



A CMI INSTITUTION

CHRIST COLLEGE OF ENGINEERING (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS & COMMUNICATION CURRICULUM AND SYLLABUS

B. Tech in Electronics and Communication Engineering

2025 REGULATION



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B. Tech in Electronics and Communication Engineering

**2025 REGULATION
(SEMESTER 3)**

Approved by BoS meeting held on: 19/06/2026

Approved by Academic Council meeting held on: 23/06/26


BoS Chairperson


Director of Academics


Principal

CHAIRPERSON
Board of Studies
B.Tech. Electronics &
Communication Engineering
Christ College of Engineering
Irinjalakuda, Thrissur



THIRD SEMESTER: Electronics & Communication Engineering														
Sl. No:	Slot	Course Code	Course Type	Course Category	Course Title (Course Name)	Credit				SS	Total		Credits	Hrs./Week
						L	T	P	R		CIE	ESE		
THEORY														
1	A	G25CDT321	BS	GC	Complex analysis, Partial differential equations and Transforms	2	1	0	0	3.5	40	60	3	3
2	B	L25MCR302	PC-PBL	PC	Microelectronic Circuits	2	1	0	1	4.5	60	40	4	4
3	C	L25SST303	PC	PC	Solid State Devices	2	1	0	0	3.5	40	60	3	3
4	D	A25AIT304	ES	GC	Introduction to Artificial Intelligence and Data Science	3	1	0	0	5	40	60	4	4
5	E	A25ECT305	HM	CC	Engineering Economics	2	0	0	0	3	40	60	2	2
6	F	A25AET306	HM	CC	Strategic Communication and Documentation in Engineering Practice	2	0	0	0	3	50	-	2	2
7	G	G25EST307	HM	CC	Environmental Science	1	0	0	0	1.5	40	60	1	1
PRACTICALS														
8	H	L25ACP308	PC	PC	Analog Circuits Laboratory	0	0	3	0	1.5	50	50	2	3
9	I	A25EDR349	SE	CC	Engineering Design and Innovation Studio (EDIS-I)	0	0	0	2	2	50	-	1	2
10	J	L25EDP310	PC	PC	Electronic Product Design Laboratory	0	0	3	0	1.5	50	50	2	3
ACTIVITY POINT PROGRAMME														
11		A25APP311	MC	CC	Activity Point Programme					0			-	
VALUE ADDED COURSES														
12	M	-	VA	CC	Minor course	3	1	0	0	5	40	60	4	4
Total										28/33*			24/28*	27/31*

* Project-Based Learning (PBL) Courses Integrated in Semesters 3 to 6

SEMESTER 3**G25CDT321- Complex Analysis, Partial Differential Equations and Transforms.**

Course Code	G25CDT321	CIE Marks	40
Teaching Hours/Week (L:T:P:R)	2:1:0:0	ESE Marks	60
Credits	3	Exam Hours	2 hrs 30 min
Prerequisites (if any)	None	Course Type	Theory

PROPOSED SYLLABUS

Module	Syllabus Description	Contact Hours
1	Complex Function: Complex Function, Limit, Continuity, Derivative, Analytic functions, Cauchy-Riemann Equations (without proof), Laplace's Equations, Harmonic functions, Finding harmonic conjugate, Conformal mapping, Mappings of $w = z^2$, $w = ez$, $w = \frac{1}{z}$, $w = \sin z$.	9
2	Complex Integration: Complex Integration: Line integrals in the complex plane - First evaluation method, Second evaluation method, Cauchy's integral theorem (without proof) on simply connected domain, Cauchy integral theorem on multiply connected domain (without proof), Cauchy Integral formula (without proof), Cauchy Residue Theorem.	9
3	Partial Differential Equations: Partial differential equations, Formation of partial differential equations – elimination of arbitrary constants-elimination of arbitrary functions, Solution of equations by method of separation of variables, One dimensional wave equation- vibrations of a stretched string, derivation, solution of the wave equation using method of separation of variables, One dimensional heat equation, derivation, solution of the heat equation.	9
4	Fourier Transform: Fourier Integral, Fourier Cosine and Sine integrals, Fourier Transform, Fourier Cosine and Sine Transform, Linearity.	9

COURSE OUTCOMES

CO No.	Description	Blooms KL
CO1	Explain the fundamental concepts of complex functions, limits, continuity, differentiability, analytic functions, and the Cauchy–Riemann equations.	3
CO2	Analyse the techniques of complex integration, including line integrals, Cauchy's integral formula and Cauchy Residue theorem, to evaluate integrals of complex-valued functions.	4
CO3	Solve partial differential equations arising in physical problems using appropriate methods, including separation of variables and D'Alembert's method.	3
CO4	Analyse the behavior of continuous systems by examining the operational properties of fourier transforms.	4
CO5	Analyze complex mappings, harmonic functions, partial differential equation models, and Fourier transform techniques to interpret and solve mathematical and physical problems.	4

CO- PO MAPPING

CO	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	PSO 1	PSO2	
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												
CO6	3	3			2	2		2	3		2			

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons	10 th edition, 2016
2	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Edition, 2018

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Complex Analysis	Dennis G. Zill, Patrick D. Shanahan	Jones & Bartlett	3 rd edition, 2015
2	Higher Engineering Mathematics	B. V. Ramana	McGraw-Hill Education	39 th edition, 2023
3	Fast Fourier Transform - Algorithms and Applications	K.R. Rao, Do Nyeon Kim, Jae Jeong Hwang	Springer	1 st edition, 2011
4	Advanced Engineering Mathematics	Peter V. O'Neil	Cengage	7th Edition, 2012

SEMESTER 3

MICROELECTRONIC CIRCUITS

Course Code	L25MCR302	CIE Marks	60
Teaching Hours/Week (L:T:P:R)	2:1:0:1	ESE Marks	40
Credits	4	Exam Hours	2 Hrs and 30 Mins.
Prerequisites (if any)	Basic Electrical and Electronics Engineering	Course Type	Theory

Course Objective:

1. To provide a comprehensive understanding of circuits based on diodes and transistors
2. To offer practical understanding of analog circuits such as filters, amplifiers, regulators and oscillators

SYLLABUS

Module No.	Description	Contact Hours
1	First Order RC Circuits: RC differentiating and integrating circuits, Analysis of First order RC low pass and high pass filter for step input - rise time, bandwidth. Diode clipping and clamping circuits. Biasing of BJT: Need for biasing, DC load line, operating point, voltage divider bias (design & analysis).	9
2	BJT Amplifiers: Design of RC coupled CE amplifier - Small signal analysis of CE amplifier using hybrid- π model (mid frequency). The high frequency hybrid- π model of BJT, Miller effect, High frequency response of single stage CE amplifier Types of Multistage BJT Amplifiers, Effect of cascading on gain and bandwidth, Cascode amplifier (Analysis not required). MOSFET Amplifiers: MOSFET Biasing, Design of CS amplifier, Small signal analysis using hybrid- π model (mid frequency only), Small signal voltage gain, input & output impedance, CS stage with current source load. Basics of SPICE Modelling of CS MOSFET Amplifier	9
3	Feedback amplifiers: The general feedback structure, Effect of negative feedback on gain, bandwidth, noise reduction and distortion. The four basic feedback topologies. Analysis of discrete MOSFET circuits in voltage-series and voltage-shunt feedback topologies - voltage gain, input and output impedance. Oscillators: Classification, criterion for oscillation, Wien bridge oscillator (Design is required), Hartley and Crystal oscillator.	9
4	Power amplifiers: Classification, Transformer coupled class A power amplifier, complementary- symmetry class B and Class AB power amplifiers- Derivation of Efficiency. Linear Voltage Regulators: Types of voltage regulators- series and shunt - working and design, load & line regulation, short circuit protection and fold back protection.	9

Suggestion on Project Topics

1. MOSFET-Based Audio Amplifier Design
2. Wien Bridge Oscillator with Frequency Control
3. Voltage Regulator Design with Load and Line Regulation Analysis
4. Automatic street light using transistor switching
5. Design current mirror circuits for biasing applications
6. Design a crystal oscillator circuit for clock generation
7. Design a two-stage amplifier with Miller compensation
8. MOSFET-based LED dimmer

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)	Project	Total
15	30	30	30	20	60
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 2 marks (8x2 =16 marks)	• Each question carries 6 marks. • Two 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. • (4x6 = 24 marks)	40

Course Outcomes (Cos)

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

CO No.	Description	Blooms Knowledge Level (KL)
CO1	Design wave shaping circuits and filters using first order RC network and diodes.	K3
CO2	Analyse single stage and multistage amplifier circuits using equivalent models.	K4
CO3	Apply the principles of feedback in the design of closed loop amplifiers and oscillators.	K3
CO4	Design power amplifiers and voltage regulator circuits.	K3
CO5	Develop circuits and subsystems to solve real-world engineering problems.	K3

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

CO-PO Mapping Table:

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PS O1	PS O2	PS O3
CO-1	3	2										2		
CO-2	3	2										2		
CO-3	3	2										2		
CO-4	3	2										2		
CO-5	3	3	2	2	2			3	3	2	3	3	3	3

Text Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Electronic Devices and Circuit Theory	Robert Boylestad and L Nashelsky	Pearson	11th edition, 2015
2	Microelectronic Circuits	Sedra A. S. and K. C. Smith	Pearson Education	8/e, 2021

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Integrated Electronics: Analog and Digital Circuits and Systems	Jacob Millman and Christos C. Halkias	McGraw-Hill Education	2nd Edition, 2017
2	Design of Analog CMOS Integrated Circuits	Behzad Razavi	McGraw-Hill Education	2nd Edition, 2017
3	Electronic Devices and Circuits	David A Bell	Oxford University Press	5th edition, 2008
4	Electronic Circuits and Devices	Theodore F. Bogart; Beasley, Jeffrey S.; Guillermo Rico	Pearson Education India	6 th Edition, 2019
5	CMOS Analog Circuit Design	Phillip E. Allen and Douglas R. Holberg	Oxford University Press	3rd Edition, 2012

Video Links (NPTEL, SWAYAM, etc.)

Module No.	Link
1	https://nptel.ac.in/courses/117106030
2	https://nptel.ac.in/courses/108105159
3	https://nptel.ac.in/courses/117106031
4	https://nptel.ac.in/courses/117106030
5	https://nptel.ac.in/courses/108102113



SEMESTER 3**SOLID STATE DEVICES**

Course Code	L25SST303	CIE Marks	40
Teaching Hours/Week (L:T:P:R)	2:1:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. and 30 Mins.
Prerequisites (if any)	Engineering Physics	Course Type	Theory

Course Objective:

1. To provide a comprehensive understanding of solid-state semiconductor devices and scaling techniques.
2. To offer advanced knowledge and practical skills in drawing band diagrams of semiconductor devices and modelling current through them.

SYLLABUS

Module No.	Description	Contact Hours
1	Equilibrium and steady-state conditions , Crystal structure of solids, Formation of energy bands, Fermi-Dirac distribution and Concept of fermi level, Concept of E-K diagram, Effective mass and rest mass of electrons, Equilibrium concentration of electrons and holes, Derivation of the law of mass action. Excess carriers in semiconductors : Generation and recombination mechanisms of excess carriers, quasi-Fermi levels. Mechanisms for Carrier transport in semiconductors : Derivation of Drift current, conductivity and mobility, variation of mobility with temperature and doping	9
2	Diffusion , Einstein relations, Poisson equations, Continuity equations, Current flow equations, Diffusion length, Gradient of quasi-Fermi level. Hall effect. PN junctions : Contact potential, Electrical Field, Potential and Charge distribution at the junction, Biasing and Energy band diagrams, Ideal diode equation. Metal Semiconductor contacts : Electron affinity and work function, Ohmic and Rectifying Contacts, current voltage characteristics.	9

3	Ideal MOS capacitor: band diagrams at equilibrium, accumulation, depletion and inversion, surface potential, CV characteristics, effects of real surfaces, threshold voltage, body effect. MOSFET- Drain current equation of enhancement type MOSFET (derivation)- linear and saturation region, Drain characteristics, transfer characteristics. Introduction to SPICE Models for Semiconductor Devices – Purpose, MOSFET SPICE models (basic concepts)	9
4	MOSFET scaling: Need for scaling, constant voltage scaling and constant field scaling. Sub- threshold conduction in MOS. Short channel effects in MOSFETs: Channel length modulation, Drain Induced Barrier Lowering, Velocity Saturation, Threshold Voltage Variations and Hot Carrier Effects. Introduction to advanced MOS devices: FDSOI, FinFET, GAAFET: Structure, operation and advantages	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	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 Fermi-Dirac statistics to compare equilibrium carrier concentration.	3
CO2	State different carrier transport mechanisms in extrinsic semiconductors and obtain the current densities due to this transport.	2
CO3	Analyze the working principles of pn junctions and transistors and applications in semiconductor devices	4
CO4	Apply analytical and problem-solving skills to evaluate device behavior, scaling techniques, and the impact of scaling on device performance	3
CO5	Demonstrate the ability to simulate and analyse semiconductor devices by applying fundamental engineering knowledge and modern design tools	3

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

CO-PO Mapping Table:

	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	PSO-3
CO-1	3	3				2						2	2	
CO-2	3	3				2						2	2	
CO-3	3	3				2					2	2	2	
CO-4	3	3	2	2							3	2	2	2
CO-5	3	3	3	3	2	2	2	2	2		2	2	2	2

Text Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Solid State Electronic Devices	Ben G. Streetman and Sanjay Banerjee	Pearson Education	7/e, 2014
2	Semiconductor Devices Fundamentals	Robert F Pierret	Pearson Education	2/e, 2006
3	Physics of Semiconductor Devices	Michael S. Shur	Pearson Education	1/e, 2019

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Semiconductor Physics and Devices	Neamen	McGraw Hill	4/e, 2021
2	Modern Semiconductor Devices for Integrated Circuits	C.C Hu	Pearson Education	2nd Edn., 2010.
3	Semiconductor Devices: Physics and Technology	Sze S.M	John Wiley	3/e, 2016
4	Fundamentals of Semiconductor Devices,	Achuthan, K N Bhat,	McGraw Hill	1e, 2015
5	Semiconductor Physics and Devices	S.M. Sze, M.K. Lee	Wiley	3/e, 2021
6	Introduction to Semiconductor Materials and Devices	M. S. Tyagi	John Wiley and Sons	2004

Video Links (NPTEL, SWAYAM, etc.)

Module No.	Link
1	https://nptel.ac.in/courses/117106091
2	https://onlinecourses.nptel.ac.in/noc25_ee92/preview
3	https://nptel.ac.in/courses/115105099
4	https://www.nptelprep.in/courses/117106091/materials

SEMESTER S3**INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

Course Code	A25AIT304	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Linear Algebra and Python	Course Type	Theory

Course Objectives:

1. Demonstrate an in-depth understanding of advanced linear algebra, machine learning algorithms, and statistical analysis methodologies within the context of engineering applications and computational frameworks.
2. Integrate theoretical foundations with practical problem-solving by analyzing complex engineering data, extracting significant insights, and employing appropriate mathematical and computational techniques for artificial intelligence and data science applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basics of AI and Machine Learning – applications in engineering – types of Machine Learning systems, Components of an ML system and challenges in ML. Principles of supervised learning – regression analysis ... logistic regression model. Unsupervised model example - K-means clustering. Artificial Neural Network - Perceptron- Universal Approximation Theorem (statement only)- Multi-Layer Perceptron- Introduction to Deep Neural Network.	13
2	Role of linear algebra in Data representation and analysis. Matrix decomposition – Spectral Decomposition, Singular Value Decomposition (SVD) and its applications. Dimensionality reduction technique - Principal Component Analysis (PCA) and its application (No numerical	10

3	Applied Probability: Basics of probability- Conditional probability- Bayes theorem and its applications. Random variables and analysis. Statistics: Statistical measures of central tendency and statistical	12
4	Basics of Data Science: Benefits of data science-use of statistics and Machine Learning in Data Science- data science process - applications of Machine Learning in Data Science. Introduction to Big Data and its applications. Application of PowerBI Demonstration of ML applications in data science using Python	10

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

Continuous Internal Evaluation Marks (CIE):

Assignment (Application 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

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 (8x3 =24marks)	- 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. (4x9 = 36 marks)	60

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the basics of AI and machine learning and apply techniques to develop solutions for simple engineering problems.	K2/K3
CO2	Apply advanced mathematical methods such as matrix decomposition to analyze and solve engineering problems, contributing to scientific and sustainable development.	K3
CO3	Analyze and interpret data using statistical tools to extract actionable insights and aid in decision-making in engineering	K3
CO4	Understand the basics of data science and integrate with machine learning techniques to create feasible engineering solutions that address modern industry needs.	K3
CO5	Demonstrate the ability to visualize and interpret datasets using machine learning and data science concepts to facilitate innovation in engineering practices	K3/K4

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

CO-PO Mapping Table:

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

Text Books				
Sl. No	Title of the Book	Name of the	Name of the	Edition and Year
1	Introduction to Linear Algebra	Gilbert Strang	Wellesley-Cambridge Press	6 th edition, 2023
2	Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow	Aurélien Géron	O'Reilly Media, Inc.	2 nd edition, 2022

3	Mathematics for machine learning	Deisenroth, Marc Peter, A. Aldo Faisal, and Cheng Soon Ong	Cambridge University Press	1 st edition, 2020
4	Fundamentals of mathematical statistics	Gupta, S. C., and V. K. Kapoor	Sultan Chand & Sons	9 th edition, 2020
5	Introducing data science: big data, machine learning, and more, using Python tools	Cielen, Davy, and Arno Meysman	Simon and Schuster	1 st edition, 2016

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Data science: concepts and practice	Kotu, Vijay, and Bala Deshpande	Morgan Kaufmann	2 nd edition, 2018
2	Probability and Statistics for Data Science	Carlos Fernandez-Granda	Center for Data Science in NYU	1 st edition, 2017
3	Foundations of Data Science	Avrim Blum, John Hopcroft, and Ravi Kannan	Cambridge University Press	1 st edition, 2020
4	Statistics For Data Science	James D. Miller	Packet Publishing	1 st edition, 2019
5	Probability and Statistics – The Science of Uncertainty	Michael J. Evans and Jeffrey S. Rosenthal	University of Toronto	1 st edition, 2009

Video Links (NPTEL, SWAYAM...)

Module No.	Link ID
1	https://archive.nptel.ac.in/courses/106/106/106106198/
2	https://archive.nptel.ac.in/courses/106/106/106106198/ https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/resources/lecture-29-singular-value-decomposition/
3	https://ocw.mit.edu/courses/18-650-statistics-for-applications-fall-2016/resources/lecture-19-video/
4	https://archive.nptel.ac.in/courses/106/106/106106198/

SEMESTER 3**ENGINEERING ECONOMICS**

Course Code	A25ECT305	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	2:0:0:0	ESE Marks	60
Credits	2	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

This course introduces engineering students to economic principles and decision-making techniques required for evaluating engineering projects and business investments. It focuses on demand and supply analysis, cost concepts, financial management, project evaluation techniques, and economic decision-making under risk and uncertainty.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Economics: Meaning, Nature, and Scope of Economics, Microeconomics and Macroeconomics, Role of economics in engineering decision-making, Production Possibility Curve and Opportunity cost, Consumer behaviour theory and Consumer equilibrium (Cardinal Approach). Circular flow of economic activity (Four Models), Taxation and Goods and Services Tax (GST), Sustainable development principles in engineering economics, Triple Bottom Line (People, Planet, Profit).	6

2	Fundamentals of Micro Economics: Demand and Factors determining demand – Law of Demand – Demand curve- Price elasticity of demand- measurement of price elasticity and its applications (Numerical Problems), Demand forecasting methods, Linear Regression Method (Numerical Problems) – Supply: factors determining supply - Law of supply – Supply curve-Equilibrium price determination (Numerical Problems) - Changes in demand and supply and its effects on equilibrium price and quantity Production: Factors of Production, Production function - Law of variable proportion, Returns to scale, Applications of micro economic concepts in engineering and technology markets.	6
3	Market structure and Cost: Market: Perfect Competition – Monopoly - Monopolistic Competition (features and equilibrium of a firm) - Oligopoly – Features – Kinked demand model Cost: Short run cost curves – Fixed Cost, Variable Cost, Total costs, Average and Marginal cost (Numerical Problems), Revenue, Break-even analysis and Margin of safety (Numerical Problems), Private cost and Social cost – Sunk cost –Explicit and implicit cost. Learning curve concept, Cost control and cost reduction, Productivity measurement, Economic optimization in engineering operations	6
4	Financial Management, Time Value of Money and Project Evaluation: Financial Management: Financial Statements, Balance Sheet, Income Statement, Cash Flow Statement, Financial ratio analysis. Time Value of Money: Concept of interest, Simple and compound interest, Nominal and effective interest rates, Present worth and future worth analysis.	6

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
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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:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain the fundamental economic concepts, consumer behaviour, taxation, and sustainable development principles relevant to engineering decision-making.	Understand (K2)
CO2	Apply demand, supply, elasticity, demand forecasting, and production theories to analyze economic problems in engineering and technology markets	Apply (K3)
CO3	Analyze market structures, cost concepts, break-even situations, productivity measures, and optimization techniques for engineering operations.	Analyze (K4)
CO4	Evaluate financial statements and apply time value of money concepts for investment and financial decision-making.	Evaluate (K5)
CO5	Assess engineering projects using project appraisal techniques, risk analysis methods, and sustainability principles to support managerial decision-making.	Evaluate (K5)

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

CO-PO Mapping Table:

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

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Engineering Economics	Leland Blank & Anthony Tarquin	McGraw-Hill Education	9th Edition, 2024
2	Fundamentals of Engineering Economics	Chan S. Park	Pearson Education	5th Edition, 2022
3	Principles of Economics	N. Gregory Mankiw	Cengage Learning	10th Edition, 2024
4	Engineering Economy	William G. Sullivan, Elin M. Wicks & C. Patrick Koelling	Pearson	17th Edition, 2023

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Engineering Economy and Economic Analysis	Ted G. Eschenbach	Oxford University Press	7th Edition, 2021
2	Financial Management: Theory and Practice	Eugene F. Brigham & Michael C. Ehrhardt	Cengage Learning	17th Edition, 2022
3	Project Management for Engineering, Business and Technology	John M. Nicholas & Herman Steyn	Routledge	6th Edition, 2023
4	Sustainable Engineering: Concepts, Design and Case Studies	David T. Allen & David R. Shonnard	Pearson	2nd Edition, 2021

SEMESTER 3

STRATEGIC COMMUNICATION AND DOCUMENTATION IN ENGINEERING PRACTICE

Course Code	A25AET306	CIE Marks	50
Teaching Hours/Week (L:T:P:R)	2:0:0:0	ESE Marks	0
Credits	2	Exam Hours	Nil
Prerequisites (if any)	-	Course Type	Theory

Course Objective:

1. Develop proficiency in advanced professional and technical communication required in engineering and workplace contexts.
2. Develop the ability to organize, analyze, interpret, and present technical information effectively.
3. Develop competence in professional writing, research-oriented writing, and preparation of technical reports.
4. Strengthen team communication, leadership, negotiation, interview, and professional presentation skills.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Advanced Professional Language and Communication Advanced Language Use Appropriate use of tenses, adjectives and adverbs in professional contexts. Technical vocabulary and appropriate use of jargon; abbreviations in technical communication. Editing mechanics: punctuation, proofreading, language accuracy, clarity and coherence. Professional Communication Professional and business correspondence; job application letter, resume and statement of purpose, with emphasis on engineering-specific and role-targeted formats. ATS (Applicant Tracking System) optimisation techniques, LinkedIn profile writing, and cover-letter drafting. Professional writing for engineering and workplace contexts. Task-Based Activities Editing and proofreading exercises; professional correspondence; ATS-optimised resume tailored to a specific engineering job posting; cover-letter and LinkedIn-summary drafting; peer recruiter-style resume review; context-based language exercises.	7
2	Research, Information Analysis and Technical Writing Research and Analysis Analysing and synthesising technical information from newspapers, magazines, articles and electronic content. Writing an introduction and literature review based on relevant technical information. Organisation of Information Systematic organisation of objective-oriented information for different technical reports. Questionnaire preparation for collection of relevant information. Data Interpretation and Visual Communication	7

Module No.	Syllabus Description	Contact Hours
	Interpretation of data presented through graphs, tables, charts, imagery and infographics. Converting information between textual and visual forms. Task-Based Activities Analysis of technical information; introduction and literature-review writing; questionnaire preparation; data interpretation and transcoding exercises.	
3	Technical Report Preparation and Documentation Fundamentals of Technical Reports Purpose, characteristics and major types of reports. organization of reports: title, preface, acknowledgement, abstract/summary, introduction, materials and methods, results, discussion, conclusion and suggestions/recommendations. Report Preparation Collection of information, preparation of an outline, organisation of content and drafting of technical reports. Supplementary components: appendix, index, glossary, references, bibliography and notes. Review of reports for structure, content, style, layout, clarity, coherence and referencing. Task-Based Activities Identification of report types and structure; drafting sections of technical reports; organisation of supplementary material; review and editing of completed reports.	8
4	Team, Leadership and Professional Presentation Team and Leadership Communication Advanced workplace communication: negotiation strategies, leadership styles, and conflict de-escalation in professional contexts. Collaborative interaction and cross-functional team management in engineering workplaces. Professional Interaction Participation in professional meetings and structured group interaction. Advanced interview communication in professional and technical contexts, including panel interviews and combined technical-HR interview formats. Technical Presentation Planning, organising and digitally presenting technical reports and professional information. Effective presentation of technical content and response to audience interaction. Task-Based Activities Negotiation role-play between cross-functional teams; conflict de-escalation simulation; leadership-rotation task within group projects; cross-functional meeting simulation; panel-style mock interview combining technical and HR rounds; video-recorded self-review of interview performance; planning and digital presentation of a technical report.	8

Course Assessment Method (CIE: 50 Marks)

Assignments / Quiz / Language & Editing Tasks	Professional / Research Writing Activities	Technical Report Preparation	Professional Interaction / Presentation	Total
10	10	15	15	50

Course Outcomes (COs)

At the end of the course, students will be able to:

CO No.	Description	Blooms Knowledge Level (KL)
CO1	Apply appropriate language, editing, and professional communication practices in engineering and workplace contexts.	K3
CO2	Apply technical writing practices to organize technical information, interpret data, and communicate information in textual and visual forms.	K3
CO3	Apply appropriate content organization, documentation and referencing conventions in technical report preparation	K3
CO4	Demonstrate effective communication in teamwork, leadership, negotiation and professional interactions, and deliver clear digital presentations of technical reports.	K3

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	1				1		2		3		1
CO2	2	2		1	2		1		3		2
CO3	1	1		1	1		1		3		2
CO4					2		2	3	3	1	1

Mapping level: 1 – Low, 2 – Moderate, 3 – High

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher
1	Technical Communication: Principles and Practice	Meenakshi Raman & Sangeeta Sharma	Oxford University Press
2	Effective Technical Communication	M. Ashraf Rizvi	McGraw Hill Education
3	Practical English Usage	Michael Swan	Oxford University Press

SEMESTER 3**ENVIRONMENTAL SCIENCE**

Course Code	G25EST307	CIE Marks	40
Teaching Hours/Week (L:T:P:R)	1:0:0:0	ESE Marks	60
Credits	0	Exam Hours	2 Hrs. and 30 Mins.
Prerequisites (if any)	G25MCT105	Course Type	Theory

Course Objective:

1. To understand environmental systems, biodiversity, natural resources, pollution, and their conservation and management.
2. To develop awareness of sustainability, climate change, renewable energy, green technologies, and sustainable development practices.

SYLLABUS

Module No.	Description	Contact Hours
1	Environment, ecosystem structure and functions, energy flow, food chains, food webs, ecological pyramids, biogeochemical cycles, ecosystem services, biodiversity, threats, in-situ and ex-situ conservation.	6
2	Causes and Effects of Water, Soil, Air and Noise Pollutions, Environmental Quality Standards Solid Waste, Hazardous Waste, and E-Waste Management; Cleaner Production Techniques	6
3	Sustainability: Concept, Need, and Challenges; Economic, Social, and Environmental Dimensions of Sustainability; Transition from Unsustainable to Sustainable Development; Sustainable Development Goals (SDGs) – Targets, Indicators, and Intervention Areas. Climate change- Global, Regional and local environmental issues and possible solutions Concept of Carbon Credit and Carbon Footprint.	6
4	Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles- carbon cycle, emission and sequestration. Green Engineering: Sustainable urbanization- Socio-economic and technological change.	6

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

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	Explain the fundamental concepts of environment, ecosystems, biodiversity, and ecological processes, and evaluate the importance of biodiversity conservation.	2
CO2	Identify the causes and effects of environmental pollution and waste management practices, and interpret relevant environmental regulations.	2, 3
CO3	Apply the principles of sustainability, climate change mitigation, carbon management, and environmental management to support sustainable development goals.	2,3
CO4	Apply the principles of circular economy, environmental impact assessment, green technologies, sustainable energy, and sustainable urbanization for environmental protection and resource conservation.	2,3

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					3								
CO2	2					3								
CO3	2					3								
CO4	2					3								

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Perspectives in Environmental Studies	Anubha Kaushik, C.P. Kaushik	New Age International Publishers	7 th Edition, 2024
2	Environmental Science and Engineering	Benny Joseph	McGraw Hill Education India	3 rd Edition, 2017
3	Introduction to Environmental Engineering and Science	Gilbert M. Masters, Wendell P. Ela	Pearson Education	3 rd Edition, 2008

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Sustainability Engineering: Concepts, Design and Case Studies	David T. Allen, David R. Shonnard	Pearson / Prentice Hall	2nd Edition, 2011
2	Engineering Applications in Sustainable Design and Development	Bradley A.S., Adebayo A.O., Maria P.	Cengage Learning	1st Edition, 2015
3	Environmental Impact Assessment Notification and Guidelines	Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India	Government of India	Latest Amendment Version
4	Basic Concepts in Environmental Management	Kenneth M. Mackenthun	Lewis Publishers	Reprint Edition
5	Environmental Science: A Global Concern	William P. Cunningham, Mary Ann Cunningham	McGraw Hill Education	15th Edition, 2021

Video Links (NPTEL, SWAYAM, etc.)

Module No.	Link
1	https://nptel.ac.in/courses/105105157
2	https://nptel.ac.in/courses/102104001

SEMESTER 3
ANALOG CIRCUITS LABORATORY

Course Code	L25ACP308	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:3:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Lab

Course Objectives:

1. To Familiarise the students with the analog circuits design using discrete components.
2. To Familiarise the students with simulation of basic analog circuits

Details of Experiments

No	Experiments
Part A – List of Experiments using discrete components (Any Six experiments mandatory)	
1	RC Integrating and Differentiating Circuits (Transient analysis with different inputs and frequency response)
2	Diode Clipping and Clamping Circuits (Transient and transfer characteristics)
3	Rectifier Circuits (Half-wave and full-wave rectifiers with and without filter – measurement of ripple factor and load regulation)
4	CE amplifier – Design for a specific voltage gain and plot frequency response characteristics
5	CS MOSFET amplifier - Design for a specific voltage gain and plot frequency response characteristics
6	Cascaded amplifier (CE–CE) - Design for a specific voltage gain and plot frequency response characteristics
7	Feedback amplifiers (voltage series) – Design for a specific voltage gain and plot frequency response characteristics
8	RC oscillators – RC phase shift or Wien bridge oscillator
9	Power amplifiers (Transformer less) – Class B & Class AB
10	Transistor series voltage regulator – Design for a specific output voltage with & without short circuit protection (plot load & line regulation characteristics)

Part B – Simulation Experiments (Any *Six* experiments mandatory)

The experiments shall be conducted using Open-Source Tools such as QUCS, KiCad, LT SPICE, or variants of SPICE tools

1	RC Integrating and Differentiating Circuits (Transient analysis with different inputs and frequency response)
2	Diode Clipping and Clamping Circuits (Transient and transfer characteristics)
3	Transistor CE configuration (Input and output characteristics)
4	CE amplifier – Design for a specific voltage gain and plot frequency response characteristics
5	CS MOSFET amplifier - Design for a specific voltage gain and plot frequency response characteristics
6	RC oscillators – RC phase-shift or Wien bridge oscillator
7	Cascaded amplifier (CE–CE) - Design for a specific voltage gain and plot frequency response characteristics
8	Cascode amplifier - Design for a specific voltage gain and plot frequency response characteristics
9	Power amplifiers (transformerless) – Class B & Class AB
10	Transistor series voltage regulator – Design for a specific output voltage with & without short circuit protection (plot load & line regulation characteristics)

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)	Internal Exam	Total
30	20	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	Rec ord	Total
10	15	10	10	5	50

Mandatory requirements for ESE:

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

Course Outcomes (COs)

At the end of the course the student will be able to:

Course Outcome		Bloom's Knowled ge Level (KL)
CO1	Design and implement wave-shaping circuits and first order filters using discrete components and devices.	K3
CO2	Design and implement amplifiers and oscillators using transistors.	K3
CO3	Design and demonstrate voltage regulators using transistors.	K3
CO4	Design and simulate the functioning of basic analog circuits using SPICE tool.	K3

K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO/PSO Mapping

	<i>PO1</i>	<i>PO2</i>	<i>PO3</i>	<i>PO4</i>	<i>PO5</i>	<i>PO6</i>	<i>PO7</i>	<i>PO8</i>	<i>PO9</i>	<i>PO10</i>	<i>PO11</i>	<i>PSO1</i>	<i>PSO2</i>	<i>PSO3</i>
CO1	3	2	1	3	2			3	2		2	3	3	2
CO2	3	2	1	3	2			3	2		2	3	3	2
CO3	3	2	1	3	2			3	2		2	3	3	2
CO4	3	2	1	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	Electronic Devices and Circuits	David A Bell	Oxford University Press, 2008	5/e, 2008
2	Electronic Circuits Analysis and Design 1	D. Meganathan	Yes Dee Publishing,	1 st edition, 2023
3	Sedra, A. S. and Smith, K. C	<i>Microelectronic Circuits</i>	Oxford University Press	8/e, 2020.

Video Links (NPTEL, SWAYAM...)	
Sl. No.	Link ID
1	https://nptel.ac.in/courses/108106084
2	https://nptel.ac.in/courses/108105158

Continuous Assessment (30 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 (10 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 (5 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 (5 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 End Semester Examination (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 (15 Marks)

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. Result with Valid Inference/Quality of Output (10 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



B.Tech. 2025 – S3 ECE

ENGINEERING DESIGN AND INNOVATION STUDIO - I

Course Code	A25EDR349	CIE Marks	50
Teaching Hours/Week (L:T:P:R)	0:0:0:2	ESE Marks	–
Credits	1	Exam Hours	2 Hrs (Lab Exam)
Prerequisites (if any)	NIL	Course Type	Project-Based / Skill Enhancement

Course Objectives:

1. To develop practical competence in building IoT systems using ESP8266/ESP32, applying real-time sensor data transmission via MQTT, BLE, and ZigBee mesh networking for remote monitoring, cloud integration, and actuation.
2. To develop hands-on skills in designing and implementing sensor-integrated robot systems using motor driver circuits, PWM control, and multi-protocol wireless communication including RF, Bluetooth, and ZigBee.
3. To develop skills in conducting a structured literature survey on a relevant engineering topic, synthesising information from multiple peer-reviewed sources, and presenting findings in a formal technical document.
4. To build interdisciplinary prototyping skills by integrating IoT hardware, wireless communication systems, and robotic platforms into a coherent and functional micro-project.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	MODULE I: Internet of Things – Sensing, Connectivity & Cloud Integration Lab Sessions (minimum 4 must be completed and recorded): ❑ Lab 1 – Real-Time Environmental Data Acquisition and MQTT Streaming ❑ Lab 2 – I2C Master-Slave Communication: Establish I2C between two ESP boards; master reads sensor data via slave ❑ Lab 3 – Cloud Integration (ThingSpeak / Firebase): Connect ESP8266 to ThingSpeak/Firebase; plot live sensor graph on cloud dashboard; set threshold alert. ❑ Lab 4 – IoT Dashboard for Remote Monitoring and Control: Create a multi-widget dashboard (gauge, graph, switch) on ThingSpeak or Node-RED; control an LED/relay remotely from dashboard. ❑ Lab 5 –Assistive Elder-Care Emergency Beacon System using ESP32 , Bluetooth-BLE and cloud. ❑ Lab 6 - Real-Time Industrial system Monitoring for Predictive Maintenance via Zigbee Mesh Network	10

	☐ Lab 7 – GPS Location Logger: Interface NEO-6M GPS with ESP32 over UART and post latitude/longitude to ThingSpeak/Firebase.	
2	MODULE II: Robot Design and Implementation using Sensor Integration, Motor Control, and Multi-Protocol Wireless Communication Systems. Lab Sessions (minimum 4 must be completed and recorded): ☐ Lab 1 – Line Following Robot ☐ Lab 2 – Gesture Controlled Robot ☐ Lab 3 – Voice Controlled Robot ☐ Lab 4 -Swarm Aggregation via IR-Based Inter-Robot Communication ☐ Lab 5 – ZigBee /RF Based Wireless Robot ☐ Lab 6 – Pick and Place Robotic Arm ☐ Lab 7 – Obstacle Avoiding Robot ☐ Lab 8 – Tethered Underwater ROV with 3-Thruster Propulsion System	10

Course Assessment Method

1. Integrated Lab Performance Report (10 Marks):

Students must maintain a structured laboratory log for both Module I and Module II. A comprehensive performance report covering a minimum of 8 experiments (at least 4 from IoT and 4 from Robotics) must be submitted at the end of the term. The assessment criteria include: (i) complete schematic/block diagrams, (ii) clean data tables with accurate readings, (iii) comparative analysis of simulated/hardware outputs and (iv) qualitative engineering discussions.

2. Literature Survey Report (10 Marks):

Conducted in teams of three (3) students. Each group will select a contemporary problem statement at the intersection of IoT, automation, and Robotics. Deliverables include a formal A4 PDF report (max 8 pages) comprising: (i) abstract, (ii) taxonomy of existing technical solutions, (iii) rigorous comparative matrix of previous implementations, (iv) identification of specific research or technology gaps, and (v) complete bibliography indexed in a standard formatting style (e.g., IEEE).

Continuous Internal Evaluation (CIE: 50 Marks)

Assignment I	Assignment II	Micro-Project	Lab Examination	Total
Integrated Lab Performance Report:	Literature Survey Submission: (Submitted by a team of 3 students).	Integrated IoT / Robotics Project with report, and demonstration (Submitted by a team of 3 students).	On-spot lab task: IoT and Robotics based design completed in 2 hrs	50 Marks
10 Marks	10 Marks	15 Marks	15 Marks	50 Marks

Micro-Project Guidelines

Group size: 2–3 students. The micro-project must integrate at least one IoT / Robotics hardware element (ESP32/ESP8266 with sensor and cloud connectivity).

Deliverables and Marks Distribution (15 Marks):

- ☐ Working prototype / simulation model : **5 Marks**
- ☐ Technical report (problem statement, design, results, conclusion, references): **4 Marks**
- ☐ Live demonstration and Q&A (lab viva): **6 Marks**

Course Outcomes (COs)

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

CO No.	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Implement IoT systems using ESP8266/ESP32 with MQTT, BLE, and ZigBee for cloud-based monitoring, and design sensor-integrated robotic systems with motor driver circuits and wireless communication for autonomous and remote-controlled applications.	K3 (Apply)
CO2	Conduct a structured literature survey on an IoT or robotics topic, synthesise findings from a minimum of 8 peer-reviewed sources, identify research gaps, and document findings with IEEE-format references.	K4 (Analyse)
CO3	Design and build an integrated IoT-robotics prototype with circuit schematic, commented code, and a technical report demonstrating functional performance and critical analysis of results.	K6 (Create)

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

CO-PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	3	2	3	1	--	--	2	2	2
CO2	3	3	3	3	2	1	--	--	2	1	2
CO3	3	3	3	3	3	2	--	2	3	3	3

Text Books

Sl. No.	Title of the Book	Name of the Author/s	Publisher	Edition and Year
1	Internet of Things: A Hands-On Approach	Arshdeep Bahga & Vijay Madisetti	Universities Press	1e, 2014

2	Programming Robots with ROS: A Practical Introduction to the Robot Operating System	Morgan Quigley, Brian Gerkey & William D. Smart	O'Reilly	1e, 2015
3	Introduction to Autonomous Mobile Robots	Roland Siegwart, Illah Nourbakhsh & Davide Scaramuzza	MIT Press	2e, 2011

Reference Books

Sl. No.	Title of the Book	Name of the Author/s	Publisher	Edition and Year
1	Designing the Internet of Things	Adrian McEwen & Hakim Cassimally	Wiley	1e, 2013
2	Practical Electronics for Inventors	Paul Scherz & Simon Monk	McGraw-Hill	4e, 2016
3	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things	David Hanes, Gonzalo Salgueiro & Patrick Grossetete	Cisco Press	1e, 2017
4	Robot Modeling and Control	Mark W. Spong, Seth Hutchinson & M. Vidyasagar	Wiley	1e, 2006
5	Swarm Intelligence: From Natural to Artificial Systems	Eric Bonabeau, Marco Dorigo & Guy Theraulaz	Oxford University Press	1e, 1999

Video Links (NPTEL, SWAYAM, etc.)

Module	Resource	Link
I	NPTEL – Introduction to Internet of Things (IIT Kharagpur)	https://nptel.ac.in/courses/106105166
I	NPTEL – Cloud Computing (IIT Kharagpur)	https://nptel.ac.in/courses/106105143
I	IoT Virtual Lab – MQTT, I2C, Cloud and Dashboard Experiments	https://iotvirtuallab.github.io/vlab/Experiments/index.html

I	Random Nerd Tutorials – ESP32/ESP8266 Projects and Protocols	https://randomnerdtutorials.com
II	NPTEL – Introduction to Robotics (IIT Bombay)	https://nptel.ac.in/courses/112101099
II	NPTEL – Embedded Systems Design (IIT Kharagpur)	https://nptel.ac.in/courses/108105082
II	Arduino Project Hub – Community Robotics and IoT Reference Projects	https://projecthub.arduino.cc



SEMESTER 3
Electronic Product Design Laboratory

Course Code	L25EDP310	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:3:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Lab

Course Objectives:

- To familiarize students with the process of electronic circuit design and printed circuit board (PCB) fabrication.
- To train students in using open-source tools for PCB layout design and automation.
- To introduce students to enclosure design and 3D modeling for electronic products.
- **Details of Experiments**

No.	Experiments
Part A – PCB Design and Fabrication (Three circuits should be fabricated: simple LED flasher, timer circuit using IC 555, and a multi-component sensor or control circuit.))	
1	Prepare the Bill of Materials (BOM) for three electronic circuits of varying complexity, including one using IC 555.
2	Design the circuit schematics for the selected circuits using KiCad.
3	Create the PCB layout from the schematic and ensure correct routing and component placement.
4	Perform Design Rule Check (DRC) and generate Gerber files for fabrication.
5	Transfer the PCB layout onto a copper-clad board using the screen-printing process.
6	Etch the PCB to remove unwanted copper and form the desired circuit tracks.
7	Drill holes for component leads and mount components as per the BOM.
8	Solder the components, power the circuit, and test for proper functionality.

Part B – Enclosure Design and 3D Modeling (Students must design a minimum of two enclosures and two 3D models for printing as part of this module.)	
1	Explore Fusion 360 and understand basic 3D design tools, sketching, and parametric modeling.
2	Create a 3D model of the PCB and components to define board dimensions and spatial constraints.
3	Design a PCB enclosure in Fusion 360 with proper clearances, ventilation, and mounting features.
4	Integrate cut-outs, connector slots, and assembly features such as screw mounts or snap-fits into the design.
5	Prepare the enclosure model for 3D printing by exporting to STL/OBJ and performing slicing in tools like Cura or PrusaSlicer.
6	Print the prototype enclosure, assemble it with the fabricated PCB, evaluate the mechanical fit, and refine the design if needed.

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)	Internal Exam	Total
30	20	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	15	10	10	5	50

Mandatory requirements for ESE:

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

Course Outcomes (COs)

At the end of the course the student will be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Design and prepare PCB layouts using open-source tools.	K3
CO2	Fabricate, assemble, and test PCB circuits of varying complexity.	K3
CO3	Design 3D enclosures using CAD tools and understand 3D printing workflow.	K4
CO4	Integrate circuit design with mechanical enclosure for product realization.	K5

K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

COs \ POs/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	1	3	-	-	1	1	-	2	3	3	1
CO2	3	3	2	3	2	2	1	2	1	1	2	3	3	1
CO3	2	2	3	2	3	1	-	1	1	1	2	1	3	2
CO4	3	3	3	2	3	2	1	2	2	2	2	3	3	3

Video Links (NPTEL, SWAYAM...)			
Part	Course Title	Platform	Link ID
Part A	Electronic Systems Design: Hands-on Circuits and PCB Design with CAD Software	NPTEL	https://onlinecourses.nptel.ac.in/noc24_ee127/preview (NPTEL Online Courses)
Part B	3D Printing and Design for Educators	SWAYAM	https://onlinecourses.swayam2.ac.in/ntr24_ed17/preview (Swayam)
Part B	Fundamentals of Additive Manufacturing Technologies	NPTEL	https://onlinecourses.nptel.ac.in/noc21_me115/preview (NPTEL Online Courses)

Continuous Assessment (25 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 (10 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 (5 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 (5 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 End Semester Examination (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 (15 Marks)

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. Result with Valid Inference/Quality of Output (10 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.

