction Transistor: n-p-n transistor - structure, working.	1
1.6	Transistor configuration : CE transistor characteristics only, three regions of operations and applications.	1
1.7	Active Components: N channel enhancement mode MOSFET: Structure, working. Comparison of BJT & MOSFET.	2
	MODULE II (Analysis & Derivation not required)	
2.1	Block diagram and basic elements of DC power supply. Diode Circuits: Half wave rectifier – working, ripple factor, rectification efficiency, peak inverse voltage.	1

2.2	Full wave bridge rectifier – working, ripple factor, rectification efficiency, peak inverse voltage. Comparison of half wave rectifier & full wave rectifier	1
2.3	Capacitor Filter, Zener voltage regulator – working, line and load regulation.	1
2.4	BJT circuits: Transistor as a switch, Transistor as an amplifier	2
2.5	Performance comparison of relay and transistor switch	1
	MODULE III	
3.1	Analog and Digital ICs: Concept of integrated circuit, scales of integration, Types of ICs – Digital & Analog ICs	1
3.2	Operational Amplifier: Ideal characteristics, inverting and non-inverting amplifier	1
3.3	Comparator circuit and applications.	1
3.4	Digital Circuits: Basic Boolean algebra laws and theorems, De-Morgan's theorem	1
3.5	Basic logic gates and Universal gates (with analogy)	1
3.6	Minimization of logic expressions using Boolean algebra and realization using gates.	1
	MODULE IV	
4.1	Principle and block diagram of electronic instrumentation system	1
4.2	Sensors and Transducers: Active and Passive transducers- , photoelectric transducer (Photodiode, Solar Cell)	1
4.3	Piezoelectric transducer, accelerometer and their applications.	2
4.4	Force sensor (Strain gauge), Displacement sensor (LVDT) and their applications.	1
4.5	Temperature sensor (Thermistor), light sensor (LDR) and applications.	1
	MODULE V	
5.1	**Communication Systems:** Introduction, need for modulation, frequency bands used for various communication systems.	1
5.2	Radio communication: principle of AM, FM, comparison of AM & FM.	1
5.3	Radio receiver: Block diagram of AM super heterodyne receiver.	1

5.4	Mobile Communication: Basic principles of cellular communications, principle and block diagram of GSM, concept of frequency reuse, hand off – soft and hard hand off.	2
5.5	Pulse Code Modulation, Various Digital Modulation Techniques-ASK, PSK, FSK	2
5.6	Basics of Networking, Network Topologies-Bus, Ring, Star and hybrid topology, Classifications of Computer Networks-LAN, MAN, WAN	1

CO Assessment Questions	
1	Perform a role play to illustrate the different current components in a pnp transistor.
2	Illustrate the working of a full wave bridge rectifier. Compare any three parameters of a half wave and full wave rectifier using appropriate simulation tool and give the reason for selecting the parameters.
3	Write any logic function, minimize it and simulate using appropriate tool. Selected function should be capable of illustrating minimization rules.
4	Sketch an op-amp circuit for comparing the voltage levels of two distinct signals. Illustrate how this circuit can be used to detect the positive half cycle of an alternating sinusoidal waveform.
5	Differentiate between a sensor and transducer. Explain the working principle of a piezo electric transducer.
6	Perform a role play to illustrate the working principle of GSM.

23ESP107/ 23ESP207	TECHNICAL ENGLISH FOR ENGINEERS	L	T	P	J	S	C	Year of Introduction
		2	0	2	0	4	3	2023

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

CO 1	Use vocabulary and language skills in professional communication. [Apply level]
CO 2	Demonstrate technical presentation and speaking skills. [Apply level]
CO 3	Make use of the interview skills in real life situation. [Apply level]
CO 4	Create professional and technical documents precisely. [Apply level]
CO 5	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
CO 1								✓	✓	✓		✓
CO 2								✓	✓	✓		✓
CO 3								✓	✓	✓		✓
CO 4								✓		✓		✓
CO 5								✓	✓	✓		✓

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	15	-	10	20	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: 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 1	**8 Hrs**
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 Hrs**
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 Hrs**
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 Hrs**
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 Hrs**
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.

23MCJ110 / 23MCJ210	IDEA LAB WORKSHOP	L	T	P	J	S	C	Year of Introduction
		2	0	2	2	5	0	2023

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

CO 1	Develop project using appropriate Microcontroller Programming languages. [Apply level]
CO 2	Develop product using PCB Design and Prototyping concepts. [Apply level]
CO 3	Create 2D and 3D models using appropriate tools. [Apply level]
CO 4	Create electronic documentation for the system/project using appropriate tools. [Apply level]
CO 5	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
CO 1	✓	✓	✓	✓	✓	✓		✓	✓			✓
CO 2	✓	✓	✓	✓	✓	✓		✓	✓			✓
CO 3	✓	✓	✓	✓	✓	✓		✓	✓			✓
CO 4	✓	✓	✓	✓	✓			✓	✓	✓		✓
CO 5	✓	✓	✓	✓	✓	✓		✓	✓			✓

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]	Project [J]			Total Marks
		Assignment	**Test-2**	**Class work**	**Evaluation 1**	**Evalaution-2 (Video Presentation)**	**Report**	
2-0-2-2	**5**	**15**	**10**	**20**	**10**	**20**	**20**	**100**

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		
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		
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	
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		
3.1	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		
4.1	3D modeling, Slicing, 3 D printing	1
4.2	2D design using Inkscape, Laser CAD	

4.3	Laser Cutting, 2D modelling, CNC Routing,	1
4.4	CNC Routing Tool familiarisation	
MODULE V		
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
PROJECT			
1	Design and implementation of a project involving embedded hardware, software and machined or 3D printed enclosure.		13
	Documentation of the above project (Report and video)		8

23HUL111/ 23HUL211	DESIGN THINKING	L	T	P	J	S	C	Year Of Introduction
		0	0	2	0	2	1	2023

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

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.

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

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

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. The Art Of Creative Thinking , https://www.amazon.in/Art-Creative-Thinking-Rod-Judkins/dp/1444794485/

8. Lateral Thinking: A Textbook of Creativity, https://www.amazon.in/Lateral-Thinking-Creativity-Edward-Bono/dp/0241257549/
9. This is Service Design Thinking: Basics, Tools, Cases , https://www.amazon.in/This-Service-Design-Thinking-Basics/dp/1118156307/
10. The Design of Business, https://www.amazon.in/Design-Business-Roger-L-Martin/dp/1422177807/
11. 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/
12. 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? e) 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? ii) 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

23EST117	BASICS OF ELECTRICAL ENGINEERING	L	T	P	J	S	C	Year of Introduction
		2	0	0	0	2	2	2023

Preamble: To provide the students with a broad perspective of the field of Electrical Engineering. The course is designed to empower the students in solving simple electrical circuits. The course facilitates the students to learn about the generation and transmission of electrical power. The course introduces the operation and characteristics of DC and AC machines.

Prerequisite: NIL

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

CO 1	Apply Electrical laws to compute different circuit parameters (Apply)
CO 2	Identify the parameters of simple magnetic circuits (Understand)
CO 3	Compute the parameters of simple A.C. electrical circuits (Understand)
CO 4	Demonstrate the benefits of a three-phase system for industrial electrical applications (Analyze)
CO 5	Understand the operation and characteristics of electrical machines

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓	✓										
CO 2	✓	✓								✓		
CO 3	✓	✓										
CO 4	✓								✓	✓		
CO 5	✓								✓			

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
		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

D. C. Circuits: Ohm's Law and Kirchhoff's Laws; Loop current and Nodal voltage method; Steady state analysis with independent sources, Star-Delta conversion (Analysis of resistive networks only).

Magnetic circuits: MMF, field strength, flux density, reluctance, energy stored in magnetic circuits, Simple problems in series magnetic circuits.

Electromagnetism: Faradays Laws, Lenz's Law, Fleming's Rules, Statically and dynamically induced EMF; Concepts of self-inductance, mutual inductance and coefficient of coupling.

MODULE II

Single Phase system: Generation of sinusoidal voltage, RMS and Average value, form factor and peak factor of sinusoidal waveforms, Impedance of series circuits (RL, RC and RLC circuits). Phasor diagram of series circuits; Real, reactive and apparent power, power factor, Power triangle.

MODULE III

Three Phase System: Generation of three phase voltages- advantages of three phase systems, star and delta connection, three wire and four wire systems, relation between line and phase voltages, line and phase currents. Expressions for power in three phase circuits; definition of phase sequence, balanced supply and balanced

load; Relationship between line and phase values of balanced star and delta connections; Power in balanced three phase circuits.

Power transmission and distribution: Typical electrical power transmission scheme, need for high voltage transmission, primary and secondary transmission and distribution systems.

MODULE IV

DC Machines Working principle of DC generator and motors; Types and constructional features; EMF equation of generator, Voltage equations and effects of armature reaction; Significance of Back EMF, torque equation; Types of D.C. motors, characteristics (series and Shunt motors only) and applications; Necessity of a starter for DC motor.

Transformer: Principle of operation and construction of single-phase transformers (core and shell types), emf equation, losses, efficiency, and voltage regulation

MODULE V

AC Machines

Three Phase Synchronous Generators: Principle of operation; Types and constructional features; emf equation.

Three Phase Induction Motors: Concept of rotating magnetic field; Principle of operation, types and constructional features; Slip and its significance; Applications of squirrel cage and slip ring motors; Necessity of a starter, star-delta starter.

Text books

1. Hughes, Electrical Technology, Pearson, 10th Edition, 2011.
2. Fitzgerald and Higginbotham, Basic Electrical Engineering, McGraw Hill Inc, 1981.
3. D.P. Kothari and I.J. Nagrath, Basic Electrical Engineering, 3rd Edition, TMH, 2009
4. Basic Electrical Engineering, D. C. Kulshreshtha, McGraw-Hill Education, Revised first edition, 2019

Reference books

1. Electrical Engineering Fundamentals, Vincent Del Toro, Prentice Hall, New Delhi.
2. Fundamentals of Electrical Engineering and Electronics, B.L. Theraja, S Chand and Company, Reprint Edition 2013.
3. Principles Electrical Engineering and Electronics, V.K Mehta, Rohit Mehta, S Chand and Company, 2nd edition, 2015.
4. M.S.Sukhija and T.K.Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University Press, 2012.
5. S. B. Lal Seksena and Kaustuv Dasgupta, “Fundamentals of Electrical Engineering”, Cambridge University Press.
6. NPTEL course on Basic Electrical Technology, Prof. G. D. Roy, IIT Kharagpur.

COURSE CONTENTS AND LECTURE SCHEDULE		
No.		No. of Hours [24]
MODULE 1 (6 Hr)		
1.1	Ohm's Law and Kirchhoff's Laws; Loop current Method	1
1.2	Nodal voltage method; Steady state analysis with independent sources	1
1.3	Star-Delta conversion (Analysis of resistive networks only).	1
1.4	MMF, field strength, flux density, reluctance, energy stored in magnetic circuits, Simple problems in magnetic circuits	1
1.5	Faradays Laws, Lenz's Law, Fleming's Rules, Statically and dynamically induced EMF	1
1.6	Concepts of self-inductance, mutual inductance and coefficient of coupling	1
MODULE II (4 Hr)		
2.1	Generation of sinusoidal voltage	1
2.2	RMS and Average value, form factor and peak factor of sinusoidal waveforms	1
2.3	Impedance of series circuits (RL, RC and RLC circuits). Phasor diagram of series circuits;	1
2.4	Real, reactive and apparent power, power factor, Power triangle	1
MODULE III (5 Hr)		
3.1	Generation of three phase voltages- advantages of three phase systems, star and delta connection, three wire and four wire system	1
3.2	Relation between line and phase voltages, line and phase currents. Expressions for power in three phase circuits	1
3.3	Definition of phase sequence, balanced supply and balanced load; Relationship between line and phase values of balanced star and delta connections	1
3.4	Power in balanced three phase circuits	1

3.5	Typical electrical power transmission scheme, need for high voltage transmission, primary and secondary transmission and distribution systems.	1
MODULE IV (5 Hr)		
4.1	Working principle of DC generator and motors; Types and constructional features; EMF equation of generator	1
4.2	Voltage equations and effects of armature reaction; Significance of Back EMF, torque equation	1
4.3	Types of D.C. motors, characteristics (series and Shunt motors only) and applications; Necessity of a starter for DC motor	1
4.4	Principle of operation and construction of single-phase transformers (core and shell types)	1
4.5	Emf equation, losses, efficiency, and voltage regulation	1
MODULE V (4Hr)		
5.1	Three phase synchronous generators - principle of operation. Types and constructional features; emf equation	1
5.2	Three Phase Induction Motors: Concept of rotating magnetic field; Principle of operation	1
5.3	Types and constructional features; Slip and its significance	1
5.4	Applications of squirrel cage and slip ring motors; Necessity of a starter, star-delta starter.	1

CO Assessment Questions	
CO1	Given two resistances, draw a circuit with both of them so as to draw minimum current. (Understand)
CO1	What is the shape of the electrical voltage waveform coming to your house? Draw the waveform with neat label. (Remember)
CO1	Solve problems applying Ohms law and Kirchoff's Laws (Apply)
CO2	Define and explain the terms MMF, reluctance and permeability with the help of a neat sketch. (Remember)
CO2	Describe the concept of magnetic reluctance and its relationship to magnetic circuits. How does it affect the flow of magnetic flux? Provide an example that illustrates the calculation of reluctance in a simple series magnetic circuit. Present your reasoning in a clear and organized manner. (Understand)

CO3	The voltage and current across a circuit is out of phase by 30°. The voltage is having a frequency of 50Hz. Plot the waveforms and compute the real and reactive power. (Apply)
CO3	Explain with the aid of a neat sketch, how the average and rms values of an alternating current are obtained. (Remember)
CO4	Three inductive coils, each with a resistance of 15Ω and an inductance of 0.03H are connected in (i) star and (ii) delta, to 3-phase, 400V, 50Hz supply. Calculate for each of the above case (i) phase current and line current and (ii) total power absorbed. (Apply)
CO4	Submit a report by identifying three cases where star and delta connected three phase AC systems are used (Understand)
CO5	Identify the motors used in all the machines/lathe in the Machine shop. (Understand)
CO5	The voltage applied to the stator of a 3 -phase, 6 pole induction motor has a frequency of 50 Hz. The frequency of the emf induced in the rotor is 2 Hz. What is the slip and at what speed is the motor running? (Apply)

23EST119	Basic Mechanical Engineering	L	T	P	J	S	C	Year of Introduction
		2	0	0	0	2	2	2023

Preamble:

Enable the students to build a foundation in fundamentals of Mechanical Engineering, to correlate theoretical concepts with their industrial/engineering applications. The course imparts knowledge on various topics like thermodynamics, heat transfer, thermal and hydraulic machines. It helps the learners to prepare them for advanced concepts in Mechanical Engineering and to do interdisciplinary research.

Prerequisite: Nil

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

CO 1	Explain the significance and applications of thermodynamics and heat transfer (Understand, Apply)
CO 2	Illustrate the working and features of thermal power generation systems (Understand)
CO 3	Describe and compare the working of hydraulic machines (Understand)
CO 4	Explain the basic principles of Refrigeration and Air Conditioning systems (Understand)
CO 5	Discuss the basic manufacturing, metal joining and machining processes (Understand, Apply)

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓	✓								✓		
CO 2	✓	✓										
CO 3	✓	✓							✓	✓		
CO 4	✓	✓										
CO 5	✓	✓							✓	✓		

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: Thermodynamics and Heat Transfer

Thermodynamics: Laws of thermodynamics, Significance and Applications of Heat Engine, Heat Pump and Refrigerator — Efficiency, Coefficient of Performance (COP)

Heat Transfer: Modes of Heat Transfer, Statement and explanation of Fourier's law of heat conduction, Newton's law of cooling, Stefan Boltzmann's law, Significance and Applications of heat transfer.

MODULE II: Thermal power generation Systems

Boilers: Classification, FBC

Steam Turbines: Classification, Working principle of Impulse and reaction turbines,

Gas turbines: Classification, Working principle of Open and Closed cycle Gas turbine,

IC Engines: Classification, Working principle of two stroke and four stroke (SI and CI) Engines

MODULE III: Fluid Machines

Pumps: Types, Operation of Reciprocating and Centrifugal pumps

Hydraulic Turbines: Classification, Description about working with sketches of: Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles)

MODULE IV: Refrigeration and Air Conditioning

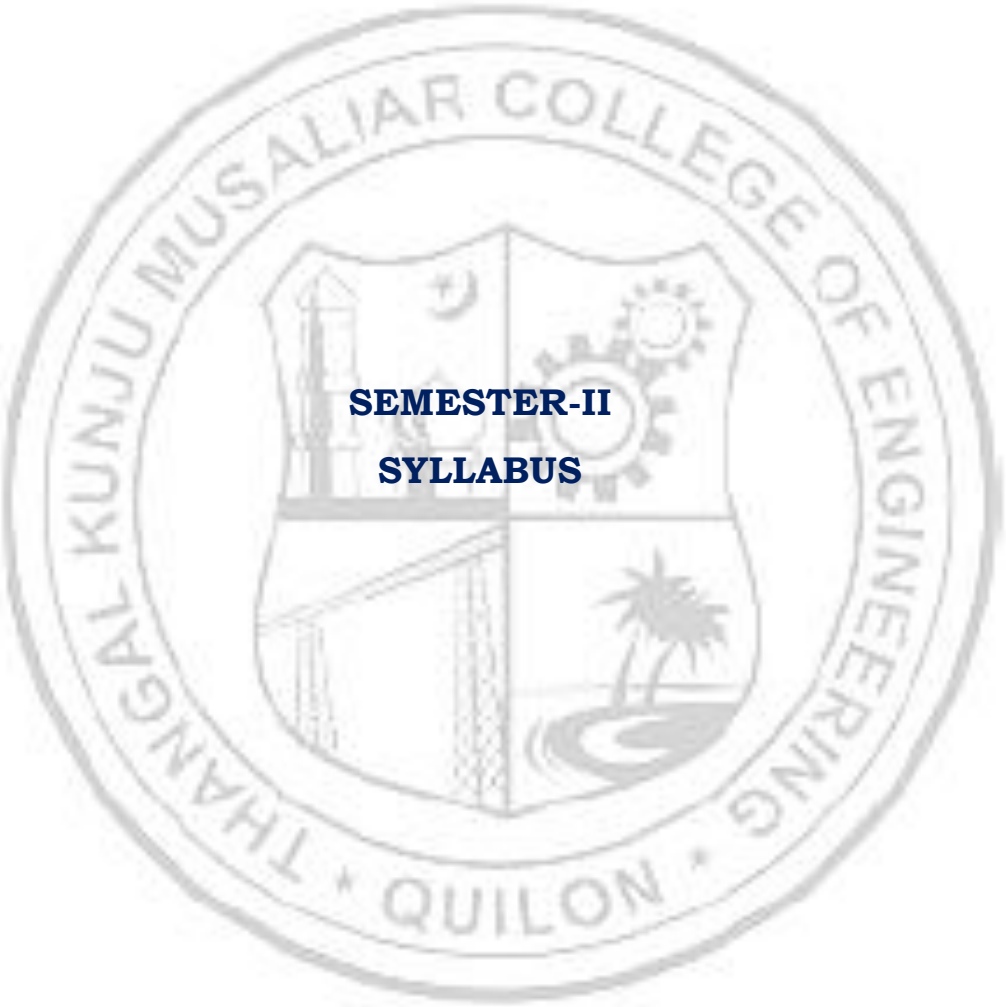
Refrigerant, Vapor compression refrigeration system- Principle, Domestic Refrigerator, Window and split air conditioners- Description about working with sketches.
MODULE V: Manufacturing Process
Basic description of the manufacturing processes *(Basic Concepts only and examples of products)* – Die Casting, Forging, Rolling, Extrusion. Basic description: Lathe Machine and Lathe operations, Drilling Basic description of Metal Joining Processes: Arc Welding, Soldering and Brazing and their applications,
Text books 1. Benjamin J., Basic Mechanical Engineering, Pentex Publishers Ltd., Kollam. 2. Balachandran P., Basic Mechanical Engineering, Owl publishers.
Reference books 1. Spalding and Cole, Engineering Thermodynamics, Hodder& Stoughton Educational. 2. Gill, Smith and Zuirys, Fundamentals of IC Engines, Oxford and IBH publishing Company Pvt. Ltd. New Delhi. 3. Crouse, Automobile Engineering, Tata Mc-Graw-Hill, New Delhi. 4. Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters & Publishers Pvt. Ltd., Mumbai. 5. Bansal R.K., Fluid Mechanics and Machine, Laxmi Publications Pvt. Ltd. New Delhi. 6. Pravin Kumar, Basic Mechanical Engineering, Pearson.

COURSE CONTENTS AND LECTURE SCHEDULE		
No.		No. of Hours
	MODULE 1	
1.1	Thermodynamics: Laws of thermodynamics, Significance and Applications	1
1.2	Heat engine, heat pump and refrigerator — Efficiency, Coefficient of Performance (COP)	1
1.3	Heat Transfer: Modes of Heat Transfer, Statement and explanation of Fourier's law of heat conduction, Newton's law of cooling, Stefan Boltzmann's law.	1
1.4	Significance and Applications of heat transfer	1
	MODULE II	
2.1	**Thermal power generation Systems**	1

	Boilers: Classification, FBC	
2.2	**Steam Turbines**: Classification, Working principle of Impulse and reaction turbines,	1
2.3	**Gas turbines**: Classification, Working principle of Open and Closed cycle Gas turbine	1
2.4	**IC Engines:** Classification, Working principle of four stroke (SI and CI) Engine	1
2.5	Working principle of two stroke (SI and CI) Engine	1
	MODULE III	
3.1	**Fluid Machines** **Pumps:** Types, Operation of Reciprocating pumps	1
3.2	Operation of Centrifugal pumps	1
3.3	**Hydraulic Turbines**: Classification, Description about working with sketches of Pelton turbine	1
3.4	**Hydraulic Turbines**: Description about working with sketches of Francis turbine.	1
3.5	**Hydraulic Turbines**: Description about working with sketches of Kaplan turbine.	1
3.6	Overall efficiency, Problems on calculation of input and output power of pumps and turbines	1
	MODULE IV	
4.1	**Refrigeration and Air Conditioning**: Refrigerant, Vapor compression refrigeration system - Principle	1
4.2	Domestic Refrigerator - Description about the working with sketches	1
4.3	Window air conditioners - Description about the working with sketches	1
4.4	Split air conditioners - Description about the working with sketches	1
	MODULE V	
5.1	Basic description of the manufacturing processes – Die Casting, Forging and their applications	1
5.2	Basic description of the manufacturing processes - Rolling, Extrusion, and their applications	1
5.3	Basic description: Lathe Machine and Lathe operations, Drilling	1

5.4	Basic description of Metal Joining Process: Arc Welding	1
5.5	Basic description of Metal Joining Processes: Soldering, Brazing, Applications	1

CO Assessment Questions	
1	1. An office worker claims that a cup of cold coffee on his table warmed up to 80°C by picking up energy from the surrounding air, which is at 25°C. Is there any truth to his claim? Does this process violate any thermodynamic laws? 2. Compare heat pump and refrigerator. Also obtain an expression for C.O.P. 3. Prepare a report on the applications of heat transfer in industries. 4. Consider two walls of a house that are identical except that one is made of 10-cm-thick wood, while the other is made of 25-cm-thick brick. Through which wall will the house lose more heat in winter?
2	1. Compare impulse and reaction steam turbine and state applications 2. Give the practical applications of Gas turbine 3. Identify and explain with neat sketch, the working of the engine that gives one power stroke for two revolutions of crank shaft. 4. Compare the working of 2 stroke and 4 stroke IC engines
3	1. Explain the working of a pump with sketches used for low head and high discharge 2. Prepare a report on the pumps with specifications used in industries 3. Identify hydroelectric power plant that uses Pelton wheel turbine and illustrate the working of the turbine. 4. A turbine is to operate under a head of 25 m at 200 rpm. The discharge is 9 m^3/s. If the overall efficiency of the turbine is 90%. Determine the power developed by the turbine.
4	1. Illustrate the principle of operation of household refrigerator. 2. It is proposed to use water instead of refrigerant- 134a as the working fluid in air-conditioning applications where the minimum temperature never falls below the freezing point. Would you support this proposal? Explain 3. With the help of suitable sketch explain the working of a split air conditioner 4. When selecting a refrigerant for a certain application, what qualities would you look for in the refrigerant?
5	1. Identify the manufacturing process that uses mould to produce desired parts? Explain the procedure. 2. Discuss the metal joining process to connect dissimilar metals. 3. Explain the method employed for making metal sheets in manufacturing process. 4. Submit a report by identifying three objects and list the different processes involved to obtain the finished product from raw material



SEMESTER-II

SYLLABUS

23MAP200	ORDINARY DIFFERENTIAL EQUATIONS AND TRANSFORMS [Circuit branches]	L	T	P	J	S	C	Year of Introduction
		3	1	2	0	5	5	2023

Preamble:

This course is to familiarize prospective engineers with some advanced concepts and methods in Mathematics which include ordinary differential equations, partial differential equations, and basic transforms such as Laplace and Fourier Transforms and Fourier series which are invaluable for any engineer's mathematical toolbox. The topics treated in this course have applications in all branches of engineering.

Prerequisite: Calculus of single and multivariable functions and partial differentiation.

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

CO 1	Solve homogeneous and non-homogeneous linear differential equations with constant coefficients (Apply level).
CO 2	Apply Laplace transforms to solve ordinary differential equations arising in engineering (Apply level).
CO 3	Develop the given functions as Fourier series expansions and apply them to solve problems arising in engineering (Apply level).
CO 4	Determine Fourier transforms of functions and learn their applications (Apply level).
CO 5	Use the concept of Z- transforms to solve practical problems (Apply level).

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓	✓			✓			✓	✓			✓
CO 2	✓	✓			✓			✓	✓			✓
CO 3	✓	✓			✓			✓	✓			✓
CO 4	✓	✓			✓			✓	✓			✓
CO 5	✓	✓			✓			✓	✓			✓

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	
	Classwork	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	
	5	15	10	10	20		**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: (**Ordinary differential equations**)
(Text 2: Relevant topics from sections 2.1, 2.2, 2.5, 2.6, 2.7, 2.10, 3.1, 3.2, 3.3) Homogenous linear differential equation of second order, superposition principle, general solution, homogenous linear ODEs with constant coefficients-general solution. Solution of Euler-Cauchy equations (second order homogeneous only). Non-homogenous linear ODEs-general solution, solution by the method of undetermined coefficients (for the right-hand side of forms $x^n, e^{kx}, sinax, cosax, e^{ax}sinax, e^{ax}cosax$ and their linear combinations), method of variation of parameters. Solution of higher order equations-homogeneous linear ODE with constant coefficients.
MODULE II: (**Laplace transforms**)
(Text 2: Relevant topics from sections 6.1,6.2,6.3,6.4,6.5) Laplace Transform and its inverse, Existence theorem (without proof), linearity, Laplace transform of basic functions, first shifting theorem, Laplace transform of derivatives and integrals, solution of differential equations using Laplace transform, Unit step function, Second shifting theorem. Convolution theorem (without proof) and its application to finding inverse Laplace transform of products of functions.
MODULE III: (Fourier Series)
(Text 1: Relevant topics from sections 9.8, 9.9. Text 2: Relevant topics from sections 11.1, 11.2,11.6) Taylor series (without proof, assuming the possibility of power series expansion in appropriate domains), Binomial series and series representation of exponential, trigonometric, logarithmic functions (without proofs of convergence); Fourier series, Euler formulas, Convergence of Fourier series (without proof), half range sine and cosine series, Parseval's theorem (without proof).
MODULE IV: (Fourier Transforms)
(Text 2: Relevant topics from sections 11.7,11.8, 11.9) Fourier integral representation, Fourier sine and cosine integrals. Fourier sine and cosine transforms, inverse sine and cosine transform. Fourier transform and inverse Fourier transform, basic properties.
MODULE V: (Z -Transforms)
(Text 3: Relevant portions of sections (23.1, 23.2, 23.3, 23.4, 23.5,23.6, 23.7, 23.8, 23.12, 23.15, 23.16) Introduction to Z-transform, definition, some standard Z-transforms - and their inverses, linearity property, damping rule, some standard results, convolution,

region of convergence of two-sided Z -transforms, evolution of inverse Z- transform using partial fraction.

Text books

1. H. Anton, I. Biven S.Davis, "Calculus", Wiley, 10th edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley, 10th edition, 2015.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2018

Reference books

9. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017
10. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9 th Edition, Pearson, Reprint, 2002.
11. Peter O Neil, Advanced Engineering Mathematics, 7th Edition, Thomson, 2007.
12. Louis C Barret, C Ray Wylie, "Advanced Engineering Mathematics", Tata McGraw Hill, 6th edition, 2003.
13. Veerarajan T, "Engineering Mathematics for first-year", Tata McGraw - Hill, 2008.
14. Srimanta Pal, Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, 2015.
15. Ronald N. Bracewell, "The Fourier Transform and its Applications", McGraw - Hill International Editions, 2000.
16. Prof. Haynes Miller, Prof. Arthur Mattuck, Differential Equations [MITOPENCOURSEWARE] https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/download/(Relevant sections)
17. Prof. Alan V. Oppenheim, Signals and Systems [MITOPENCOURSEWARE] https://ocw.mit.edu/courses/res-6-007-signals-and-systems-spring-2011/pages/introduction/ (Relevant sections).

COURSE CONTENTS AND LECTURE SCHEDULE

No.		No. of Hours
	MODULE 1	
1.1	Homogenous linear equation of second order, Superposition principle, general solution	1
1.2	Homogenous linear ODEs of second order with constant coefficients.	1
1.3	Homogenous linear ODEs of second order with constant coefficients (continued).	1
1.4	Second order Euler-Cauchy equation	1

1.5	Non-homogenous linear differential equations of second order with constant coefficient-solution by undetermined coefficients.	1
1.6	Non-homogenous linear differential equations of second order with constant coefficient-solution by undetermined coefficients	1
1.7	Variation of parameters	1
1.8	Higher-order equations with constant coefficients	1
1.9	Higher-order equations with constant coefficients	1
MODULE II		
2.1	Laplace Transform, Inverse Transform, Linearity	1
2.2	First shifting theorem, transform of basic functions	1
2.3	Transform of derivatives and integrals	1
2.4	Solution of Differential equations, Initial value problems by Laplace transform method.	1
2.5	Solution of Differential equations, Initial value problems by Laplace transform method. (Continued)	1
2.6	Unit step function -Second shifting theorem	1
2.7	Unit step function -Second shifting theorem (Continued)	1
2.8	Convolution and related problems.	1
2.9	Convolution and related problems (Continued).	1
MODULE III		
3.1	Taylor series, Binomial series.	1
3.2	Taylor series, Binomial series (continued)	1
3.3	Series representation of exponential, trigonometric, and logarithmic functions	1
3.4	Fourier series, Euler formulas	1
3.5	Fourier series, Euler formulas (Continued)	1
3.6	Convergence of Fourier series (Dirichlet's conditions).	1
3.7	Half-range sine and cosine series	1
3.8	Half-range sine and cosine series (Continued)	1
3.9	Parseval's theorem.	1

MODULE IV		
4.1	Fourier integral representation	1
4.2	Fourier integral representation (Continued)	1
4.3	Fourier Cosine and Sine integrals	1
4.4	Fourier Cosine and Sine integrals (Continued)	1
4.5	Fourier Cosine and Sine transform	1
4.6	Fourier Cosine and Sine transform (Continued)	1
4.7	Fourier transforms and its inverse transforms, basic properties.	1
4.8	Fourier transforms and its inverse transforms, basic properties (Continued)	1
MODULE V		
5.1	Z-transform, some standard Z-transforms - and their inverses	1
5.2	Z-transform, some standard Z-transforms - and their inverses (Continued)	1
5.3	Linearity property, damping rule	1
5.4	Linearity property, damping rule (Continued)	1
5.5	Some standard results	1
5.6	Convolution	1
5.7	Region of convergence of two-sided Z -transforms	1
5.8	Region of convergence of two-sided Z -transforms (Continued)	1
5.9	Evolution of inverse Z- transform using partial fraction	1
5.10	Evolution of inverse Z- transform using partial fraction (Continued)	1

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Basics for solving ODE	2	Basic Integration, differentiation, arithmetic operations, matrix operations and plotting solution curves of ODE using MATLAB/Scilab.
2	Solution Curves of ODE	1	
3	Solution of ODE using Simple Integrals	2	Find solutions of differential equations using simple integrals.
4	Analytic Solution of ODE	2	Evaluating analytic solutions of ODE and apply them to solve engineering problems
5	Laplace Transforms	3	Evaluating Laplace transforms of different functions.
6.	Inverse Laplace Transforms	3	Evaluating inverse Laplace transforms of different functions.
7.	Heaviside functions, Dirac delta function, and Ramp function.	2	Laplace transforms of Heaviside functions, Dirac delta function, and ramp function.
8.	Applications of Laplace Transform	2	Solving ODE using Laplace transforms.
9.	Fourier Series	2	Evaluating Fourier series of different functions.
10.	Fourier Transforms	2	Evaluating Fourier transforms of different functions.
11.	Z- Transforms	2	Evaluating Z transforms of different functions.

CO Assessment Questions	
1	1. Solve $y'' - y = 0$ for the initial conditions $y(0) = 1, y'(0) = -1$. Then change the initial conditions to $y(0) = 1.001, y'(0) = -0.999$ and explain why this small change of 0.001 causes a larger change later. Sketch the graph of the solution in both cases using any Mathematical software and comment. 2. Find the current $I(t)$ in an RLC-circuit with $R = 11\Omega$ (ohms), $L = 0.1$H (henry), $C = 10^{-2}$ F (farad), which is connected to a source of EMF $E(t) = 110\sin(60 \cdot 2\pi t) = 110\sin 377t$ (hence 60 Hz = 60cycles/sec, the usual in the U.S. and Canada; in Europe it would be 220 V and 50 Hz). Assume that current and capacitor charge are 0 when $t = 0$. 3. Solve the differential equation of $y''' - 3y'' + 3y' - y = e^x - x - 1$. 4. **Team Work:** A 10-kg mass is attached to a spring having a spring constant of 140 N/m. The mass is started in motion from the equilibrium position with an initial velocity of 1 m/sec in the upward direction and with an applied external force given by sin t (in newtons). The mass is in a viscous medium with a coefficient of resistance equal to 90 N-sec m. Formulate an initial value problem that models the given system; solve the model and interpret the results. Also include MATLAB code for solving ODE. Prepare a short report on the problem highlighting the observations you made and interpretation of the results.
2	1. Using convolution, determine the response of the damped mass-spring system modeled by $y'' + 3y' + 2y = r(t)$, $r(t) = 1$ if $1 < t < 2$ and 0 otherwise, $y(0) = y'(0) = 0$. 2. Solve differential equation $9y'' + 6y' + y = 0, y(0) = 3, y'(0) = 1$ using Laplace transforms. Use any mathematical software find the solution and compare the solutions. 3. **Team Work:** Find at least two applications of Laplace transforms in the engineering domain. Prepare a short report and a presentation of the same.
3	1. Use Maclaurin series of $\ln(1 + x), -1 < x \leq 1$ to find an approximate value of ln2. 2. Find the Fourier series of the function $f(x) = x^2, -2 \leq x < 2, f(x + 4) = f(x)$. Hence using Parseval's identity prove that $1 + \frac{1}{2^4} + \frac{1}{3^4} + \cdots = \frac{\pi^4}{90}$. 3. **Team Work:** Find the Fourier series of the function obtained by passing the voltage $v(t) = V_0 \cos 100\pi t$ through a half-wave rectifier that clips the negative half-waves. (a) Write a program for obtaining partial sum of the Fourier series so obtained. (b) Choose the first 5 or more partial sums until they approximate the given function reasonably well. Compare and comment.
4	1. Find Fourier cosine transform and sine transform of any function. Write a short report on ways of obtaining these transforms, with illustrations by examples of your own.

	2. Find the Fourier integral representation of function defined by $f(x) = e^{-x}$ for $x > 0$ and $f(x) = 0$ for $x < 0$. 3. **Team Work:** What are the conditions for the existence of Fourier Transform of a function $f(x)$ and write at least two applications of Fourier transform in engineering domain. Sketch the function and its transform using any mathematical software.
5	1. Find Z- transform of the function $\sin(3n + 5)$. 2. Find the Z- transform and region of convergence of $u(n) =^{n} C_k, n \geq k$. 3. **Team Work:** Create a group of at least 8 students and identify an application of Z-transform in real life. Solve the problem using any mathematical software and comment on the result. Prepare a short report.

THANGAL KUNJU MUSALIAR COLLEGE OF ENGINEERING · QUILON ·

23CYP203	ENGINEERING CHEMISTRY (Circuit Branches)	L	T	P	J	S	C	Year of Introduction
		2	1	2	0	4	4	2023

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

Course Outcomes: 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
CO 1	✓											✓
CO 2	✓	✓			✓				✓	✓		✓
CO 3	✓	✓							✓	✓		✓
CO 4	✓	✓							✓	✓		✓
CO 5	✓	✓			✓		✓		✓	✓		✓
CO 6	✓	✓			✓			✓	✓	✓		✓

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools	End Semester

	Test1	Test 2	Other tools	Examination
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]	Theory [L- T]				Practical [P]		
	Attendance	Assignment	Test-1	Test-2	Class work	Lab Exam	Total Marks
	5	10	10	10	15	10	60

Total Marks distribution

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

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
	MODULE 1	
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	
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	
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	
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	
5.1	Nanomaterials - Definition - Unique characteristics	1
5.2	Top-down and bottom-up approach for synthesis (brief explanation) - Chemical methods of 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	
1	Illustrate why the molecular orbital energy level diagram for O_2 is different from N_2
2	a) 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. b) Compare XPS and AES techniques and identify when each testing method is used.
3	a) Write the cell reactions of the following cell. $Cd/CdSO_4(0.01)//CuSO_4(0.5M)/Cu$. Sketch the electrochemical cell. b) Prepare a presentation on the topic "Energy storage devices; past, present and future" c) Write a report on the topic "Corrosion Control in Industry"
4	a) Prepare a table comparing various charge transport carriers in polymers b) Prepare a power point presentation on conducting polymer-based biosensors
5	a) Compare top-down and bottom-up methods for nanomaterial synthesis. b) Write a report on the role of nanotechnology in your branch of engineering c) Group discussion on "can nanotechnology offer solutions to environmental issues"
6	a) Estimate the amount of iron from iron ore using volumetric and potentiometric titrations, compare the results and identify which technique is more accurate. b) Collect water from three different sources. Measure their conductivity and pH and interpret the results.

23ESP204	PROBLEM SOLVING AND PROGRAMMING	L	T	P	J	S	C	Year of Introduction
		3	0	2	0	5	4	2023

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

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

CO 1	Formulate simple algorithms/flowcharts for arithmetic and logical problems using appropriate tools.[Apply level]
CO 2	Implement conditional branching, iteration and recursion.[Understand level]
CO 3	Use arrays, pointers and structures to formulate algorithms and implement programs.[Understand level]
CO 4	Decompose a problem into functions and synthesize a complete program using divide and conquer approach.[Understand level]
CO 5	Develop readable C programs with files for reading input and storing output.[Understand level]
CO 6	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
CO 1	✓	✓			✓			✓				✓
CO 2	✓	✓						✓				✓
CO 3	✓	✓						✓				✓
CO 4	✓	✓						✓				✓
CO 5	✓	✓						✓				✓
CO 6	✓	✓						✓				✓

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]	**Theory [L- T]**				**Practical [P]**		**Total Marks**
	Attendance	**Assignment**	**Test-1**	**Test-2**	**Class work**	**Lab Exam**	
3-0-2-0	5	15	10	10	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 (7 hours)

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 (8 hours)

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 (7 hours)

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 (7 hours)

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 (7 hours)

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
	MODULE 1	
1.1	Basics of Computer Architecture: Processor	1 Hour
1.2	Basics of Computer Architecture: Memory	1 Hour
1.3	Basics of Computer Architecture: Input& Output devices	1 Hour
1.4	Application Software & System software: Compilers, interpreters, High level and low level languages	1 Hour
1.5	Introduction to structured approach to programming, Flow chart	1 Hour
1.6	Algorithms, Pseudo code	1 Hour

1.7	Bubble sort, linear search - algorithms and pseudocode	1 Hour
MODULE II		
2.1	Basic structure of C program: Character set, Tokens, Identifiers in C	1 Hour
2.2	Basic structure of C program: Variables and Data Types , Constants, Console IO Operations, printf and scanf	1 Hour
2.3	Operators and Expressions: Expressions and Arithmetic Operators, Relational and Logical Operators.	1 Hour
2.4	Operators and Expressions: Conditional operator, size of operator, Assignment operators and Bitwise Operators. Operators Precedence	1 Hour
2.5	Control Flow Statements: If Statement, Unconditional Branching using goto statement.(Simple programs covering control flow)	1 Hour
2.6	Control Flow Statements: Switch Statement, Break statement.(Simple programs covering control flow)	1 Hour
2.7	Control Flow Statements: While Loop, Do While Loop (Simple programs covering control flow)	1 Hour
2.8	Control Flow Statements: For Loop, Continue statement.(Simple programs covering control flow)	1 Hour
MODULE III		
3.1	Arrays Declaration and Initialization, 1-Dimensional Array, Simple programs covering 1 – Dimensional Array	1 Hour
3.2	Arrays Declaration and Initialization, 2-Dimensional Array , Simple programs covering 2 – Dimensional Array	1 Hour
3.3	Arrays -2- Programs covering 1 and 2 – Dimensional Arrays	1 Hour
3.4	String processing: In built String handling functions(strlen, strcpy, strcat and strcmp, puts, gets)	1 Hour
3.5	Linear search program- Implementation	1 Hour
3.6	Bubble sort program- Implementation	1 Hour
3.7	Simple programs covering arrays and strings	1 Hour
MODULE IV		
4.1	Introduction to modular programming - writing functions	1 Hour
4.2	Writing functions with formal parameters and actual parameters	1 Hour

4.3	Writing functions with Pass by Value and Recursion	1 Hour
4.4	Writing functions with arrays as Function Parameters	1 Hour
4.5	Structure and union	1 Hour
4.6	Storage Classes, Scope and life time of variables	1 Hour
4.7	Simple programs using functions	1 Hour
MODULE V		
5.1	Basics of Pointers: declaring pointers	1 Hour
5.2	Pointers: accessing data though pointers, NULL pointer, simple programs	1 Hour
5.3	Pointers: Array access using pointers, pass by reference effect, simple programs	1 Hour
5.4	File Operations: open, close, read, write, append	1 Hour
5.5	Programs using file operations	1 Hour
5.6	Sequential access and random access to files: In built file handling functions (rewind() ,fseek(), ftell(), feof(), fread(), fwrite()),	1 Hour
5.7	Sequential access and random access to files: Simple programs	1 Hour

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	

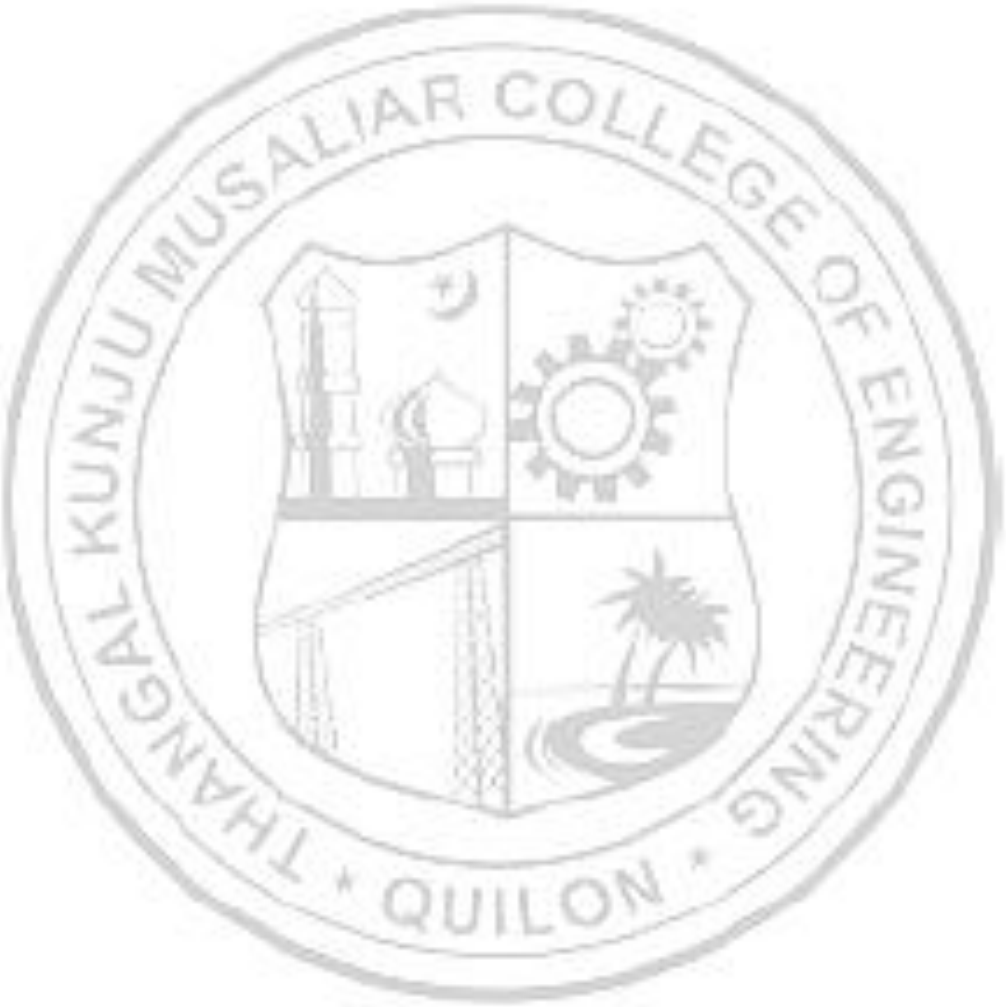
7	Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array	1	i) Read n integers, store them in an array and find their sum and average ii) Read n integers, store them in an array and search for an element in the array using an algorithm for Linear Search iii) Read n integers, store 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,
	Pass by Value, Recursion, Arrays as Function Parameters	2	

			(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	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
13	Sequential access and random access to files: In built file	2	

	handlingfunctions (rewind() ,fseek(), ftell(), feof(), fread(), fwrite())		(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.

CO Assessment Questions	
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
2	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.
3	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.
4	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
5	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
6	Test and execute the above programs using a C Complier.



23ESP108/ 23ESP208	ENGINEERING GRAPHICS	L	T	P	J	S	C	Year of Introduction
		3	0	2	0	5	4	2023

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 conics, orthographic / pictorial projections, dimensioning and specifications, sectional views, isometric projection, development of surfaces and use of AutoCAD 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

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

CO1	Construct plain, diagonal and vernier scales.
CO2	Construct conic sections and engineering curves.
CO3	Prepare multi-view orthographic projections of regular solids by visualizing them in different positions.
CO4	Draw sectional views and develop surfaces of regular geometric solids.
CO5	Prepare pictorial drawings using the principles of isometric projection to visualize objects in three dimensions and convert isometric views to orthographic views.
CO6	Obtain multi-view projections, sections and solid models of objects using CAD tools.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓											
CO 2	✓											
CO 3	✓											
CO 4	✓											
CO 5	✓									✓		✓
CO 6	✓				✓					✓		✓

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	10	10	10	10	**60**

Total Marks distribution

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

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
Part A
MODULE I: Introduction to Engineering Drawing
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Dimensioning, Conic sections – ellipse, parabola, hyperbola (eccentricity method and rectangle method only); Cycloid, Involute, helix (basic curves only); Scales – Plain, Diagonal and Vernier Scales (simple problems only).
MODULE II: Orthographic Projections
Principles of Orthographic Projections-Conventions - Projections of Points and projection of lines parallel to/inclined to both reference planes. Traces of lines.
MODULE III: 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 IV: Sections and Sectional Views of Right Angular Solids, Development of Surfaces
Draw the sectional orthographic views of geometrical solids- Prism, Cylinder, Pyramid, Cone. Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone.
MODULE V: Isometric Projections
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and isometric views to orthographic views.
Part B
AutoCAD (Internal Evaluation only) Demonstrating knowledge of AutoCAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Prepare CAD drawing of objects.
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
MODULE 1		
1.1	Principles of Engineering Graphics and their significance, usage of Drawing instruments, Types of lines and their uses.	1
1.2	Types, system of dimensioning and lettering practice.	1
1.3	Conic section– ellipse (eccentricity method)	1
1.4	Conic section– ellipse (rectangle method)	1
1.5	Conic section- parabola (eccentricity method)	1
1.6	Conic section- parabola (rectangle method only)	1
1.7	Conic section –hyperbola (eccentricity method and rectangle method only)	1
1.8	Construction of Cycloid (basic curve only)	1
1.9	Involute (simple case only)	1
1.10	Helix (simple case only)	1
1.11	Introduction to Scales, Scales – Plain Scale, Diagonal and Vernier Scales (simple problems only)	1
1.12	Plain Scale (simple problems only)	1
1.13	Diagonal Scales (simple problems only)	1
1.14	Vernier Scales (simple problems only)	1
MODULE II		
2.1	Principles of Orthographic Projections-Conventions - Projections of Points	1
2.2	Projections of Points (Problems on projection of points)	1
2.3	Projection of lines parallel to/inclined to one reference plane.	1
2.4	Problems on lines inclined to one plane and parallel to other.	1
2.5	Problems on lines inclined to one plane and parallel to other.	1
2.6	Projection of lines inclined to both reference planes. Line rotation method	1
2.7	Problem on lines inclined to both planes	1

2.8	Problem on lines inclined to both planes when apparent lengths are given.	1
2.9	Traces of lines using line rotation.	1
2.10	Projection of lines-Plane rotation method	1
2.11	Problems on Lines using plane rotation method	1
2.12	Traces of lines using plane rotation.	1
2.13	Problems on Lines when traces are given.	1
	MODULE III	
3.1	Projection of solids- Prisms, pyramids - simple position	1
3.2	Projection of solids- Cylinder, cone - simple position	1
3.3	Projection of solids-Prisms inclined to one plane.	1
3.4	Projection of solids-Pyramids inclined to one plane.	1
3.5	Projection of solids-Cylinders inclined to one plane.	1
3.6	Projection of solids-Cone inclined to one plane.	1
3.7	Projection of solids-Prisms inclined to both the reference Planes	1
3.8	Projection of solids-Pyramids inclined to both the reference Planes	1
3.9	Projection of solids-Cone inclined to both the reference Planes	1
3.10	Projection of solids-Cylinders inclined to both the reference Planes	1
3.11	Problems on projection of solids inclined to both planes.	1
3.12	Problems on projection of solids inclined to HP with solid resting on VP in simple position.	1
3.13	Problems on projection of solids inclined to both planes with solid resting on VP in simple position.	1
	MODULE IV	
4.1	Introduction to section- Types of section planes -Sectional orthographic view of Prism when section plane perpendicular to VP inclined to HP	1
4.2	Sectional orthographic view of Pyramid when section plane perpendicular to VP inclined to HP	1
4.3	Sectional orthographic view of Cylinder when section plane perpendicular to VP inclined to HP	1

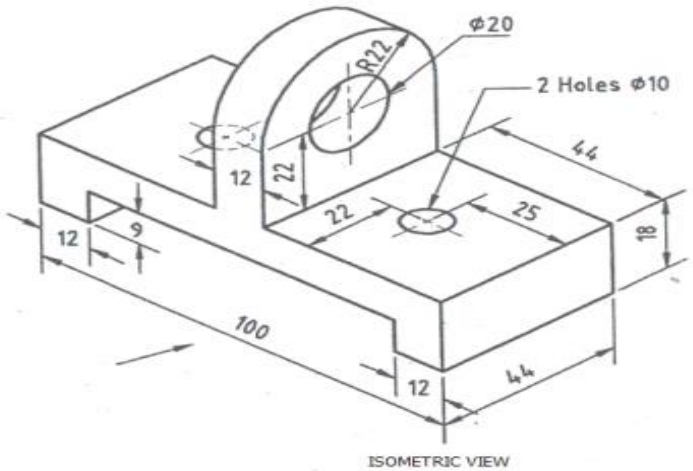
4.4	Sectional orthographic view of Cone when section plane perpendicular to VP inclined to HP	1
4.5	Sectional orthographic view of above solids when section plane perpendicular to HP inclined to VP	1
4.6	Sectional orthographic view of above solids when true shape of the section is given	1
4.7	Problems on Sectional orthographic view of above solids when true shape of the section is given	1
4.8	Development of surfaces of Right Regular Solids – Prism.	1
4.9	Development of surfaces of Pyramid.	1
4.10	Problems on development of Prism and Pyramid for sectional solids.	1
4.11	Development of surfaces of Right Regular Solid- Cone and Cylinder.	1
4.12	Problems on development showing shortest path.	1
MODULE V		
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.	1
5.6	Conversion of Isometric Views to Orthographic Views.	1
Total Hours		**58**

LESSON PLAN FOR LAB COMPONENT

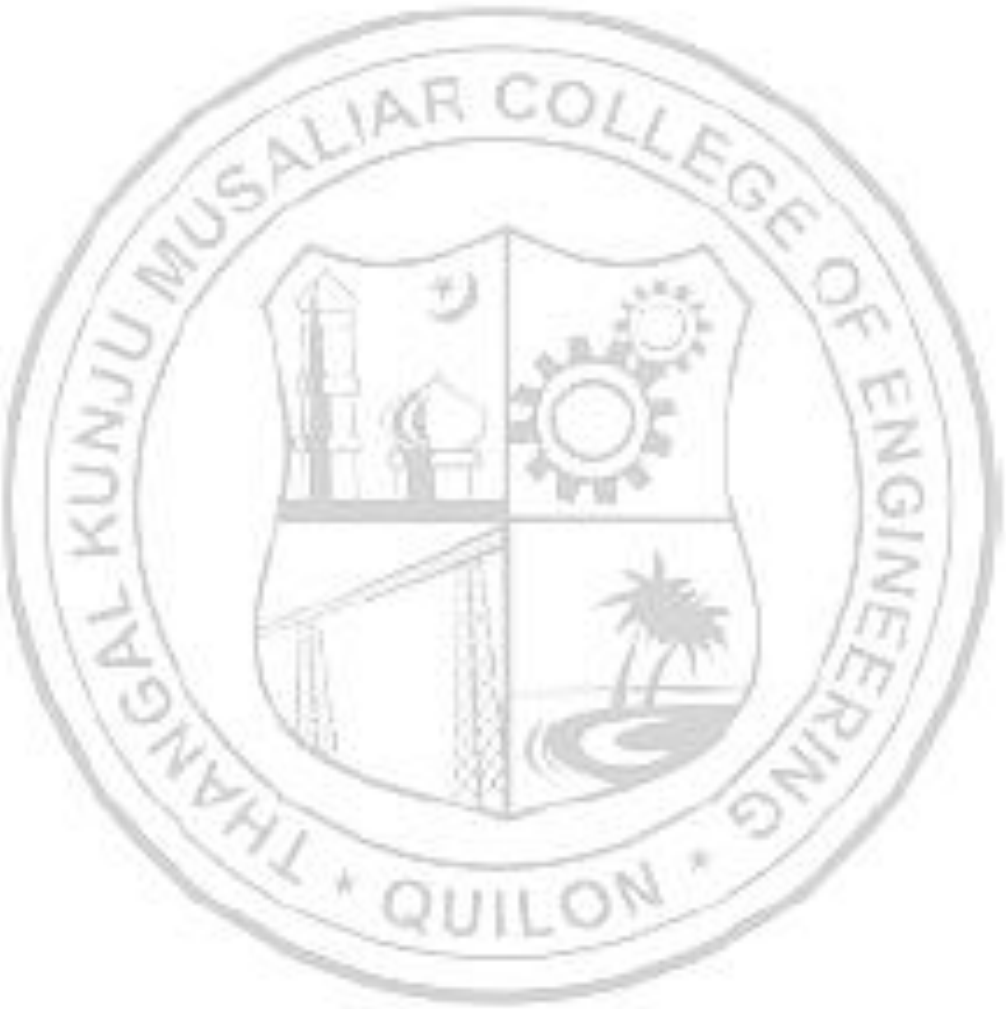
No.	**Topic**	**No. of Hours**	**Experiment**
1	Familiarization with AutoCAD commands and tools	2	Auto CAD drawing of Simple geometries
2	Dimensioning, conversion of isometric views in to orthographic views using AutoCAD	2	Conversion of simple components to orthographic views

3	AutoCAD Lab Test	2	Conversion of simple components to orthographic views

CO Assessment Questions	
CO1	1. Construct a plain scale to show meters when 1cm represents 4 meters and long enough to measure up to 50 meters. Find the R.F. and mark on it a distance of 36 meters. 2. Construct a diagonal scale of R.F.= 1:32,00,000 to show kilometers and long enough to measure up to 400 km. Show distances of 257 km on your scale. 3. A room of 1000 m^3 volume is represented by a block of 125 cm^3 volume. Find R.F. and construct a plain scale to measure up to 30 m. Measure a distance of 18 m on the scale.
CO2	1. The focus of a conic is 30 mm from directrix. Draw the locus of a point P moving in such a way that eccentricity is 2/3. Also draw a tangent and normal at any point on the curve. 2. A circle of diameter 50 mm rolls on a straight line without slipping. Trace the locus of a point on the circumference of the circler rolling for one complete revolution. Name the curve, draw the tangent and normal at any point on the curve. 3. A point moves such that its distance from a fixed straight line to its distance from a fixed point is equal. Draw the locus of the curve traced by that point. Add a normal and tangent to the curve at 40mm above the axis. 4. A roller of 40 mm diameter rolls over a horizontal table without slipping. A point on the circumference of the roller is in contact with the table surface in the beginning till one end of revolution. Draw the path traced by the point.
CO3	1. The ends of three guy ropes are tied to a vertical post at a height of 20m above the ground. The other ends of the ropes are pegged to the ground. In the front view the distance between the first peg and the pole is 10m and is on the left side of the pole, while the other two pegs are on the right side of the pole and are 15m and 20m from the pole respectively. In the top view the bearings of the ropes appear as S45°W, N30°E and S40°E for the first, second and third ropes respectively. Find the true lengths and inclination of the ropes with the ground. 2. Draw the projections of a cone having base diameter 50mm and 60mm axis, when it is resting on the ground on a point of its base circle with the axis inclined at 30° to the HP and 45° to the VP. by auxiliary projection method. 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.
CO4	1. 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. 2. A triangular prism with a base side of 50mm and a height of 80mm is standing on its end on the ground with a side of the end perpendicular to VP. It is cut by an A.I.P in such a way that the true shape of the section is a trapezium with parallel sides of 40mm and12mm. Draw the projections and an auxiliary view showing the true shape of the section. Find the angle made by the cutting plane with the HP 3. 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. 4. 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.



23ESL109/ 23ESL209	MANUFACTURING PRACTICES	L	T	P	J	S	C	Year of Introduction
		0	0	4	0	4	2	2023

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

Course Outcomes: 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

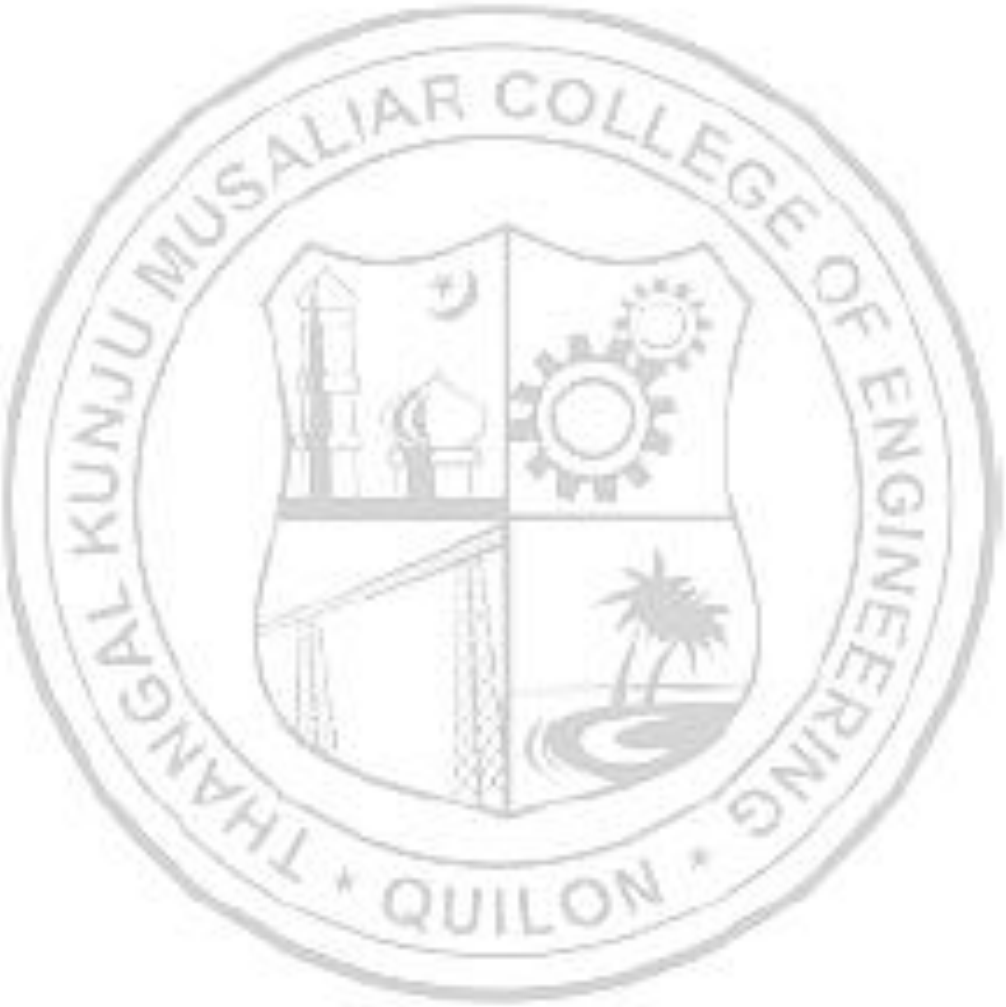
1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai**.**
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education 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 Hrs	
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 Hrs	
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 Hrs	
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	
1	Identify the best suitable manufacturing processes for a given product/design
2	A team work to fabricate the component as per the given design using available manufacturing methods and submit the report
3	Identify the components in the electric system shown in the drawing and complete the wiring as per the drawing to get the required result
4	Identify the electronic components in the given figure and assemble the component on a circuit board to enable the required function



23MCT110/ 23MCT210	SPORTS AND YOGA	L	T	P	J	S	C	Year of Introduction
		2	0	0	0	2	0	2023

Preamble: This course enables the learners to understand how to attain physical fitness, mental well-being, and holistic growth through the combined benefits of sports and yoga. The topics covered in this course are Physical fitness, wellness and exercise programmes, First aid, Fundamentals of Anatomy & physiology in physical education, Postures & nutrition, Sports & games and Yoga & Lifestyle. This course helps the students to develop appreciation of physical activity as a lifetime pursuit and a means to better health.

Prerequisite: NIL

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

CO 1	Demonstrate the need of physical activities and Yoga for the strength, flexibility, and relaxation of mind and body. [Apply level]
CO 2	Use scientific principles of exercise and training in daily routine. [Apply level]
CO 3	Apply first aid promptly and appropriately whenever and wherever the need arises. [Apply level]
CO 4	Identify the importance of the components of health-related fitness, such as cardio respiratory endurance, flexibility, and body composition. [Understand level]
CO 5	Use the opportunities to participate in sports and games activities with a scientific approach. [Apply level]

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1								✓	✓	✓		✓
CO 2								✓	✓	✓		✓
CO 3						✓		✓	✓	✓		✓
CO 4								✓	✓	✓		✓
CO 5								✓	✓	✓		✓

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	-	-

SYLLABUS
MODULE I: Physical fitness, wellness and exercise programmes.
• Meaning and importance of physical fitness and wellness. • Components of physical fitness and health related fitness. • How to start an exercise programme. • 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 battery for speed, strength, endurance, flexibility. • Importance of weight training. • 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, 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, Postures and nutrition

- Define Anatomy, physiology and its importance.
- Effects of exercise on the functioning of various body system (Circulatory system, muscular system and respiratory 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.
- Balanced diet, malnutrition and Deficiency diseases.
- Hydration.

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
- History of the game / sports.
- Latest general rule of the game / sports.
- Specification of play fields and related sports equipments

MODULE V : Yoga & Lifestyle

- Meaning & importance of Yoga.
- Elements of Yoga
- Introduction-Asanas, Pranayama, Meditation & Yogic Kriyas.
- Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Shashankasana)
- Relaxation Techniques for improving concentration-Yog-nidra.
- Asanas as preventive measure.
- Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana.
- Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana.
- Back pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana.
- Diabetes: Procedure, Benefits & Contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana.
- Asthema: Procedure, Benefits & Contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.

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.
5.

COURSE CONTENTS AND LECTURE SCHEDULE		
No.		No. of Hours [26]
MODULE 1: Physical fitness, wellness and exercise programmes.		
1.1	• Meaning and importance of physical fitness and wellness. • Components of physical fitness and health related fitness.	1 Hour
1.2	• How to start an exercise programme. • Exercise for improving speed, strength, endurance, and flexibility and co ordinative abilities.	1 Hour
1.3	• Exercises to prevent back pain, tennis elbow, shoulder injury and knee pain, Neck pain.	1 Hour
1.4	• Fitness test battery for speed, strength, endurance, flexibility.	1 Hour
1.5	• Importance of weight training. • Warming up and cooling down.	1 Hour
1.6	• How to deal with every day stress.	1 Hour
MODULE II: First aid		
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 Hour
2.4	• Common injuries and their management - Wounds, Cuts, Sprain, Fracture and Dislocation.	1 Hour
2.5	• Cardio pulmonary resuscitation. (CPR)	1 Hour
2.6	• How to prevent muscle cramps and its management. • How to carry an injured person	1 Hour
MODULE III: Fundamentals of Anatomy and physiology in physical education, Postures and nutrition		
3.1	• Define Anatomy, physiology and its importance. • Effects of exercise on the functioning of various body system (Circulatory system, muscular system and respiratory system)	1 Hour
3.2	• Posture and its importance. • Common Postural Deformities-Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis. • Corrective Measures for Postural Deformities.	1 Hour
3.3	• Balanced diet, mal nutrition and Deficiency disease.	1 Hour
3.4	• Hydration.	1 Hour

MODULE IV: Sports and games.		
Following subtopics related to anyone game/sport of choice of student out of		
4.1	• Football	1 Hour
4.2	• Shuttle badminton	1 Hour
4.3	• Volleyball	1 Hour
4.4	• Basketball	1 Hour
4.5	• Cricket	1 Hour
4.6	• Tennis • History of the game / sports. • Latest general rule of the game / sports. • Specification of play fields and related sports equipments.	1 Hour
	Module 5-Yoga & Lifestyle	
5.1	• Meaning & importance of Yoga. • Elements of Yoga • Introduction-Asanas, Pranayama, Meditation & Yogic Kriyas. • Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Shashankasana) • Relaxation Techniques for improving concentration-Yog-nidra. • Asanas as preventive measures	1 Hour
5.2	• Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana. • Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana. • Back pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana.	1 Hour
5.3	• Diabetes: Procedure, Benefits & Contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana.	1 Hour
5.4	• Asthema: Procedure, Benefits & Contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.	1 Hour

CO Assessment Questions	
1	1. Group Activity - Group discussion about the need and benefits of physical activities and Yoga for the strength, flexibility, and relaxation of mind & body. 2. Make a demonstrative video about various yoga poses with the members in your team - Break down the yoga poses that you learned into smaller steps or stages. Demonstrate each step slowly and methodically, explaining the alignment, placement of body parts, and any variations or modifications.

	Emphasize proper breathing techniques throughout the demonstration.
2	1. Analyze the exercise activities of at least five famous personalities and give a PPT presentation about how each one of them uses physiological principles related to exercise and training in daily routine. 2. Conduct a survey on how the following categories of people follow physiological principles related to exercise and training in daily routine. 1. Sports person 2. Working woman 3. Students 4. Ladies in the age group of 25-35, 35-45,45- 55,55-65, above 65 5. Gents in the age group of 25-35, 35-45,45- 55,55-65, above 65 Prepare a survey form and conduct the survey. Based on the survey give a presentation about your findings and demonstrate whether it matches with the concepts you learned.
3	With a role play, illustrate various first aid activities that can be followed at various situation in life. In each illustration, try to give emphasis on dos and don'ts to be followed in each situation. Observe at least 10 students in your class and identify Common Postural Deformities each one of them have. Also identify good posters they follow. Have a discussion with each one of them to identify whether they have already recognized it or not. Make a report about it.
4	Create a video presentation about the exercises to prevent back and shoulder pain.
5	Create a PPT presentation on the rules of any one of the sports items given below. Try to identify the rules violated by some players in some popular competition and include those cases in the PPT. • Football • Shuttle badminton • Volleyball • Basketball • Cricket • Tennis

23HUT212	UNIVERSAL HUMAN VALUES-II	L	T	P	J	S	C	Year of Introduction
		2	1	0	0	2	3	2023

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)

Course Outcomes: 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. [Analyze 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 1	
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	
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	
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	
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		
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

1

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?			

2

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).
3	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.
4	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?
5	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.