B. Tech.

MECHANICAL ENGINEERING

Semester – II

CURRICULUM AND SYLLABUS

2025 Scheme

CHRIST COLLEGE OF ENGINEERING

(AUTONOMOUS)

Irinjalakuda, Thrissur - 680125

MECHANICAL ENGINEERING

B. Tech – 2025 Scheme

SEMESTER – S2 (GROUP - C)

CURRICULUM AND SYLLABUS

SECOND SEMESTER: Mechanical Engineering														
Sl. No:	Slot	Course Code	Course	Course Category	Course Title (Course Name)	Credit Structure				SS	Total Marks		Credits	Hrs./Week
						L	T	P	R		CIE	ESE		
THEORY														
1	A	G25MAT221	BS	GC	Mathematics for Physical Science-2	3	0	0	0	4.5	40	60	3	3
2	B	G25CYE223	BS	GC	Chemistry for Physical Science	3	0	2	0	5.5	40	60	4	5
3	C	G25EGE204	ES	GC	Engineering Graphics & Computer Aided Drawing	2	0	2	0	4	40	60	3	4
4	D	G25EET205	ES	GC	Basics of Electrical and Electronics Engineering (Part 1: Electrical Engineering)	2	0	0	0	3	20	30	2+2=4	4
					(Part 2: Electronics Engineering)	2	0	0	0		20	30		
5	E	M25MST206	PC	PC	Material Science and Engineering	3	1	0	0	5	40	60	4	4
6	F	A25IPT207	ES	CC	Engineering Entrepreneurship & IPR	3	0	0	0	4.5	40	60	3	3
PRACTICALS														
7	I	A25LSE109	HM	CC	Life Skills and Professional Communication	2	0	1	0	3.5	100	0	1	3
8	L	G25EWP210	ES	CC	Basic Electrical and Electronics Engineering Workshop	0	0	2	0	1	40	60	1	2
MANDATORY COURSES														
9	M	A25ILE211	SE	CC	Introduction to Idea Lab and Digital Twin Technology	1	0	2	0	2.5	50	-	2	3
10	-		MC	MC	Activity Point Programme								-	-
Total										**33.5**			**25**	**31**

SEMESTER S2

MATHEMATICS FOR PHYSICAL SCIENCE - 2

Course Code	G25MAT221	**CIE Marks**	40
Teaching Hours/Week (L:T:P:R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. and 30 Mins.
Prerequisites (if any)	Basic knowledge in single variable calculus.	**Course Type**	Theory

Course Objective:

1. To provide a comprehensive understanding of partial derivatives, multiple integrals, and the differentiation and integration of vector-valued functions, emphasizing their applications in engineering contexts.

SYLLABUS

Module No.	Description	Contact Hours
1	Limits and continuity, Partial derivatives, Partial derivatives of functions with two variables, Partial derivatives viewed as rate of change and slope3s, Partial derivatives of functions with more than two variables, Higher order partial derivatives, Local Linear approximations, Chain rule, Implicit differentiation, Maxima and minima of functions of two variables - relative maxima and minima.	9
2	Double integrals, Reversing the order of integration in double integrals, change of coordinates in double integrals (Cartesian to polar), Evaluating areas using Double integrals, finding volumes using double integration, Triple integrals, Volume calculated as triple integral, Triple integral in Cartesian and cylindrical coordinates.	9
3	Vector valued function of single variable - derivative of vector valued function, Concept of scalar and vector fields, Gradient and its properties, Directional derivative, Divergent and curl, Line integrals of vector fields, Work done as line integral, Conservative vector field, independence of path, Potential function (results without proof).	9
4	Green's theorem (for simply connected domains, without proof) and applications to evaluating line integrals, finding areas using Greens theorem, Surface integrals over surfaces of the form z = g (x, y), Flux integrals over surfaces of the form z = g (x, y), Divergence theorem (without proof), Using Divergence theorem to find flux, Stokes theorem (without proof)	9

Course Assessment Method
(CIE: 40 Marks, ESE: 60 Marks)

Continuous Internal Evaluation Marks (CIE):

Assignment (Activity based)	Internal Examination-I (Written)	Internal Examination-II (Written)	Internal Examination-III (Written)	Total
15*	30	30	30	
	A total of 90 marks will be scaled to 25.			**40**

*One or more assignments should be given, and the total marks should be consolidated and converted to 15 as per revised evaluation guidelines.

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
• 2 questions from each module. • Total of 8 questions, each carrying 3 marks **(8 x 3 = 24 Marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4 x 9 = 36 Marks)**	**60**

Course Outcomes (Cos)

At the end of the course students should be able to:

CO No.	Description	Blooms Knowledge Level (KL)
CO1	Compute the partial derivatives of multivariable functions and apply second derivative test to find the relative extremas.	3
CO2	Analyse geometrical shapes using multiple integrals to identify and interpret their areas and volumes	4
CO3	Apply differentiation and integration of vector-valued functions to model and analyse curves in three-dimensional space.	3
CO4	Analyse the concepts of surface and volume integrals and to learn their inter-relations and & applications.	4
CO5	Able to develop, analyse and make use of theoretical concepts to solve complex problems and visualize the output	4

Note: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, and K6 - Create

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3									2	3		
CO2	3	3									2	2		
CO3	3	3									2	3	3	
CO4	3	3				2		2	3		2	2	2	
CO5	3	3									2	2	2	

Text Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Calculus	H. Anton, I. Biven, S. Davis	Wiley	12th Edition, 2024

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Thomas' Calculus	Maurice D. Weir, Joel Hass, Christopher Heil, Przemyslaw Bogacki	Pearson	15th Edition, 2023
2	Essential Calculus	J. Stewart	Cengage	2nd Edition, 2017
3	Advanced Engineering Mathematics	Erwing Kreyszig	John Wiley & Sons	10th Edition, 2016
4	Bird's Higher Engineering Mathematics	John Bird	Taylor & Francis	9th Edition, 2021
5	Higher Engineering Mathematics	B. V. Ramana	McGraw-Hill Education	39th Edition, 2023

Video Links (NPTEL, SWAYAM, etc.)

Module No.	Link
1	https://nptel.ac.in/courses/111107108
2	https://nptel.ac.in/courses/111107108
3	https://nptel.ac.in/courses/111107108
4	https://nptel.ac.in/courses/111107108

SEMESTER S2

CHEMISTRY FOR PHYSICAL SCIENCE

Course Code	G25CYE223	**CIE Marks**	40
Teaching Hours/Week (L:T:P:R)	3:0:2:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. and 30 Mins.
Prerequisites (if any)	None	**Course Type**	Lab Embedded Theory

Course Objective:

1. To equip students with a thorough understanding of chemistry concepts relevant to engineering applications.
2. To familiarize students with applied topics such as spectroscopy, electrochemistry, and instrumental methods.
3. To raise awareness among students about environmental issues, including climate change, pollution, and waste management, and their impact on quality of life.

SYLLABUS

Module No.	Description	Contact Hours
1	**Engineering Materials** **Fuels:** Calorific value – HCV and LCV – Experimental determination of calorific value of solid fuels. Analysis of coal – Proximate analysis- Octane & Cetane Number. Biofuels- Biodiesel-Green Hydrogen. **Lubricants:** Classification - Solid, Semisolid and Liquid lubricants. Properties of lubricants - Viscosity Index, Flash point, Fire point, Cloud Point, Pour Point & Aniline Point. **Cement:** Manufacture of Portland cement – Theory of setting and hardening of cement. **Nanomaterials:** Classification based on Dimension & Materials- Synthesis – Sol gel & Chemical Reduction - Applications of nanomaterials – Supercapacitor Materials - Carbon Nanotubes, Fullerenes & Graphene – structure, properties & application. **Polymers:** ABS & Kevlar -Synthesis, properties and applications. Conducting Polymers- Classification – Application.	9

2	**Electrochemistry and Corrosion Science** **Electrochemical Cell**- Electrode potential- Nernst equation for single electrode and cell (Numerical problems)- Reference electrodes – SHE & Calomel electrode –Construction and Working - Electrochemical series - Applications – Glass Electrode & pH Measurement Conductivity- Measurement using Digital conductivity meter. Li-ion battery & H_2-O_2 fuel cell (acid electrolyte only) construction and working. **Corrosion** –Electrochemical corrosion mechanism (acidic & alkaline medium). - Galvanic series - Corrosion control methods - Cathodic Protection - Sacrificial anodic protection and impressed current cathodic protection –Electroplating of copper - Electroless plating of copper.	9
3	**Instrumental Methods of Analysis** **Molecular Spectroscopy:** Types of spectra- Molecular energy levels - Beer Lambert's law – Numerical problems - Electronic Spectroscopy – Principle, Types of electronic transitions –Role of Conjugation in absorption maxima - Instrumentation-Applications – Vibrational spectroscopy – Principle- Number of vibrational modes - Vibrational modes of CO_2 and H_2O – Applications **Thermal analysis:** –TGA- Principle, instrumentation (block diagram) and applications – TGA of $CaC_2O_4.H_2O$ and polymers. DTA Principle, instrumentation (block diagram) and applications - DTA of $CaC_2O_4.H_2O$. **Chromatography**-Gas Chromatography - Principle Instrumentation-Application – Analysis of chemical composition of exhaust gases. **Electron Microscopic Techniques:** SEM - Principle, instrumentation and Applications.	9
4	**Environmental Chemistry** **Water characteristics** - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Degree of hardness (Numericals) Water softening methods-Ion exchange process Principle, procedure and advantages. Reverse osmosis – principle, process and advantages. – Water disinfection methods – chlorination Break point chlorination, ozone and UV irradiation. Dissolved oxygen (DO), BOD and COD- Definition & Significance **Waste Management:** Air Pollution- Sources & Effects- Greenhouse Gases- Ozone depletion. Control methods. Sewage water treatment- Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process. Solid waste-disposal methods- Composting, Landfill & Incineration.	9

Course Assessment Method
(CIE: 40 Marks, ESE: 60 Marks)

Continuous Internal Evaluation Marks (CIE):

Continuous Assessment	Internal Examination-I (Written)	Internal Examination-II (Written)	Internal Examination-III (Written)	Lab Examination	Total
10	30	30	30	10	**40**
	A total of 90 marks will be scaled to 25.				

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
• 2 questions from each module. • Total of 8 questions, each carrying 3 marks **(8 x 3 = 24 Marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4 x 9 = 36 Marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

CO No.	Description	Blooms Knowledge Level (KL)
CO1	Apply the basic concepts of Electrochemistry and corrosion to examine their possible applications in various engineering fields for creating clean energy.	3
CO2	Illustrate the use of analytical techniques for the synthesis and characterisation of different engineering materials for sustainable consumption and production.	2
CO3	Interpret the use of various engineering materials for the production of affordable and clean energy in different industries.	4
CO4	Analyse water treatment techniques and waste management methods to ensure the availability of water, a good climate and to maintain a sustainable life below water and on land.	4
CO5	Apply scientific principles in an engineering context, training students through hands-on learning.	3

Note: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, and K6 – Create

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2			3						3		
CO2	2	2	2			3						3		
CO3	2	2				3						2	3	
CO4	2	2	2			3						2	2	
CO5	2	2	2	2	2	2		3	3	3	3	2	2	

Text Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Engineering Chemistry	B. L. Tembe, Kamaluddin, M. S. Krishnan	NPTEL Web-book	2018
2	Physical Chemistry	P. W. Atkins	Oxford University Press	International Edition-2018
3	Instrumental Methods of Analysis	H. H. Willard, L. L. Merritt	CBS Publishers	7th Edition-2005
4	Engineering Chemistry	Jain & Jain	Dhanpath Rai Publishing Company	17th Edition – 2015

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Fundamentals of Molecular Spectroscopy	C. N. Banwell	McGraw-Hill	4th Edition, 1995
2	Principles of Physical Chemistry	B. R. Puri, L. R. Sharma, M. S. Pathania	Vishal Publishing Co	47th Edition, 2017
3	Introduction to Spectroscopy	Donald L. Pavia	Cengage Learning India Pvt. Ltd	2015
4	Polymer Chemistry: An Introduction	Raymond B. Seymour, Charles E. Carraher	Marcel Dekker Inc	4th Revised Edition, 1996
5	The Chemistry of Nanomaterials:	Prof. Dr. C. N. R. Rao, Prof. Dr. H.C. Mult.	Wiley-VCH Verlag GmbH & Co. KGaA	2014

	Synthesis, Properties and Applications	Achim Müller, Prof. Dr. A. K. Cheetham		
6	Organic Electronics Materials and Devices	Shuichiro Ogawa	Springer Tokyo	2024
7	Principles and Applications of Thermal Analysis	Gabbot, P Oxford:	Blackwell Publishing	2008

Video Links (NPTEL, SWAYAM, etc.)

Module No.	Link
1	https://archive.nptel.ac.in/courses/104/106/104106137/ https://archive.nptel.ac.in/courses/113/105/113105102/ https://archive.nptel.ac.in/courses/113/104/113104082/ https://www.youtube.com/watch?v=BeSxFLvk1h0
2	https://archive.nptel.ac.in/courses/113/104/113104102/ https://archive.nptel.ac.in/courses/104/105/104105124/ https://archive.nptel.ac.in/courses/105/104/105104157/

Continuous Assessment (10 Marks)

i. **Preparation and Pre-Lab Work (2 Marks)**
- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

ii. **Conduct of Experiments (2 Marks)**
- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

iii. **Lab Reports and Record Keeping (3 Marks)**
- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

iv. **Viva Voce (3 Marks)**
- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: *The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.*

Evaluation Pattern for Lab Examination (10 Marks)

1. **Procedure/Preliminary Work/Conduct of Experiments (4 Marks)**
   - Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
   - Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
   - Setup and Execution: Proper setup and accurate execution of the experiment or programming task
2. **Result (4 Marks)**
   - Accuracy of Results: Precision and correctness of the obtained results.
3. **Viva Voce (2 Marks)**
   - Proficiency in answering questions related to theoretical and practical aspects of the subject.

Experiments List

(Any 10 Experiments Mandatory)

Experiment No.	Experiment
1	Estimation of iron in iron ore
2	Estimation of copper in brass
3	Determination of cell constant and conductance of solutions
4	Calibration of pH meter and determination of pH of a solution
5	Synthesis of polymers (a) Urea-formaldehyde resin (b) Phenol-formaldehyde resin
6	Determination of wavelength of absorption maximum and colorimetric estimation of Fe^{3+} in solution
7	Determination of molar absorptivity of a compound ($KMnO_4$ or any water-soluble food colorant)
8	Analysis of IR spectra
9	Identification of drugs using TLC
10	Estimation of total hardness of water-EDTA method
11	Estimation of dissolved oxygen by Winkler's method
12	Determination of calorific value using Bomb calorimeter
13	Determination of saponification value of a given vegetable oil
14	Determination of acid value of a given vegetable oil
15	Verification of Nernst equation for electrochemical cell.

SEMESTER S2

ENGINEERING GRAPHICS AND COMPUTER AIDED DRAWING

Course Code	G25EGE204	**CIE Marks**	40
Teaching Hours/Week (L:T:P:R)	2:0:2:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. and 30 Mins.
Prerequisites (if any)	None	**Course Type**	Lab integrated Theory

Course Objective:

1. To learn the principles and techniques of dimensioning and preparation of drawings
2. To develop the ability to accurately interpret engineering drawings
3. To learn the features of CAD software

SYLLABUS

Module No.	Description	Contact Hours
1	Introduction: Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing. (No questions for the end semester examination) Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Traces of a line. Inclination of lines with reference planes True length and true inclinations of line inclined to both the reference planes.	9
2	Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cone Cylinder and tetrahedron. Projection of solids in simple position including profile view. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes.	9
3	Sections of Solids: Sections of tetrahedron, Prisms, Pyramids, Cone, Cylinder with axis in vertical position and cut by different section planes. True shape of the sections. (Exclude true shape given problems) Development of Surfaces: Development of surfaces of the solids and solids cut by different section planes. (Exclude problems with through holes)	9
4	Isometric Projection: Isometric scale- Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Frustum of Pyramid, Frustum of Cone, Sphere, Hemisphere and their combinations. Computer Aided Drawing (CAD): Introduction, Role of CAD in design and development of new products, Advantages of CAD. Creating two-dimensional drawing with dimensions using suitable software. (CAD, only internal evaluation)	9

Course Assessment Method
(CIE: 40 Marks, ESE: 60 Marks)

Continuous Internal Evaluation Marks (CIE):

Continuous Assessment	Internal Examination-I (Written)	Internal Examination-II (Written)	Internal Examination-III (Written)	Total
20*	30	30	30	
	A total of 90 marks will be scaled to 20			**40**

***** Twenty marks for continuous assessment are allotted based on the drawings submitted for the assigned problems.

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

	Total
2 Questions from each module. Total 8 Questions, each question carries 15 marks (15x4 = 60 marks)	**60**

Course Outcomes (Cos)

At the end of the course students should be able to:

CO No.	Description	Blooms Knowledge Level (KL)
CO1	Apply Engineering drawing principles and projection methods, to accurately represent points and lines in different quadrants.	2
CO2	Visualize and draw the projections of simple solids in various orientations	3
CO3	Prepare sectional views and surface developments to optimize material usage, reduce waste, and support eco-friendly production systems	3
CO4	Interpret principles of isometric projections to convey 3d information and Execute 3D and 2D modelling with CAD tools.	4

Note: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, and K6 – Create

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2				2			3		1	3		3
CO2	2	2				2			3		1	2		3
CO3	2	2	2			2			3		1	2	2	3
CO4	2	2	1		3				3		1		3	3

Text Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Engineering Graphics	Varghese P. I.	V.I.P Publishers	1st Edition 2012
2	Engineering Graphics	Benjamin J	Pentex Publishers	5th Edition, 2017
3	Engineering Graphics for Degree	John, K.C.	Prentice hall India Publishers	Published in 2011
4	Engineering Graphics	Anilkumar K.N.	Adhyuth Narayan Publishers	10th Edition, 2016

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Engineering Graphics with AutoCAD	Kulkarni D. M., Rastogi A. P., and Sarkar A. K.	Prentice Hall India Publishers	2009
2	Engineering Drawing & Graphics	Venugopal K	New Age International Publishers	4th Edition, 2007
3	Engineering Drawing	Parthasarathy N. S., and Murali V.	Oxford University Press	2015

Video Links (NPTEL, SWAYAM, etc.)

Module No.	Link
1	https://archive.nptel.ac.in/courses/112/102/112102304/
2	https://archive.nptel.ac.in/courses/112/102/112102304/
3	https://archive.nptel.ac.in/courses/112/102/112102304/
4	https://archive.nptel.ac.in/courses/112/102/112102304/

SEMESTER S2

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Course Code	G25EET205	**CIE Marks**	40
Teaching Hours/Week (L:T:P:R)	4:0:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. and 30 Mins.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objective:

1. Apply fundamental concepts and circuit laws to solve simple DC/AC electric circuits
2. Develop an awareness on the fundamentals of electric power generation, transmission and distribution
3. Compare different types of DC and AC motors
4. Describe the fundamental concepts of electronic components and devices
5. Outline the basic principles of an electronic instrumentation system
6. Identify important applications of modern electronics in the contemporary world

SYLLABUS

Module No.	Description	Contact Hours
1	**Generation of alternating voltages: -** Faradays laws of Electromagnetic induction, Generation of Alternating Voltage, Elementary Generator, Representation of ac voltage and currents, sinusoidal waveforms: frequency, period average, RMS values and form factor of waveform; (Simple numerical problems) DC Circuits: Resistance in Series and Parallel, Ohms Law and Kirchhoff's laws, Voltage and current divider rule (Simple numerical problems) **AC circuits:** Purely resistive, inductive and capacitive circuits; Inductive and capacitive reactance, concept of impedance. (Simple numerical problems) **Three phase AC systems:** Representation of three phase voltages; star and delta connections (balanced only), relation between line and phase voltages, line and phase currents **Power in AC circuits:** Power factor; active, reactive and apparent power in single phase and three phase system. (Simple numerical problems)	11

2	**Generation of electrical energy:** Conventional Sources: Hydro, thermal, nuclear plants (Block diagram description) **Introduction to non-conventional energy sources:** solar, wind, small hydro plants, PV system for domestic application. **Transformers. Principle of operation, step-up and step-down transformers** **AC power supply scheme:** Single phase and three phase system, three phase 3 wire and 4 wire systems, Transmission System, Distribution system: Feeder, distributor, service mains **Types of Motors** – Principle of Operation: Block diagram showing power stages, losses and efficiency (electrical and mechanical and overall efficiency); Simple numerical efficiency **Introduction to different types of DC and AC motors.** Classification and different type of dc and ac motors, common applications: Principle of traction and applications **Earthing:** need for earthing, Types of earthing; pipe earthing, plate earthing; **Principle of operation of MCB, ELCB/RCCB**	11
3	**Introduction to Semiconductor devices:** Electronic components- Passive and active components - Resistors, Capacitors and Inductors (constructional features not required): types, specifications. Standard values, colour coding. PN Junction diode: - Principle of operation, V-I characteristics. Bipolar Junction Transistors: PNP and NPN structures, Principle of operation **Digital Electronics:** -Binary number system, Boolean algebra and Logic Gates, Universal gates. Basic electronic circuits: - Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: - Transistor as an amplifier, Block diagram of PublicAddress system	11
4	**Electronic Instrumentation:** Quality of measurements -accuracy, precision, sensitivity and resolution, Working principle and applications of Sensors – pressure – strain gauge, Bourden gauge, temperature – RTD, thermocouple, proximity – capacitive sensor, ultrasonic sensor and accelerometer. Internet of things (IoT): Introduction, architecture of IoT, Implementation of smart city – street lighting, smart parking.	11

Continuous Internal Evaluation Marks (CIE):

Continuous Assessment	Internal Examination-I (Written)	Internal Examination-II (Written)	Internal Examination-III (Written)	Lab Examination	Total
10	30	30	30	10	**40**
	A total of 90 marks will be scaled to 25.				

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
• 2 questions from each module. • Total of 8 questions, each carrying 3 marks **(8 x 3 = 24 Marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4 x 9 = 36 Marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

CO No.	Description	Blooms Knowledge Level (KL)
CO1	Apply fundamental concepts and circuit laws to solve simple DC/AC electric circuits	3
CO2	Design basic electronic circuits with the knowledge of passive and active electronic components	3
CO3	Apply fundamental concepts of magnetic circuits to classify series and parallel magnetic circuits and design the values of self and mutual inductance of coils	3
CO4	Distinguish the principles of various Communication systems & electronic instruments	2
CO5	Analyse AC circuits with resistive, inductive and capacitive loads and solve three phase Star and Delta connected circuits	4
CO6	Apply knowledge of modern electronics to study case studies related to IoT applications in smart homes, healthcare and agriculture	2
CO7	Design and Develop applications of modern electronics in contemporary world	6

Note: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, and K6 – Create

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3		2		2					2	2	3	3
CO2	2	2		2		2					2	2	2	2
CO3	3	3		2		2					2	2	3	3
CO4	2	2	2	2		2					2	2	2	2
CO5	3	3		2		2					2	2	3	3
CO6	2	3	2	2		2					3	2	2	3
CO7	3	3	3	3	2	3	2	3	3	3	3	2	3	3

Text Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Basic Electrical Engineering	D P Kothari and I J Nagrath	Tata McGraw Hill	4th Edition, 2019
2	Schaum's Outline of Basic Electrical Engineering	J.J. Cathey and Syed A Nasar	Tata McGraw Hill	1st Edition
3	Basic Electronics: Principles and Applications	Chinmoy Saha, Arindham Halder and Debarati Ganguly	Cambridge University Press	1st Edition, 2018
4	Basic Electrical and Electronics Engineering	D.P Kothari and I.J. Nagrath	McGraw Hill	2nd Edition, 2020
5	The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities are Changing the World	Michael Miller	QUE	1st Edition, 2015
6	Basic Electronics and Linear Circuits	N N Bhargava D C Kulshreshtha and S.C. Gupta	McGraw Hill	2nd Edition, 2017
7	Electronic Communication Systems	Kennedy and Davis	McGraw Hill	6th Edition, 2017

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Basic Electrical Engineering	D C Kulshreshtha	Tata McGraw Hill	2nd Edition, 2019
2	Electrical Engineering Fundamentals	Del Toro V	Pearson Education	2nd Edition, 2019
3	Basic Electrical Engineering	T.K. Nagsarkar, M.S. Sukhija	Oxford higher Education	3rd Edition, 2017
4	Electronics: A Systems Approach	Neil Storey	Pearson	6th Edition, 2017
5	Electronic Devices and Circuit Theory	Robert L. Boylestad Louis Nashelsky	Pearson	11th Edition, 2015

6	Principles of Electronic Communication Systems	Frenzel, L. E.	McGraw Hill	4th Edition, 2016
7	Internet of Things: Architecture and Design Principles	Raj Kamal	McGraw Hill	1st Edition, 2017
8	Electronic Communication	Dennis Roddy and John Coolen	McGraw hill	4th Edition, 2008
9	Basic Electrical Engineering	D C Kulshreshtha	Tata McGraw Hill	2nd Edition, 2019

SEMESTER S2

MATERIAL SCIENCE AND ENGINEERING

Course Code	M25MST206	**CIE Marks**	40
Teaching Hours/Week (L:T:P:R)	3:1:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. and 30 Mins.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objective:

1. To recognize the importance of the microstructures and physical properties of the materials to enable the material selection process.
2. To develop an understanding of the basic principles of phase transformations and apply those principles to engineering applications.

SYLLABUS

Module No.	Description	Contact Hours
1	Introduction to material science: Classification of engineering materials, Structure of solids- Metallic, Ionic and covalent bonding. Properties based on atomic bonding. Crystallography: - SC, BCC, FCC, HCP structures, APF - theoretical density simple problems – Miller Indices: - crystal plane and direction - Modes of plastic deformation: - Slip and twinning	11
2	Crystal imperfections – - Point defects, Line defects, Surface defects, Volume defects. edge and screw dislocations – Burger's vector – interaction between dislocations. Polishing and etching, Metallographic characterisations of metallic materials. SEM, TEM- Grain size determination Wear, Roughness, Corrosion. Diffusion in solids, fick's laws, mechanisms, applications of diffusion in mechanical engineering, simple problems. Applications of Diffusion.	11
3	Mechanical properties: Tensile properties, Hardness and hardness measurement, Impact properties, Fatigue, Creep, DBBTT, Super plasticity. Types of steels- low, medium and high carbon steels, stainless steels, alloy steels and their applications. Properties and applications of composites, super-alloys, intermetallic- Stoichiometric and Non stoichiometric compounds- Applications. maraging steel, Titanium Ceramics: - structures, applications	11
4	Phase diagrams: - need of alloying - classification of alloys - Hume Rothery`s rule – equilibrium diagram of common types of binary systems: isomorphous (Cu- Ni) eutectic (Pb- Sn), lever rule and Gibb`s phase rule. Detailed discussion on Iron-Carbon equilibrium diagram with microstructure and properties -Heat treatment: - TTT, CCT diagram, applications - Tempering- Hardenability, Jominy end quench test, applications-Surface hardening methods.	11

Course Assessment Method
(CIE: 40 Marks, ESE: 60 Marks)

Continuous Internal Evaluation Marks (CIE):

Assignment (Activity based)	Internal Examination-I (Written)	Internal Examination-II (Written)	Internal Examination-III (Written)	Total
15*	30	30	30	**40**
	A total of 90 marks will be scaled to 25.			

*One or more assignments should be given, and the total marks should be consolidated and converted to 15 as per revised evaluation guidelines.

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
• 2 questions from each module. • Total of 8 questions, each carrying 3 marks **(8 x 3 = 24 Marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4 x 9 = 36 Marks)**	**60**

Course Outcomes (Cos)

At the end of the course students should be able to:

CO No.	Description	Blooms Knowledge Level (KL)
CO1	Apply the basic crystallographic principles and select suitable material for engineering applications.	3
CO2	Analyse the effects of heat treatment on various strengthening mechanisms in metals and understand its effects on cyrstallograhic properties	4
CO3	Analyse the material properties among different materials for material selection effect of alloying elements in enhancing mechanical properties of alloys.	4
CO4	Apply the principles of metal failures to identify the type of failure and differentiate the microstructure of metallic materials using phase diagrams.	3

Note: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, and K6 – Create

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2					2				2	2		
CO2	2	2					2					2		
CO3	3	2					2					2		
CO4	3	2	2									2		

Text Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Material Science and Engineering	Callister Willian. D	John Wiley	2014
2	Engineering Metallurgy Part – I	Higgins R.A.	Arnold	6th Edition, 1998

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	The Science and Engineering of Materials	Donald R Askeland	Thomson	
2	Introduction to Physical Metallurgy	Avner H Sidney	Tata Mcgraw Hill	2009
3	Material Science and Engineering	Raghavan V	Prentiece Hall	2004

Video Links (NPTEL, SWAYAM, etc.)

Module No.	Link
1	https://archive.nptel.ac.in/courses/113/105/113105103/
2	https://archive.nptel.ac.in/courses/113/105/113105103/
3	https://archive.nptel.ac.in/courses/113/105/113105103/
4	https://archive.nptel.ac.in/courses/113/105/113105103/

SEMESTER S2

ENGINEERING ENTREPRENEURSHIP AND IPR

Course Code	A25IPT207	**CIE Marks**	40
Teaching Hours/Week (L:T:P:R)	3:0:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. and 30 Mins.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objective:

1. Develop a framework for identifying, curating and validating engineering-based business ideas.
2. Learn essential tools for understanding product-market fit and customer needs.
3. Create a comprehensive business plan for a new venture.
4. Gain foundational knowledge of Intellectual Property Rights (IPR) and their importance for startups.
5. Develop skills for prototyping, stakeholder engagement, and team collaboration

SYLLABUS

Module No.	Description	Contact Hours
1	**Introduction to Ideation, Innovation & Entrepreneurship** What is Ideation? Understanding Innovation, Frameworks for Innovation, The Entrepreneurial Mindset, Starting a Business, types formation statutory compliances, Resources for Aspiring Entrepreneurs **Introduction to Intellectual Property Rights (IPR)** Types of IPR: Patents, trademarks, copyrights, trade secrets, Strategies for protecting intellectual property based on the type of innovation, Role of IPR in securing funding and competitive advantage **Importance of building a strong team** Identifying roles, Skill sets, Team dynamics **Identifying Pain Points and problem statement** Idea Generation Techniques, Developing and Refining Ideas, develop strategies for bringing your innovation to life	9

2	**Problem and solution canvas preparation** Orientation and canvas introduction, Customer needs assessment, Market segmentation, Value proposition, Competitive analysis, Market entry strategy, Market validation, Regulatory and legal considerations **Customer profiling** Review of market research, Customer segmentation, Customer profiling, Persona development, Validation and feedback, Prioritisation and selection, Communication and messaging **Competitor analysis** Identify competitors, Competitor profiling, SWOT analysis, Market positioning, Customer feedback and reviews, Pricing analysis, Differentiation strategy, Benchmarking and improvement	9
3	**Business plan preparation** Business plan framework, Market analysis, Product/ service description, Marketing and sales strategy, Operations plan, Financial projections, Risk management **Prototype development plan preparation** Prototype requirements analysis, technical specifications, Development approach, Development timeline, Resource allocation, Testing and quality assurance, Iterative development and feedback loop, Documentation and version control	9
4	**Prototype development Stakeholder engagement strategies** Investors, Partners, Customers, Advisors & Mentors	9

Course Assessment Method
(CIE: 60 Marks, ESE: 40 Marks)

Continuous Internal Evaluation Marks (CIE):

<table>
<tr><th>Micro Project</th><th>Internal Examination-I (Written)</th><th>Internal Examination-II (Written)</th><th>Internal Examination-III (Written)</th><th>Total</th></tr>
<tr><td rowspan="2">40</td><td>30</td><td>30</td><td>30</td><td rowspan="2">60</td></tr>
<tr><td colspan="3">Average of best two and then convert to 20</td></tr>
</table>

Micro project / Comprehensive Business Plan:

The course will be evaluated based on a comprehensive Business Plan Report submitted and prototype development evaluation at the end of the course. The report should integrate learnings and activities from each module, demonstrating a deep understanding of the concepts and your ability to apply them to a chosen engineering venture.

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
• Minimum 1 and Maximum 2 Questions from each module • Total of 6 questions, each carrying 2 marks **(6 x 2 = 12 Marks)**	• Each question carries 7 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4 x 7 = 28 Marks)**	**40**

Course Outcomes (Cos)

At the end of the course students should be able to:

CO No.	Description	Blooms Knowledge Level (KL)
CO1	Gain foundational knowledge of Innovation and Entrepreneurship, Intellectual Property Rights (IPR) and their importance for startups	2
CO2	Develop a framework for identifying, curating and validating engineering-based business ideas.	3
CO3	Learn essential tools for understanding product-market fit and customer needs.	3
CO4	Create a comprehensive business plan for a new venture.	6
CO5	Develop skills for prototyping, stakeholder engagement, and team collaboration.	4

Note: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, and K6 – Create

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	3	3		2					2	2	3	3
CO2	2	2	3	3	2	2	3	3	3		2	2	2	2
CO3	2	2	2	2	2	2	3	3	3		2	2	3	3
CO4	3	3	3	3	3	2	3	3	3		2	2	2	2
CO5	3	3	3	3	3	2	3	3	3		2	2	3	3

Text Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	The Engineering Handbook	Richard C Dorf	CRC Press	2nd Edition, 2004
2	The Innovator's DNA	Clayton M. Christensenand Jeffrey H. Dyer	Harward Business Review Press	Revised Edition (June 4, 2019)
3	Start with Why	Simon Sinek	Portgolio	Reprint Edition (December 27, 2011)
4	Business Model Generation	Alexander Osterwalder & Yves Pingneur	Wiley	2010
5	The Engineering Entrepreneur: A Practical Guide to Starting and Running a Successful Engineering Business in India	Saibal Gupta and Ashok Jhunjhunwala	Sage Publications	2011
6	Innovation and Entrepreneurship for Engineers	Bharat Bhushan and Seema Bhushan	CRS Press	2016
7	Indian Patent Law	P. Narayanan	Eastern Book Company	2nd Edition 2020
8	The Law of Copyright and Designs	B.L. Wadehra	Universal Law	5th Edition, 2010
9	Intellectual Property Rights (Including IPR in the Digital Age)	Prabuddha Ganguli	Tata McGraw-Hill Education	2001
10	The Startup India Manifesto: A Guide to the Indian Startup Ecosystem	Rashmi Bansal and Deepinder Goyal	Westland Publications	2020

SEMESTER S2

LIFE SKILLS AND PROFESSIONAL COMMUNICATION

Course Code	A25LSE109	**CIE Marks**	100
Teaching Hours/Week (L:T:P:R)	2:0:1:0	**ESE Marks**	0
Credits	1	**Exam Hours**	-
Prerequisites (if any)	None	**Course Type**	Activity-based learning

Course Objective:

1. To foster self-awareness and personal growth, enhance communication and interpersonal connection skills, promote effective participation in groups and teams, develop critical thinking, problem-solving, and decision-making skills, and cultivate the ability to exercise emotional intelligence.
2. To equip students with the necessary skills to listen, read, write & speak, to comprehend and successfully convey any idea, technical or otherwise.
3. To equip students to build their profile in line with the professional requirements and standards.

Continuous Internal Evaluation Marks (CIE):

- Continuous internal evaluation is based on the individual and group activities as detailed in the activity table given below.
- The students should be grouped into groups of size 4 to 6 at the beginning of the semes ter. They should use online collaboration tools for group activities, report/presentation making and work management.
- Activities are to be distributed between 3 class hours (2L+1P) and 3.5 Self-study hours.
- Marks given against each activity should be awarded fully if the students successfully complete the activity.
- Students should maintain a portfolio file with all the reports and other textual materials generated from the activities. Students should also keep a journal related to the activities undertaken.
- Portfolio and journal are mandatory requirements for passing the course, in addition to the minimum marks required.
- The portfolio and journal should be carried forward and displayed during the 7th Semester Seminar course as a part of the experience sharing regarding the skills developed through the HMC courses and Mini project course.

- Self-reflection questionnaire shall be given at the beginning of the semester, in between and at the end of the semester based on the guidelines in the manual of the course.

Table 1: Activity List

Sl. No.	Activity	Class room (L) / Self Study (SS)	Week of completion	Group / Individual (G/I)	Marks	Skills	CO
1.1	Group formation and self-introduction among the group members	L	1	G	-	Connecting with group members Time management – Gantt Chart	
1.2	Familiarizing the activities and preparation of the time plan for the activities	L	1	G	-		
1.3	Preparation of Gantt chart based on the time plan	SS	1	G	2		
2.1	Take an online personality development test, self-reflect and report	SS	1	I	2	Self-Awareness writing	CO1
2.2	Role-storming exercise 1: Students assume 2 different roles given below and write about their ● Strengths, ● Areas for improvement, ● Concerns, ● Areas in which he/she hesitates to take advice, ● Goals/Expectations, from the point of view of the following assumed roles i) their parent/guardian/mentor ii) their friend/sibling/cousin	L	1	I	2	Goal setting - Identification of skills and setting goal Self-awareness Discussion in groups Group work- Compiling of ideas Mind mapping	CO1
2.3	Role-storming exercise 2: Students assume the role of their teacher and write about the ● Skills required as a B.Tech graduate ● Attitudes, habits, approaches required and activities to be practised during their B.Tech years, in order to achieve the set goals	SS	1	I	2		CO1`
2.4	Discuss the skills identified through role storming exercise by each one within their own group and improvise the list of skills	L	1	G	2		CO1
2.5	Prepare a mind map based on the role storming exercise and exhibit/present it in class	SS	2	G	2		CO1
3	Prepare a presentation on instances of empathy they have observed in their own life or in other's life	L	2 to 4	I	2	Empathy	CO2

4.1	Each student connects and networks with a minimum of 3 professionals from industry/public sector organizations/other agencies/NGOs /academia (atleast 1 through LinkedIn)	SS	3	I	2	Workplace awareness • Listening • Communication - interacting with people • Networking through various media including LinkedIn • Discussion in groups • Report prepara tion • Creativity Goal setting - Prep aration of action plan	
4.2	Interact with them to understand their workplace details including ● workplace skills required ● their work experience ● activities they have done to enhance their employability during their B.Tech years ● suggestions on the different activities to be done during B.Tech years Prepare a documentation of this	SS	3	I	4		CO2
4.3	Discuss the different workplace details & work readiness activities assimilated by each through the interactions within their group and compile the inputs collected by the individuals Prepare the Minutes of the discussions	SS	3	G	2		CO2
4.4	Report preparation based on the discussions	SS	4	G	3		CO4
4.5	Perform a role-play based on the work place dynamics assimilated through interactions and group discussions	L	5	G	4		CO3
4.6	Identify their own goal and prepare an action plan for their undergraduate journey to achieve the goal	SS	5	I			CO1
5.1	Select a real-life problem that requires a technical solution and list the study materials needed	L	6	G	2		CO3
5.2	Listen to TED talks & video lectures from renowned Universities related to the problem and prepare a one-page summary (Each group member should select a different resource)	SS	6	1	2		CO4
5.3	Use any online tech forum to gather ideas for solving the problem chosen	SS	6	G	2		CO5CO4
5.4	Arrive at a possible solution using six thinking hat exercise	L	7	G	3		CO3
5.5	Prepare a report based on the problem-solving experience	SS	7	G	2		CO4
6.1	Linkedin profile creation	SS	1	I	2	Profile-building	CO6
6.2	Resume preparation	SS	8	I	2		CO6
6.3	Self-introduction video	SS	8	I	3		CO6

7	Prepare a presentation on instances of demonstration of emotional intelligence	SS	9	I	2	Emotional intelligence	CO2
8	Prepare a short video presentation on diversity aspects observed in our society (3 to 5 minutes)	SS	10	G	3	Diversity	CO2, CO5
9	Take online Interview skills development sessions like robotic interviews; self-reflect and report	SS	10	I	2	Interview skills	CO6
10	Take an online listening test, self-reflect and report	SS	11	1	2	Listening skills	CO6
11.1	Activities to improve English vocabulary of students	L	8	I/G	4	English vocabulary English language skills Writing Presentation Group work Self-reflection	CO4
11.2	Activities to help students identify errors in English language usage	L	9	I/G	2		CO4
11.3	Activity to help students identify commonly misspelled words, commonly mispronounced words and confusing words	L	10	I/G	2		CO4
11.4	Write a self-reflection report on the improvement in English language communication through this course	SS	12	I	2		CO4
11.5	Presentation by groups on the experience of using online collaboration tools in various group activities and time management experience as per the Gantt chart prepared	L	11 to 12	G	2		CO4, CO5
12.1	Each group prepares video content for podcasts on innovative technological interventions/research work tried out in Kerala context by academicians/professionals/Govt. agencies/research institutions/private agencies/NGOs/other agencies	SS	12	G	4	Audio-visual presentations creations with the use of technology tools Effective use of social media plat forms Profile building	CO2, CO4, CO5
12.2	Upload the video content to podcasting platforms or YouTube	SS	12	G	1		CO5
12.3	Add the link of the podcast in their LinkedIn profile	SS	12	G	1		CO5

Table 2: Lab hour activities: 24 Marks

Sl. No.	Activity	Marks	Skill	CO
1	Hands-on sessions on day-to-day engineering skills and a self-reflection report on the experience gained: 1. Drilling practice using electric hand drilling machines.	24	Basic Practical engineering skills	3

	2. Cutting of MS rod and flat using electric hand cutters. 3. Filing, finishing and smoothening using electrically operated hand grinders. 4. MS rod cutting using Hack saw by holding the work in bench wise. 5. Study and handling different types of measuring instruments. 6. Welding of MS, SS work pieces. 7. Pipe bending practice (PVC and GI). 8. Water tap fitting. 9. Water taps rubber seal changing practice. 10. Union and valves connection practice in pipes. 11. Foot valve fitting practice. 12. Water pump seal and bearing changing practice.			
2	Language Lab sessions	-	Language Skills	4

Course Outcomes (Cos)

At the end of the course students should be able to:

CO No.	Description	Blooms Knowledge Level (KL)
CO1	Develop the ability to know & understand oneself, show confidence in one's potential & capabilities, set goals and develop plans to accomplish tasks	5
CO2	Develop the ability to communicate and connect with others, participate in groups/teams, empathise, respect diversity, be responsible and understand the need to exercise emotional intelligence	3
CO3	Develop listening, reading, writing & speaking skills, ability to comprehend & successfully convey any idea, and ability to analyse, interpret & effectively summarize textual, audio & visual content	4
CO4	Develop the ability to create effective presentations through audio-visual mediums with the use of technology tools and initiate effective use of social media platforms & tech forums for content delivery and discussions	6
CO5	Initiate profile-building exercises in line with the professional requirements, and start networking with professionals/academicians.	3

Note: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, and K6 – Create

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1							3	3		2	2
CO2						2	2	2			2
CO3								2	2		
CO4									3		
CO5	1	3		2	2				3	2	3

Text Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Life Skills & Personality Development	Maithry Shinde et.al.	Cambridge University Press	First Edition, 2022
2	Emotional Intelligence: Why it can matter more than IQ	Daniel Goleman	Bloomsbury, Publishing PLC	25th Anniversary Edition December 2020
3	Think Faster, Talk Smarter: How to speak successfully when you are put on the spot	Matt Abrahams	Macmillan Business	September 2023
4	Deep Work: Rules for focused success in a distracted world	Cal Newport	PIATKUS	January 2016
5	Effective Technical Communication	Ashraf Rizvi	McGraw Hill Education	2nd Edition 2017
6	Interchange	Jack C. Richards, With Jonathan Hull, Susan Proctor	Cambridge publishers	5th Edition

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Life Skills for Engineers	Remesh S., Vishnu R.G.	Ridhima Publications	First Edition, 2016
2	Soft Skills & Employability Skills	Sabina Pillai and Agna Fernandez	Cambridge University Press	First Edition, 2018
3	Effective Technical Communication	Ashraf Rizvi	McGraw Hill Education	2nd Edition 2017
4	English Grammar in Use	Raymond Murphy,	Cambridge University Press India PVT LTD	5th Edition 2023
5	Guide to writing as an Engineer	David F. Beer and David McMurrey	John Willey. New York	2004

SEMESTER S2

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP

Course Code	G25EWP210	**CIE Marks**	50
Teaching Hours/Week (L:T:P:R)	0:0:2:0	**ESE Marks**	50
Credits	1	**Exam Hours**	2 Hrs. and 30 Mins.
Prerequisites (if any)	None	**Course Type**	Lab

Course Objective:

1. Demonstrate safety measures against electrical shocks
2. Develop familiarity with transformers, rheostats, batteries and earthing schemes
3. Develop the connection diagram and identify the suitable accessories necessary for wiring simple electric circuits
4. Identify various electronic components
5. Operate various measuring instruments
6. Design simple electronic circuits on breadboard and PCB
7. Build the ability to work in a team with good interpersonal skills.

Experiments

(Minimum 12 Exercises)

Expmt. No.	ELECTRICAL WORKSHOP (Minimum of 7 Experiments to be done)
1	a) Demonstrate the precautionary steps adopted in case of Electrical shocks. b) Identify different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB and MCCB, familiarise the ratings.
2	Wiring of a simple light circuit for light/ fan point (PVC conduit wiring) and a6A plug socket with individual control.
3	Wiring of light/fan circuit using two-way switches. (Staircase wiring)

4	Wiring of fluorescent lamp and a power plug (16 A) socket with a control switch.
5	Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.
6	Familiarization of step up and step-down transformers, (use low voltage transformers) Measurement and representation of voltage and waveform to scale in graph sheet with the help of CRO
7	Familiarization of rheostats, measurement of potential across resistance elements and introducing the concept of relative potential using a DC circuit.
8	a) Identify battery specifications using different types of batteries (Lead acid, Li Ion, NiCd etc.) b) Familiarize different types of earthing (Pipe, Plate Earthing, Mat Schemes) and ground enhancing materials (GEM).
ELECTRONICS WORKSHOP (Minimum of 7 Experiments to be done)	
1	Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol and cost of -Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.)
2	Drawing of electronic circuit diagrams using BIS/IEEE symbols and Interpret datasheets of discrete components and IC's
3	Familiarization/Application of testing instruments and commonly used tools. - Multimeter, Function generator, Power supply, CRO, DSO. Soldering iron, Desoldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de- soldering station
4	Testing of electronic components using multimeter - Resistor, Capacitor, Diode, Transistor and JFET.
5	Printed circuit boards (PCB) - Types, Single sided, Double sided, PTH, Processing methods. Design and fabrication of a single sided PCB for a simple circuit.
6	Inter-connection methods and soldering practice. Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions. Soldering practice in connectors and general-purpose PCB, Crimping.
7	Assembling of electronic circuit/system on general purpose PCB, test and show the functioning (Any two)- ●Fixed voltage power supply with transformer ●Rectifier diode ●Capacitor filter ●Zener/IC regulator ●Square wave generation using IC 555 timer in IC base.
8	Assembling of electronic circuits using SMT (Surface Mount Technology) stations.
9	Introduction to EDA tools (such as KiCad or XCircuit)

Course Assessment Method
(CIE: 50 Marks, ESE: 50 Marks)

Continuous Internal Evaluation Marks (CIE):

Preparation/Pre-Lab Work, experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Total
50	**50**

End Semester Examination Marks (ESE)

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	**20**	**5**	**10**	**5**	**50**

Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified Lab record.

Pass Criteria:

- A student must score a minimum of 50% overall, combining marks from both Continuous Internal Evaluation (CIE) and End Semester Examination (ESE).
- In addition, the student must secure at least 40% in the End Semester Examination (ESE).

Course Outcomes (COs)

At the end of the course students should be able to:

CO No.	Description	Blooms Knowledge Level (KL)
CO1	Identify and familiarize various electrical components.	2
CO2	Identify and familiarize various electronic components.	2
CO3	Illustrate the connection diagram and identify the suitable accessories necessary for wiring simple electric circuits.	3
CO4	Apply the design procedure of simple electronic circuits on breadboard, PCB and Operate various measuring instruments to take measurements of circuit parameters.	3
CO5	Design and interpret basic circuit diagrams and translate them into physical layouts for prototyping and testing, as a team.	3, 5

Note: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, and K6 – Create

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2										3		
CO2	2	2										2		
CO3	3	2										2	2	
CO4	3	2			2							2	3	
CO5	3	2			2	2		3	3	2	2	2		

Text Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Electrical design Estimating and Costing	K B Raina and S K Bhattacharya	New Age International Publishers	2nd Edition, 2024
2	Electrical Systems Design	M K Giridharan	I K International Publishing House Pvt. Ltd	3rd Edition, 2022
3	Basic Electrical Engineering	D P Kothari and I J Nagrath	Tata McGraw Hill	4th Edition, 2019
4	Basic Electronics and Linear Circuits	NN Bhargava, D. C Kulshreshta and S.C. Gupta	Mc Graw Hill	2nd Edition, 2017

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Elements of Workshop Technology Vol-1 Manufacturing Processes	S K Hajra Choudhury A K Hajra Choudhury Nirjhar Roy	MPP Media Promoters and Publishers	2008

Continuous Assessment with Equal Weightage for Both Specialisations (50 Marks)

1. Preparation and Pre-Lab Work (10 Marks)

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2.Conduct of Experiments (20 Marks)

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

3. Lab Reports and Record keeping (10 Marks)

- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record

4. Viva Voce (10 Marks)

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Evaluation Pattern for End Semester Examination with equal weightage in both specializations (50 Marks)

1. **Procedure/Preliminary Work/Design/Algorithm (10 Marks)**
    - Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
    - Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
    - Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
    - Creativity and logic in algorithm or experimental design.
2. **Conduct of Experiment/Execution of Work/Programming (20 Marks)**
    - Setup and Execution: Proper setup and accurate execution of the experiment or programming task.
3. **Result with Valid Inference/Quality of Output (5 Marks)**
    - Accuracy of Results: Precision and correctness of the obtained results.
    - Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. **Viva Voce (10 Marks)**
    - Ability to explain the experiment, procedure results and answer related questions
    - Proficiency in answering questions related to theoretical and practical aspects of the subject.
5. **Record (5 Marks)**
    - Completeness, clarity, and accuracy of the lab record submitted

SEMESTER S2

INTRODUCTION TO IDEA LAB AND DIGITAL TWIN TECHNOLOGY

Course Code	A25ILE211	**CIE Marks**	50
Teaching Hours/Week (L:T:P:R)	1:0:2	**ESE Marks**	-
Credits	2	**Exam Hours**	
Prerequisites (if any)	NIL	**Course Type**	Project-Based/Skill Enhancement

Course Objective:

1. To introduce the fundamentals of innovation, Design Thinking, and the Idea Lab ecosystem.
2. To enable students to translate ideas into functional prototypes using Idea Lab tools.
3. To impart basic concepts, architecture, and applications of Digital Twin Technology.
4. To provide hands-on experience in modelling, simulating, and visualizing a basic Digital Twin.
5. To Empower students to solve real-life problems through Project-Based Learning and present validated prototypes.

SYLLABUS

Module No.	Description	Contact Hours
1	**MODULE I (6 Hrs): Introduction to Idea Lab & Design Thinking** **Design Thinking Basics**: Empathize → Define → Ideate → Prototype → Test. **Problem Identification**: Observation, need analysis, pain–gain chart. **IDEA Lab**: Objectives, structure, interdisciplinary innovation culture. **Lab Activity:** Students (3 per team) identify **one problem statement** and generate **three solution ideas, Familiarization with IDEA Lab Equipment** (3D printer, laser cutter, basic electronics bench, IoT kit). | **Assignment I (Presentation):** Team-based identification of a real-world problem and presentation of three solution concepts using structured ideation methods.	2L+4P=6

2	**MODULE II (12 Hrs): Basic Prototyping in IDEA Lab** Additive Manufacturing: CAD (Computer-Aided Design) basics, 3D printing workflow (Design,Slice , Print). **Lab Activity:** **IoT Kit** based sensing and control in a physical prototype. **3D Printing** based on CAD modelling software **Autodesk Fusion 360** **Assignment II:** Build a basic functional or visual prototype using at least two different IDEA Lab tools (e.g., a 3D printed housing with simple sensor circuits).	2L+10P=12
3	**MODULE III (12 Hrs):** **Digital Twin Fundamentals:** Definition, DT vs. Simulation, DT Components & Architecture. Types of DTs (Product, Operation, Process). **Lab Activity:** **Modelling & Simulation for DT: Introduction to DT / Simulation Tools:** MATLAB/Simulink Digital Twin **(*AnyLogic, Node-RED, Unity, and Blender)* **Assignment III- Basic DT Simulation:** Develop a basic DT simulation. Task involves creating a virtual model and linking it to mock data to demonstrate state changes (e.g., Virtual object behaviour simulation, or environmental parameter twin).	2L+10P=12
4	**MODULE IV (7 Hrs): Micro Project** **Project Management & Presentation**: Basics of technical report writing, data visualization, and technical presentation skills for project pitching. **Lab Activity:** **Micro Project:** The team (3 Members) integrates their Idea Lab prototype with its Digital Twin model. Demonstration of the physical model and the virtual model synchronizing via data.	1L+6P=7

****Note:** ***MATLAB/Simulink Digital Twin is compulsory. In addition, any one of the following tools—AnyLogic, Node-RED, Unity, or Blender—may be introduced based on branch relevance (Optional)***

Course Assessment Method
Continuous Internal Evaluation Marks (CIE: 50 Marks)

Assignment-I (Practical)	Assignment-II (Practical)	Assignment -III (Practical)	Internal Lab Examination	Micro Project	Total
10	10	10			
Take average of three and convert it into 20			15	15	50

Course Outcomes (Cos)

On successful completion, students will be able to:

CO No.	Description	Blooms Knowledge Level (KL)
CO1	Explain the objectives, structure, and role of the IDEA Lab ecosystem and the principles of Design Thinking in fostering interdisciplinary innovation.	2
CO2	Apply structured problem identification and ideation techniques to identify real-world problems and propose multiple solution concepts.	3
CO3	Demonstrate basic prototyping skills by developing simple physical prototypes using IDEA Lab tools such as CAD modelling, 3D printing, and IoT kits.	4
CO4	Analyse the fundamentals, architecture, and types of Digital Twin systems and develop basic digital models using suitable simulation software.	4
CO5	Design and implement a mini–Digital Twin–enabled micro-project by integrating a physical prototype with its virtual model to address a real-world problem.	6

Note: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, and K6 - Create

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO3
CO1	3	3	2								2	3		
CO2	3	3	2								2	2		
CO3	3	3	2								2	3	3	
CO4	3	3	2			2		2	3		2	2	2	
CO5	3	3	2			2		2	2		2	2	2	
CO6	3	3	2			2		2	2		2	2	2	

Text Books

Sl. No.	Title of the Book	Name of the Author(s)/Editor(s)	Name of the Publisher	Edition and Year
1	Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation,	Tim Brown	Harper Collins	2/e, 2019
2	Product Design and Development.	Karl T. Ulrich & Steven D. Eppinger	McGraw-Hill	7/e, 2020
3	Digital Twin Technology: Fundamentals and Applications	Soheil Sabri , Kostas Alexandridis & Newton Lee	Springer	Kindle Edition , 2024

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)/Editor(s)	Name of the Publisher	Edition and Year
1	The Digital Twin	Noel Crespi , Adam T. Drobot & Roberto Minerva	Springer	1/e, 2023
2	AICTE IDEALAB Handbook		AICTE, New Delhi	2022

Video Links (NPTEL, SWAYAM, etc.)

Module	Link
1	Design thinking nptel.ac.in/courses/110106124
3	Lec 30:- Digital Twin https://www.youtube.com/watch?v=3cCOB_W1CH0&t=7s