SYLLABUS

B. Tech.

ELECTRONICS AND COMPUTER ENGINEERING (ER)

2024 SCHEME

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Reason: Approved by SJCET Academic Council held on 13.05.2025

SEMESTER 3

ELECTRONICS AND COMPUTER ENGINEERING

SEMESTER S3
MATHEMATICS FOR ELECTRICAL SCIENCE AND PHYSICAL SCIENCE – 3
(Common to Group B&C)

Course Code	24SJGYMAT301	CIE Marks	40
Teaching Hours/Week (L:T:P:R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Basic knowledge in complex numbers.	Course Type	Theory

Course Objectives:

1. To introduce the concept and applications of Fourier transforms in various engineering fields.
2. To introduce the basic theory of functions of a complex variable, including residue integration and conformal transformation, and their applications

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Fourier Integral, From Fourier series to Fourier Integral, Fourier Cosine and Sine integrals, Fourier Cosine and Sine Transforms, Linearity, Transforms of Derivatives, Fourier Transform and its inverse, Linearity, Transforms of Derivative. **(Text 1: Relevant topics from sections 11.7, 11.8, 11.9)**	9
2	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 , $w=e^z$, $w = \frac{1}{z}$, $w= sinz$. **(Text 1: Relevant topics from sections 13.3, 13.4, 17.1, 17.2, 17.4)**	9
3	Complex Integration: Line integrals in the complex plane (Definition & Basic properties), First evaluation method, Second evaluation method, Cauchy's integral theorem (without proof) on simply connected domain, Independence of path, Cauchy integral theorem on multiply connected domain (without proof), Cauchy Integral formula (without proof). **(Text 1: Relevant topics from sections 14.1, 14.2, 14.3)**	9

4	Taylor series and Maclaurin series, Laurent series (without proof), Singularities and Zeros – Isolated Singularity, Poles, Essential Singularities, Removable singularities, Zeros of Analytic functions – Poles and Zeros, Formulas for Residues, Residue theorem (without proof), Residue Integration- Integral of Rational Functions of cosθ and sinθ. **(Text 1: Relevant topics from sections 15.4, 16.1, 16.2, 16.3, 16.4)**	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro project	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	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	Determine the Fourier transforms of functions and apply them to solve problems arising in engineering.	K3
CO2	Understand the analyticity of complex functions and apply it in conformal mapping.	K3
CO3	Apply Cauchy's integral theorem and Cauchy's integral formula to compute complex integrals.	K3

CO4	Understand the series expansion of complex function about a singularity and apply residue theorem to compute real integrals.	K3

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
CO2	3	3	-	2	-	-	-	-	-	-	2
CO3	3	3	-	2	-	-	-	-	-	-	2
CO4	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	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons	10th edition, 2016

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	3rd edition, 2015
2	Higher Engineering Mathematics	B. V. Ramana	McGraw-Hill Education	39th edition, 2023
3	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th edition, 2018
4	Fast Fourier Transform - Algorithms and Applications	K.R. Rao, Do Nyeon Kim, Jae Jeong Hwang	Springer	1st edition, 2011

SEMESTER 3

DATA STRUCTURES

Course Code	**24SJPCERT 302**	**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)	24SJGXEST204 Programming in C	**Course Type**	Theory

Course Objectives:

1. To impart a thorough understanding of linear data structures such as arrays, stacks, queues and linked lists and their applications.
2. To impart a thorough understanding of non-linear data structures such as trees, graphs and their applications.
3. To impart familiarity with various sorting, searching and hashing techniques and their performance comparison.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Concepts of Data Structures: Algorithms, Performance Analysis, Space Complexity, Time Complexity, Asymptotic Notations. Arrays: Linear Search and Binary Search, Stacks, Queues, Circular Queues, Priority Queues, Double Ended Queues, Infix to postfix conversion, Evaluation of postfix Expressions.	11
2	Linked List: Self-Referential Structures, Dynamic Memory Allocation, Singly Linked List- Operations on Linked List. Doubly Linked List, Circular Linked List, Stacks and Queues using Linked List, Polynomial representation using Linked List.	11
3	Trees and Graphs: Trees, Binary Trees- Operations, Binary Tree Representation, Tree Traversals, Binary Search Trees- Binary Search Tree Operations. Graphs, Representation of Graphs, Depth First Search and Breadth First Search on Graphs, Applications of Graphs.	11

4	Sorting and Hashing: Sorting Techniques – Selection Sort, Insertion Sort, Quick Sort, Merge Sort and Heap Sort. Hashing- Hashing Techniques, Collision Resolution, Overflow handling, Hashing functions – Mid square, Division, Folding.	11

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**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	Illustrate the use of arrays, stacks, queues, and expression evaluation techniques, and explain the fundamental concepts of data structures, algorithm complexity, and asymptotic notations.	**K3**
CO2	Implement singly, doubly, and circular linked lists using dynamic memory allocation and perform various operations.	**K3**
CO3	Apply tree and graph data structures to represent hierarchical and networked data, and perform traversal operations such as DFS and BFS to solve problems.	**K3**
CO4	Demonstrate the working of various sorting techniques and utilize hashing techniques with suitable collision resolution strategies for efficient data storage and retrieval.	**K3**

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *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	Fundamentals of Data Structures in C	Ellis Horowitz, Sartaj Sahni and Susan Anderson - Freed	Universities Press	2/e, 2008
2	Classic Data Structures	Samanta D	Prentice Hall India	2/e, 2009

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Data Structures: A Pseudocode Approach with C	Richard F. Gilberg, Behrouz A. Forouzan	Cengage Learning	2/e, 2007
2	Data Structures and Algorithms	Aho A. V., J. E. Hopcroft and J. D. Ullman	Pearson Publication	1983
3	Introduction to Data Structures with Applications	Tremblay J. P. and P. G. Sorenson	Tata McGraw Hill	1995
4	Advanced Data Structures	Peter Brass	Cambridge University Press	2008
5	Theory and Problems of Data Structures	Lipschuts S.	Schaum's Series	1986

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/106102064 https://youtu.be/zWg7U0OEAoE https://youtu.be/g1USSZVWDsY https://youtu.be/PGWZUgzDMYI
2	https://nptel.ac.in/courses/106102064 https://youtu.be/PGWZUgzDMYI
3	https://nptel.ac.in/courses/106102064 https://youtu.be/tORLeHHtazM https://youtu.be/eWeqqVpgNPg https://youtu.be/9zpSs845wf8
4	https://youtu.be/KW0UvOW0XIo https://youtu.be/gtWw_8VvHjk

SEMESTER – S3

DIGITAL SYSTEM DESIGN USING VERILOG

Course Code	**24SJPCERT303**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2.30
Prerequisites (if any)	Digital Electronics	**Course Type**	Theory

Course Objectives:

- This course enables students to design/model Digital systems, consisting of combinational and sequential circuits, using Verilog HDL

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Verilog HDL: Evolution of CAD, emergence of HDLs, typical HDL - based design flow, Importance of Verilog HDL, trends in HDLs. Hierarchical Modelling Concepts - Top-down and bottom-up design methodology. Basic Concepts of Lexical conventions, data types, Modules & ports (list of ports, port declarations, port connection rules, Connecting ports to external signals). Introduction to modelling styles: Dataflow, Behavioral and Structural Modelling, Verilog implementation of basic gates.	12
2	Verilog for Digital Logic Design: Operator Types – Arithmetic, Logical, Relational, Equality, Bit-wise, Reduction, shift, concatenation, conditional operators. Implementation of combinational circuits - Half adder & full adder with test bench, Half subtractor & full subtractor with test bench, decoder & encoder with test bench, multiplexer & demultiplexer with test bench, 1-bit magnitude comparator. Modelling of flipflops in Verilog (with test bench).	12
3	Finite State machine: State diagram, State Table, State assignments, state graphs, capabilities and limitations of FSM. Mealy and Moore machines, Modelling of clocked synchronous circuits as Mealy machines: Serial binary adder, sequence detector using overlapping method (Mealy machine) & non-overlapping method (Mealy machine). Modelling of clocked synchronous circuits as Moore machines: Serial binary adder, sequence detector using overlapping method (Moore machine) & non-overlapping method.	12
4	Introduction to Logic families: Digital IC specification terminologies (Threshold voltage, propagation delay, power dissipation, fan-in, fan-out), Voltage & current parameters, Noise margin. Structure & operation of TTL NAND gate, Structure & operation of I^2L inverter, Structure & operation of ECL OR/NOR gate. Introduction to FPGAs: Evolution of Programmable Devices, what is an FPGA - Logic Blocks, Interconnection Resources, Applications of FPGAs, Implementation Process.	12

Course Assessment Method

(CIE: 60 marks, ESE: 40 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
10	10	10	10	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)**	• 2 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. Each question carries 9 marks. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

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

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Describe the programming concepts in Verilog HDL.	**K2**
CO2	Design combinational and sequential digital circuits using Verilog HDL, incorporating test benches for verification.	**K3**
CO3	Apply the concepts of finite state machines (FSMs) to design synchronous digital circuits.	**K3**
CO4	Illustrate the structure and operation of digital logic families and fundamentals of FPGA-based design.	**K2**

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

Textbooks				
SL No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of Logic Design	Charles H. Roth	Thomson Press (India) Ltd	7th Edition, 2015
2	Verilog HDL A Guide to Digital Design & Synthesis	Samir Palitkar	Pearson	2nd Edition, 2003
3	Field-Programmable Gate Arrays	Stephen D. Brown	Springer	1st Edition, 2012
4	Digital Design with an Introduction to the Verilog HDL	Mano M.M, Ciletti M. D	Pearson	6th Edition, 2022

Reference Books			
Introduction to digital systems	Milos D. Ercegovac	John Wiley Sons	1st Edition, 1998
Digital Fundamentals	Thomas L Floyd	Pearson Education	10th Edition , 2009
Digital Principles and Design	Donald D Givone	Tata McGraw Hill	1st Edition, 2003
Fundamentals of Digital Circuits	A. Ananthakumar	Prentice Hall	2nd Edition, 2016
Fundamentals of Digital Logic with Verilog HDL	S Brown & Z. Varanestic,	Mc Graw Hill.	2nd Edition, 2007

Video Links (NPTEL, SWAYAM etc):	
Module - I	NPTEL : Computer Science and Engineering - NOC: Hardware Modeling Using Verilog; Prof. Indranil Sen Gupta, IIT Kharagpur; Lecture 9 https://archive.nptel.ac.in/courses/106/105/106105165/
Module - II	NPTEL : Electrical Engineering - NOC: Digital System Design; Prof. Neeraj Goel, IIT Ropar; Lecture 20 https://archive.nptel.ac.in/courses/108/106/108106177/
Module - III	NPTEL : Electrical Engineering - NOC: Digital System Design; Prof. Neeraj Goel, IIT Ropar; Lecture 51 https://archive.nptel.ac.in/courses/108/106/108106177/
Module - IV	NPTEL : Electrical Engineering - NOC: Digital System Design; Prof. Neeraj Goel , IIT Ropar; Lecture 65 https://archive.nptel.ac.in/courses/108/106/108106177/

SEMESTER S3

ELECTRONIC DEVICES AND CIRCUITS

Course Code	**24SJPBERT 304**	**CIE Marks**	60
Teaching Hours/Week (L: T:P: R)	4	**ESE Marks**	40
Credits	3:0:0:1	**Exam Hours**	2 Hrs 30 Min.
Prerequisites (if any)	Introduction to Electrical and Electronics Engineering	**Course Type**	Theory

Course Objectives:

1. To develop the skill of the design of various analog circuits.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Wave shaping circuits:** First order RC low pass and high pass filters. First order RC differentiating and integrating circuits, Diode Clipping circuits. Diode Clamping circuits. **Bipolar Junction Transistors:** Review of BJT characteristics- Operating point of BJT – Factors affecting stability of Q-point. DC Biasing–Biasing circuits: fixed bias, collector to base bias, voltage divider bias. Stability factor. Transistor as switch, RC coupled amplifier (CE configuration)–need of various components and design.	**11**
2	**Wave Generating circuits: Multivibrator and Oscillator Circuits:** Multivibrators - Types of multivibrators (Astable and monostable) - Feedback concepts, Barkhausen's criterion for oscillation - Types of oscillators – RC phase shift, Wien bridge, crystal oscillators. (Analysis of RC phase shift and Wien bridge oscillator required)	**11**
3	**Field Effect Transistors:** MOSFET – Enhancement and Depletion Modes, Regions of Operation. MOSFET Characteristics – Ideal Capacitance - Voltage Characteristics, Current - Voltage Characteristics, The MOSFET as an Amplifier and as a Switch, Biasing in MOS Amplifier Circuits, comparison of BJT and MOSFET.	**11**
4	**MOSFET single stage amplifiers:** Small signal voltage and current gain, input and output impedance of Basic Common Source amplifier, Common Source amplifier with and without source bypass capacitor, Source follower amplifier, Common Gate amplifier, Frequency Response. Feedback Amplifiers, MOSFET differential amplifier with active load (Analysis not required).	**11**

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Project	Internal Ex-1	Internal Ex-2	Total
5	30	12.5	12.5	60

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)**	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 6 marks. **(4x6 = 24 marks)**	**40**

Course Outcomes (COs)

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

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Design analog signal processing circuits using diodes and first order RC circuits.	**K3**
CO2	Explain the fundamental characteristics of Bipolar Junction Transistors (BJTs)	**K2**
CO3	Design wave-shaping multivibrator and oscillator circuits using BJT	**K3**
CO4	Explain the construction, working principles, and modes of operation of MOSFETs	**K2**
CO5	Design and evaluate different MOSFET amplifier configurations	**K3**

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	2			3						3
CO2	3	3			3	2		3	2		3
CO3	3	3			3	3		3	2		3
CO4	3	3			3	3		3	2		3
CO5	3	3			3	3		3	2		3

Sl. No	Title of the Book	Name of the Publisher	Edition and Year
1	Microelectronic Circuits	Oxford University Press	7/e, 2017
2	Electronic Devices and Circuit Theory	Pearson	11/e, 2015
3	Electronic Circuits, Analysis and Design	TMH	3/e, 2007

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of Microelectronics	Razavi B	Wiley	2015
2	Integrated Electronics	Millman J. and C. Halkias	McGraw-Hill	2/e, 2010.
3	Microelectronic Circuits- Analysis and Design	Rashid M.H.,	Cengage Learning	2/e, 2011
4	Electronic Devices and Circuits	David A Bell	Oxford University Press	2008.

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/117/103/117103063
2	https://archive.nptel.ac.in/courses/117/103/117103063
3	https://archive.nptel.ac.in/courses/117/103/117103063
4	https://archive.nptel.ac.in/courses/117/103/117103063

PBL Course Elements

L: Lecture (3 Hrs.)	R: Project (1 Hr.), 2 Faculty Members		
	Tutorial	**Practical**	**Presentation**
Lecture delivery	Project identification	Simulation/ Laboratory Work/ Workshops	Presentation (Progress and Final Presentations)
Group discussion	Project Analysis	Data Collection	Evaluation
Question answer Sessions/ Brainstorming Sessions	Analytical thinking and self-learning	Testing	Project Milestone Reviews, Feedback, Project reformation (If required)
Guest Speakers (Industry Experts)	Case Study/ Field Survey Report	Prototyping	Poster Presentation/ Video Presentation: Students present their results in a 2 to 5 minutes video

Assessment and Evaluation for Project Activity

Sl. No	Evaluation for	Allotted Marks
1	Project Planning and Proposal	5
2	Contribution in Progress Presentations and Question Answer Sessions	4
3	Involvement in the project work and Team Work	3
4	Execution and Implementation	10
5	Final Presentations	5
6	Project Quality, Innovation and Creativity	3
Total		**30**

1. **Project Planning and Proposal (5 Marks)**
   - Clarity and feasibility of the project plan
   - Research and background understanding
   - Defined objectives and methodology
2. **Contribution in Progress Presentation and Question Answer Sessions (4 Marks)**
   - Individual contribution to the presentation
   - Effectiveness in answering questions and handling feedback
3. **Involvement in the Project Work and Team Work (3 Marks)**
   - Active participation and individual contribution
   - Teamwork and collaboration
4. **Execution and Implementation (10 Marks)**
   - Adherence to the project timeline and milestones
   - Application of theoretical knowledge and problem-solving
   - Final Result
5. **Final Presentation (5 Marks)**
   - Quality and clarity of the overall presentation
   - Individual contribution to the presentation
   - Effectiveness in answering questions
6. **Project Quality, Innovation, and Creativity (3 Marks)**
   - Overall quality and technical excellence of the project
   - Innovation and originality in the project
   - Creativity in solutions and approaches

SEMESTER S3

INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Course Code	24SJGYEST305	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)	None	Course Type	Theory

Course Objectives:

1. Demonstrate a solid understanding of advanced linear algebra concepts, machine learning algorithms and statistical analysis techniques relevant to engineering applications, principles and algorithms.
2. Apply theoretical concepts to solve practical engineering problems, analyze data to extract meaningful insights, and implement appropriate mathematical and computational techniques for AI and data science applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to AI and Machine Learning**: Basics of Machine Learning - Supervised Learning, Unsupervised Learning, Reinforcement Learning (Basics only) -types of Machine Learning systems-challenges in ML- Supervised learning model example- regression models- Classification model example- Logistic regression-unsupervised model example- K-means clustering. Artificial Neural Network- Perceptron- Universal Approximation Theorem (statement only)- Multi-Layer Perceptron- Deep Neural Network (definition only)- demonstration of regression and classification problems using MLP. (Text-2)	11
2	**Mathematical Foundations of AI and Data science**: Role of linear algebra in Data representation and analysis - Vectors, Matrices, Matrix Multiplication and Transformation – Matrix decomposition- Singular Value Decomposition (SVD)- Spectral decomposition- Dimensionality reduction technique- Principal Component Analysis (PCA). (Text-1)	11

3	**Applied Probability and Statistics for AI and Data Science**: Basics of probability- Sample Space, Event, Probability of an Event - random variables and statistical measures - rules in probability- Addition rule, Multiplication rule, Complementary rule - Bayes theorem and its applications- statistical estimation-Maximum Likelihood Estimator (MLE) - statistical summaries- Correlation analysis- linear correlation (direct problems only)- regression analysis- linear regression (using least square method) (Text book 4)	**11**
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- modelling process- demonstration of ML applications in data science- Big Data and Data Science. (For visualization the software tools like Tableau, PowerBI, R or Python can be used. For Machine Learning implementation, Python, MATLAB or R can be used.) (Text book-5)	**11**

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	**15**	**10**	**10**	**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	Apply the concept of machine learning algorithms including neural networks and supervised/unsupervised learning techniques for engineering applications.	**K3**
CO2	Apply advanced mathematical concepts such as matrix operations, singular values, and principal component analysis to analyze and solve engineering problems**.**	**K3**
CO3	Analyze and interpret data using statistical methods including descriptive statistics, correlation, and regression analysis to derive meaningful insights and make informed decisions.	**K3**
CO4	Integrate statistical approaches and machine learning techniques to ensure practically feasible solutions in engineering contexts.	**K3**

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	3	3							
CO2	3	3	3	3							
CO3	3	3	3	3							
CO4	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	Introduction to Linear Algebra	Gilbert Strang	Wellesley-Cambridge Press	6th edition, 2023
2	Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow	Aurélien Géron	O'Reilly Media, Inc.	2nd edition,2022
3	Mathematics for machine learning	Deisenroth, Marc Peter, A. Aldo Faisal, and Cheng Soon Ong	Cambridge University Press	1st edition. 2020
4	Fundamentals of mathematical statistics	Gupta, S. C., and V. K. Kapoor	Sultan Chand & Sons	9th edition, 2020
5	Introducing data science: big data, machine learning, and more, using Python tools	Cielen, Davy, and Arno Meysman	Simon and Schuster	1st 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	2nd edition, 2018
2	Probability and Statistics for Data Science	Carlos Fernandez-Granda	Center for Data Science in NYU	1st edition, 2017
3	Foundations of Data Science	Avrim Blum, John Hopcroft and Ravi Kannan	Cambridge University Press	1st edition, 2020
4	Statistics For Data Science	James D. Miller	Packt Publishing	1st edition, 2019
5	Probability and Statistics -The Science of Uncertainty	Michael J. Evans and Jeffrey S. Rosenthal	University of Toronto	1st edition, 2009
6	An Introduction to the Science of Statistics: From Theory to Implementation	Joseph C. Watkins	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.math.arizo	Preliminary Edition.

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 S3

ECONOMICS FOR ENGINEERS

(Common to All Branches)

Course Code	24SJICHUT346	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	2:0:0:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. Understanding of finance and costing for engineering operation, budgetary planning and control
2. Provide fundamental concept of micro and macroeconomics related to engineering industry
3. Deliver the basic concepts of Value Engineering.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Economics Concepts - Basic economic problems – Production Possibility Curve – Utility – Law of diminishing marginal utility – Law of Demand - Law of supply – Elasticity - measurement of elasticity and its applications – Equilibrium- Changes in demand and supply and its effects Production function - Law of variable proportion – Economies of Scale – Internal and External Economies – Cobb-Douglas Production Function	6
2	Cost concepts – Social cost, private cost – Explicit and implicit cost – Sunk cost - Opportunity cost - short run cost curves - Revenue concepts Firms and their objectives – Types of firms – Markets - Perfect Competition – Monopoly - Monopolistic Competition - Oligopoly (features and equilibrium of a firm)	6
3	Monetary System – Money – Functions - Central Banking –Inflation - Causes and Effects – Measures to Control Inflation - Monetary and Fiscal policies – Deflation Taxation – Direct and Indirect taxes (merits and demerits) - GST National income – Concepts - Circular Flow – Methods of Estimation and Difficulties - Stock Market – Functions- Problems faced by the Indian stock market-Demat Account and Trading Account – Stock market Indicators- SENSEX and NIFTY	6

4	Value Analysis and value Engineering - Cost Value, Exchange Value, Use Value, Esteem Value - Aims, Advantages and Application areas of Value Engineering - Value Engineering Procedure - Break-even Analysis - Cost-Benefit Analysis - Capital Budgeting - Process planning	6

Course Assessment Method

(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Case study/ Micro project	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
10	15	12.5	12.5	50

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 3 marks (6x3 =18marks)	• 2 questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. (4x8 = 32 marks)	50

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the fundamentals of various economic issues using laws and learn the concepts of demand, supply, elasticity and production function.	**K2**
CO2	Develop decision making capability by applying concepts relating to costs and revenue, and acquire knowledge regarding the functioning of firms in different market situations.	**K3**
CO3	Outline the macroeconomic principles of monetary and fiscal systems, national income and stock market.	**K2**
CO4	Make use of the possibilities of value analysis and engineering, and solve simple business problems using break even analysis, cost benefit analysis and capital budgeting techniques.	**K3**

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	-	-	-	-	-	1	-	-	-	-	1
CO2	-	-	-	-	-	1	1	-	-	-	1
CO3	-	-	-	-	1	-	-	-	-	-	2
CO4	-	-	-	-	1	1	-	-	-	-	2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Managerial Economics	Geetika, Piyali Ghosh and Chodhury	Tata McGraw Hill,	2015
2	Engineering Economy	H. G. Thuesen, W. J. Fabrycky	PHI	1966
3	Engineering Economics	R. Paneerselvam	PHI	2012

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Economy	Leland Blank P.E, Anthony Tarquin P. E.	Mc Graw Hill	7TH Edition
2	Indian Financial System	Khan M. Y.	Tata McGraw Hill	2011
3	Engineering Economics and analysis	Donald G. Newman, Jerome P. Lavelle	Engg. Press, Texas	2002
4	Contemporary Engineering Economics	Chan S. Park	Prentice Hall of India Ltd	2001

SEMESTER 3

DATA STRUCTURES LAB

Course Code	**24SJPCERL307**	**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)	24SJGXEST204-Programming in C	**Course Type**	Lab

Course Objectives:

1. To implement various linear data structures and applications using them.
2. To implement various non-linear data structures and applications using them.
3. To implement algorithms for various sorting techniques.

Details of Experiment

Expt. No	Experiment
1	Implementation of linear search and binary search. *
2	Implementation of Stack and linear Queue using arrays. *
3	Implementation of Priority Queues, DEQUEUE and Circular Queues using arrays. *
4	Conversion of expression from one notation to another notation. *
5	Implementation of various operations on singly linked list. *
6	Implementation of stack and queue using linked list. *
7	Polynomial addition using linked list. *
8	Polynomial multiplication using linked list.
9	Implementation of binary search tree – creation, insertion, deletion, search. *
10	Implementation of tree traversals – inorder, preorder, postorder.
11	Implementation of BFS and DFS on graph. *
12	Implementation of sorting algorithms bubble sort, insertion sort and selection sort. *
13	Implementation of Merge sort. *
14	Implementation of Quick sort. *

**Mandatory programs*

Course Assessment Method

(CIE: 50 Marks, ESE 50 Marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work, experiments, Viva and Timely completion of Lab Reports / Record. (Continuous Assessment)	Internal Exam	Total
5	25	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.
- Endorsement by External Examiner: The external examiner shall endorse the record.

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Implement basic searching algorithms and linear data structures such as stack and queue using arrays.	K3
CO2	Implement various operations on singly linked lists, stacks and queues using linked lists, and perform polynomial addition and multiplication using linked lists.	K3
CO3	Implement binary search trees with operations such as creation, insertion, deletion, and search; perform tree traversals and graph traversals.	K3
CO4	Implement sorting algorithms including bubble sort, insertion sort, selection sort, merge sort, and quick sort.	K3

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

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	Fundamentals of Data Structures in C	Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed	Universities Press	2e, 2008
2	Classic Data Structures	Samanta D	Prentice Hall India	2/e, 2009

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Data Structures: A Pseudocode Approach with C	Richard F. Gilberg, Behrouz A. Forouzan	Cengage Learning	2/e, 2005
2	Data Structures and Algorithms	Aho A. V., J. E. Hopcroft and J. D. Ullman	Pearson Publication	1983
3	Introduction to Data Structures with Applications	Tremblay J. P. and P. G. Sorenson	Tata McGraw Hill	1995
4	Advanced Data Structures	Peter Brass	Cambridge University Press	2008

Video Links (NPTEL, SWAYAM…)	
Sl. No.	**Link ID**
1	https://nptel.ac.in/courses/106102064

Continuous Assessment (25 Marks)

1. Preparation and Pre-Lab Work (7 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 (7 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 (6 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

SEMESTER S3

DIGITAL SYSTEM DESIGN LAB

Course Code	**24SJPCERL 308**	**CIE Marks**	50
Teaching Hours/Week (L:T:P:R)	0:0:3	**ESE Marks**	50
Credits	2	**Exam Hours**	2.30
Prerequisites (if any)	None	**Course Type**	Lab

Course Objectives:

1. Familiarize students with the implementation of Logic Circuits using basic logic gate ICs.
2. Familiarize students with the Verilog HDL based Digital Design Flow

Details of Experiment

Expt. No.	Experiment
1	Familiarization of logic gates *
2	Realization of functions using basic and universal gates (SOP and POS forms) *
3	Half adder and full adder using NAND*
4	Realization of 8:1 MUX and 1:8 DEMUX*
5	Flip-flop circuits (SR, JK, T, D &Master slave)*
6	Asynchronous up/down counter
7	Familiarization of FPGA devices and Verilog HDL*
8	Implementation of basic gates using Verilog & simulate the result using test bench*
9	Implementation of half adder & full adder using Verilog & simulate the result using test bench*
10	Implementation of MUX & DEMUX using Verilog & simulate the result using test bench*
11	Implementation of encoder & decoder using Verilog & simulate the result using test bench*
12	Implementation of flip-flops using Verilog & simulate the result using test bench

***Mandatory experiments**

Course Assessment Method

(Internal: 50 Marks, External: 50 Marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work, experiments, Viva and Timely completion of Lab Reports / Fair record (Continuous Assessment)	Internal Exam	Total
5	**25**	**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 Fair Record: Students shall be allowed for the end semester examination only upon submitting the duly certified Fair record.*
- *Endorsement by External Examiner: The external examiner shall endorse the Fair record.*

Course Outcomes (COs)

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

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Realize digital circuits with Logic Gates and Hardware Description Language	Apply (K3)
CO2	Design and implement combinational logic circuits.	Apply (K3)
CO3	Design and implement sequential logic circuits.	Apply (K3)

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

CO – PO Mapping Table

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

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High),0: No Correlation

Textbooks				
Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Verilog HDL: A Guide to Digital Design and Synthesis	Samir Palnitkar	Pearson	2nd Edition, 2003
2	A Verilog HDL Primer	Bhasker J	BS Publication	3rd edition, 2023
3	Modern digital Electronics	R.P. Jain	Tata McGraw Hill	4th edition, 2009
4	Fundamentals of Digital Circuits	A. Ananthakumar	Prentice Hall	2nd edition, 2016

Continuous Assessment (25 Marks)

1. **Preparation and Pre-Lab Work (7 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 (7 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 (6 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.

Evaluation Pattern for End Semester Examination (50 Marks)

1. **Procedure/Preliminary Work/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. **Design/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

SEMESTER 4

ELECTRONICS AND COMPUTER ENGINEERING

SEMESTER S4
MATHEMATICS FOR ELECTRICAL SCIENCE– 4

(B Group)

Course Code	**24SJGBMAT401**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	Basic calculus	**Course Type**	Theory

Course Objectives:

1. To familiarize students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.
2. To expose the students to the basics of random processes, which will be essential for their subsequent study of analog and digital communication.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Random variables, Discrete random variables and their probability distributions, Cumulative distribution function, Expectation, Mean and variance, Binomial distribution, Poisson distribution, Poisson distribution as a limit of the binomial distribution, Joint probability mass function of two discrete random variables, Marginal probability mass function, Independent random variables, Expected value of a function of two discrete variables. **[Text 1: Relevant topics from sections 3.1 to 3.4, 3.6, 5.1, 5.2]**	9
2	Continuous random variables and their probability distributions, Cumulative distribution function, Expectation, Mean and variance, Uniform, Normal and Exponential distributions, Joint pdf of two Continuous random variables, Marginal pdf, Independent random variables, Expectation value of a function of two continuous variables. **[Text 1: Relevant topics from sections 3.1, 4.1, 4.2, 4.3, 4.4, 5.1, 5.2]**	9

3	Confidence Intervals, Confidence Level, Confidence Intervals, and One-sided confidence intervals for a Population Mean for large and small samples (normal distribution and *t*-distribution), Hypotheses and Test Procedures, Type I and Type II errors, z-Tests for Hypotheses about a Population Mean (for a large sample), *t*-Test for Hypotheses about a Population Mean (for a small sample), and Tests concerning a population proportion for large and small samples. **[Text 1: Relevant topics from 7.1, 7.2, 7.3, 8.1, 8.2, 8.3, 8.4]**	**9**
4	Random process concept, classification of process, Methods of Description of Random process, Special classes, Average Values of Random Process, Stationarity- SSS, WSS, Autocorrelation functions and its properties, Ergodicity, Mean-Ergodic Process, Mean-Ergodic Theorem, Correlation Ergodic Process, Distribution Ergodic Process. **[Text 2: Relevant topics from Chapter 6]**	**9**

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**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 concepts, properties, and important models of discrete random variables and apply them to suitable random phenomena.	**K3**
CO2	Understand the concepts, properties, and important models of continuous random variables and apply them to suitable random phenomena.	**K3**
CO3	Estimate population parameters, assess their certainty with confidence intervals, and test hypotheses about population means and proportions using *z*-tests and the one-sample *t*-test.	**K3**
CO4	Analyze random processes by classifying them, describing their properties, utilizing autocorrelation functions, and understanding their applications in signal processing and communication systems.	**K3**

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
CO2	3	3	2	2	-	-	-	-	-	-	2
CO3	3	3	2	2	-	-	-	-	-	-	2
CO4	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	Probability and Statistics for Engineering and the Sciences	Devore J. L	Cengage Learning	9th edition, 2016
2	Probability, Statistics and Random Processes	T Veerarajan	The McGraw-Hill	3rd edition, 2008

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Probability, Random Variables and Stochastic Processes,	Papoulis, A. & Pillai, S.U.,	McGraw Hill.	4th edition, 2002
2	Introduction to Probability and Statistics for Engineers and Scientists	Ross, S. M.	Academic Press	6th edition, 2020
3	Probability and Random Processes	Palaniammal, S.	PHI Learning Private Limited	3rd edition, 2015
4	Introduction to Probability	David F. Anderson, Timo, Benedek	Cambridge	1st edition, 2017

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1, 2, 4	https://archive.nptel.ac.in/courses/117/105/117105085/

SEMESTER S4

COMPUTER ORGANIZATION AND ARCHITECTURE

Course Code	**24SJPCERT 402**	**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)	PCERT 205 Digital Electronics	**Course Type**	Theory

Course Objectives:

1. Discuss the basic concepts and structure of computers.
2. Describe the various addressing modes and memory structure kinds.
3. Define interrupts and their role in managing I/O operations and system events.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Basic Structure of computers** –functional units - basic operational concepts- bus structures. Memory locations and addresses - memory operations, Instructions and instruction sequencing, addressing modes. **Basic processing unit** – fundamental concepts – instruction cycle – execution of a complete instruction - single bus and multiple bus organization.	10
2	**Register transfer logic:** Inter register transfer – arithmetic, logic and shift micro-operations. **Processor logic design:** - processor organization – Arithmetic logic unit - design of arithmetic circuit - design of logic circuit – Design of arithmetic logic unit - status register – design of shifter - processor unit – design of accumulator (Basic Concept Only).	11
3	**Control Logic Design:** Hardwired control-microprogrammed control-Microinstructions, Microprogram Sequencing. **Arithmetic algorithms:** Addition and Subtraction, Multiplication-Signed-Operand multiplication-Booth Algorithm- Faster Multiplication, Divion-Restoring Method- Division Algorithm and Hardware, Floating-Point Representation	12

	Pipelining: Basic principles**,** classification of pipeline processors, instruction and arithmetic pipelines (Design examples not required), hazard detection and resolution.	
4	**Memory system:** Types of memory (**Concepts only),** Virtual memory**,** Content addressable memory, cache memories - mapping functions. **I/O organization:** Characteristics of I/O devices, Data transfer schemes - Programmed controlled I/O transfer, Interrupt controlled I/O transfer. Organization of interrupts - vectored interrupts – Servicing of multiple input/output devices – Polling and daisy chaining schemes. Direct memory accessing (DMA)	11

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	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 Functional Units and Basic Operational Concepts	**K2**
CO2	Describe various micro-operations including arithmetic, logic, and shift operations.	**K2**
CO3	Analyze existing processor architectures to understand the implementation of pipelining and control strategies.	**K3**
CO4	Define interrupts and their role in handling I/O operations and system events.	**K2**

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *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	Computer Organization and Design	Patterson D.A. and J. L. Hennessy	Morgan Kaufmann Publishers	5/e, 2013
2	Computer Organization	Hamacher C., Z. Vranesic and S. Zaky	McGraw Hill	5/e, 2011
3	Digital Logic & Computer Design	Mano M. M	PHI	1/e, 2016
4	Computer System Architecture	Mano M. M	PHI	**Revised 3/e** 2017

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Computer Organization and Architecture: Designing for Performance	William Stallings	Pearson,	9/e, 2013.
2	Computer Organization and Design	Chaudhuri P	Prentice Hall	2/e, 2008.
3	Computer Architecture: A Quantitative Approach	John L. Hennessy, David A. Patterson,	Morgan Kaufmann	6/e,2017

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://www.youtube.com/watch?v=msqxkEKFg8I&list=PLgHucKw979AvcnTpPNZMZyORdL5HvTr9m, https://www.youtube.com/watch?v=k_QgyvsqtwA&list=PLgHucKw979AvcnTpPNZMZyORdL5HvTr9m&index=12
2	https://www.youtube.com/watch?v=0B-y1RPDXjs&list=PL59E5B57A04EAE09C&index=17
3	https://www.youtube.com/watch?v=AgoC0mlL6eQ&list=PLdS3u59E0DKjUKPcnCYxVxssEkX 2zo-kV&index=8 https://www.youtube.com/watch?v=6CCwWCstDGc&list=PL1A5A6AE8AFC187B7&index=9https://www.youtube.com/watch?v=IQql2ojVzsU&list=PLEAYkSg4uSQ3dmkbCah82ek0KJnpz_DxL&index=5
4	https://www.youtube.com/watch?v=Wfau1WC5m4c

SEMESTER S4

COMPUTER NETWORKS

Course Code	**24SJPCERT403**	**CIE Marks**	40
Teaching Hours/Week(L:T:P:R)	3-1-0-0	**ESE Marks**	60
Credits	4	**Exam Hours**	2Hrs.30Min.
Prerequisites(if any)	None	**Course Type**	Theory

Course Objectives:

1. To acquire practical skills in network design, configuration, and management which include learning about different network topologies, transmission media, routing algorithms, and quality of service techniques**.**

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction – Uses of computer networks, Network hardware, Network Software. Reference models – The OSI reference model, The TCP/IP reference model, Comparison of OSI and TCP/IP reference models. Physical Layer–Modes of communication, Physical topologies, Transmission media.	**8**
2	Data link layer - design issues, Error detection and correction, Sliding window protocols, High-Level Data Link Control (HDLC) protocol. Medium Access Control (MAC) sub layer–Channel allocation problem, Multipleaccessprotocols, Ethernet, WirelessLANs-802.11. Repeaters, Hubs, Bridges, Switches, Routers and Gateways.	**10**
3	Network layer Services. Routing algorithms - Shortest path routing, Flooding, Distance Vector Routing, Link State Routing, Congestion control algorithms. Quality of Service (QoS) - requirements, Techniques for achieving good QoS. InternetProtocols-IPv4-IPv4addresses-IPv6-TheInternetControl Message Protocol-The Address Resolution Protocol-The Dynamic Host Configuration Protocol-Network Address Translation-Internet multicasting.	**14**

4	Transport service – Services provided to the upper layers, Transport service primitives. User Datagram Protocol (UDP). Transmission Control Protocol (TCP) – Overview of TCP, TCP segment header, Connection establishment &release, Connection management modelling, TCP retransmission policy, TCP congestion control. Application Layer –File Transfer Protocol (FTP), Domain Name System (DNS), Electronic Mail (SMTP), Simple Network Management Protocol(SNMP),World Wide Web(WWW),Multimedia in the Internet.	**12**

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro project	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	15	10	10	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)**	• Eachquestioncarries9marks. • 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=36marks)**	**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 uses of computer networks, their hardware, software, and different reference models.	**K2**
CO2	Analyze data link layer design issues, error detection, correction and Various medium access control protocols.	**K3**
CO3	Design network layer solutions characterized by routing and congestion control algorithms and implement IP protocols.	**K2**
CO4	Comprehend the concepts of TCP/UDP protocols and connection Management including congestion control and retransmission policy.	**K2**
CO5	Understand the application layer protocols and techniques for Implementing web-based applications.	**K2**

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note:*1:Slight(Low),2:Moderate(Medium),3:Substantial(High),-:NoCorrelation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Computer Networks	Andrew S. Tanenbaum	PHI(Prentice Hall India)	4/e,2008
2	Data Communication and Networking	Behrouz A Forouzan	Tata McGraw Hill	5/e,2013

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Computer Networks – A Systems Approach	Larry L Peterson and Bruce S Dave	Morgan Kaufmann	5/e,2011
2	Computer Networking and the Internet	Fred Halsall	Addison-Wesley	5/e,2005
3	Computer Networking: A Top-Down Approach	James F. Kurose, Keith W. Ross	Pearson Education	6/e,2012
4	Computer Networking with Internet Protocols.	William Stallings	Prentice-Hall	4/e,2004
5	Data Communications and Computer Networks A Business User's Approach	Curt M. White	Course Technology, Cengage Learning	7/e,2013

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/106105183
2	https://nptel.ac.in/courses/106106091
3	https://onlinecourses.swayam2.ac.in/cec21_cs04/preview
4	https://onlinecourses.nptel.ac.in/noc22_cs19/preview

SEMESTER S4

INTEGRATED CIRCUITS

Course Code	**24SJPBERT 404**	**CIE Marks**	60
Teaching Hours/Week (L: T:P: R)	4	**ESE Marks**	40
Credits	3:0:0:1	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	PBERT 304 Electronics Devices and Circuits	**Course Type**	Theory

Course Objectives:

1. To introduce students about integrated circuits and teach them how to construct and analyze circuits with the help of op-amps and other specialized ICs.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Operational amplifiers** Introduction of op-amp – block diagram of op-amp –Basic information of op-amp (741 op-amp) - Power supply requirements. Characteristics of Operational Amplifiers Ideal op amp characteristics - DC characteristics - input bias current, input offset current, input offset voltage, thermal drift, CMRR, PSRR - AC characteristics - frequency response, slew rate. Basic applications-inverting amplifier, non-inverting amplifier.	**11**
2	**Applications of Operational amplifiers** Differential amplifier, summing amplifier, scale changer, voltage follower, V-I converter (grounded load type and floating load type), I-V converter. Instrumentation amplifier (3 op amp) - op amp integrator - op amp differentiator, precision rectifier (half and full wave), peak detector, sample and hold circuit, Comparator (inverting and non-inverting type) – applications of comparator - zero crossing detector, Schmitt trigger, window detector	**11**

3	**Waveform generators and Oscillators** Timer IC 555- Functional block diagram – Waveform generators – Astable and mono stable – Design and working (using 555 and 741). Triangular and sawtooth –RC phase shift and Wien bridge oscillators (No analysis required) Voltage regulator - Introduction, series op amp regulator -IC regulators - 78XX and 79XX characteristics - voltage regulator as current source using 7805, Low voltage and high voltage regulators using 723 general purpose IC.	**11**
4	**Filters, PLL and Data Converters** Types of filters, first and second order LPF and HPF. Phase Locked Loop – Operation, Lock and capture range (No analysis), PLL IC 565, Applications - frequency multiplier, frequency translation. Data Converters: Digital to Analog converters, Specifications, Weighted resistor type and R-2R Ladder type. Analog to Digital Converters: Specifications, ADC –Direct type – Flash type, counter type, successive approximation type - Integrating type ADC - Single slope type.	**11**

Course Assessment Method

(CIE: 60 marks, ESE: 40 marks)

Continuous Internal Evaluation Marks (CIE):

	Project	**Internal Ex-1**	**Internal Ex-2**	**Total**
5	**30**	**12.5**	**12.5**	**60**

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)**	• 2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 6 marks. **(4x6 = 24 marks)**	**40**

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Describe basics of operational amplifier and characteristics of op-amps.	**K2**
CO2	Design linear and nonlinear circuits using op-amp.	**K3**
CO3	Design op-amp oscillators, waveform generators and voltage regulators.	**K3**
CO4	Design circuits using Filters, PLL, DAC and ADC.	**K3**

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

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Op-amps and Linear Integrated circuits	Coughlin & Driscoll	Prentice Hall	6/e, 2009
2	Linear Integrated Circuits	D Roy Choudhury and Shail B Jain	New Age International Publishers	4/e, 2017
3	Op-Amps and Linear Integrated Circuits	Ramakant A. Gayakwad	Pearson	4/e, 2015

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Design with operational Amplifiers & Analog Integrated Circuits	Sergio Franco	Mc Graw Hill India	4/e, 2016
2	Integrated Circuits	K R Botkar	Khanna Publishers	10/e, 2010

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/108/108/108108111
2	https://archive.nptel.ac.in/courses/108/108/108108111
3	https://archive.nptel.ac.in/courses/108/108/108108111
4	https://archive.nptel.ac.in/courses/108/106/108106184

PBL Course Elements

L: Lecture (3 Hrs.)	**R: Project (1 Hr.), 2 Faculty Members**		
	Tutorial	**Practical**	**Presentation**
Lecture delivery	Project identification	Simulation/ Laboratory Work/ Workshops	Presentation (Progress and Final Presentations)
Group discussion	Project Analysis	Data Collection	Evaluation
Question answer Sessions/ Brainstorming Sessions	Analytical thinking and self-learning	Testing	Project Milestone Reviews, Feedback, Project reformation (If required)
Guest Speakers (Industry Experts)	Case Study/ Field Survey Report	Prototyping	Poster Presentation/ Video Presentation: Students present their results in a 2 to 5 minutes video

Assessment and Evaluation for Project Activity

Sl. No	Evaluation for	Allotted Marks
1	Project Planning and Proposal	5
2	Contribution in Progress Presentations and Question Answer Sessions	4
3	Involvement in the project work and Team Work	3
4	Execution and Implementation	10
5	Final Presentations	5
6	Project Quality, Innovation and Creativity	3
Total		**30**

1. **Project Planning and Proposal (5 Marks)**
   - Clarity and feasibility of the project plan
   - Research and background understanding
   - Defined objectives and methodology
2. **Contribution in Progress Presentation and Question Answer Sessions (4 Marks)**
   - Individual contribution to the presentation
   - Effectiveness in answering questions and handling feedback
3. **Involvement in the Project Work and Team Work (3 Marks)**
   - Active participation and individual contribution
   - Teamwork and collaboration
4. **Execution and Implementation (10 Marks)**
   - Adherence to the project timeline and milestones
   - Application of theoretical knowledge and problem-solving
   - Final Result
5. **Final Presentation (5 Marks)**
   - Quality and clarity of the overall presentation
   - Individual contribution to the presentation
   - Effectiveness in answering questions
6. **Project Quality, Innovation, and Creativity (3 Marks)**
   - Overall quality and technical excellence of the project
   - Innovation and originality in the project
   - Creativity in solutions and approaches

SEMESTER 4

PROGRAM ELECTIVE - I

SEMESTER S4

COMMUNICATION ENGINEERING

Course Code	**24SJPEERT 411**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	Introduction to Electrical and Electronics Engineering	**Course Type**	Theory

Course Objectives:

1. To introduce the basic principles of analog and digital communication systems.
2. To familiarize with the satellite communication and cellular communication systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Analog Communication:** Introduction, elements of communication systems, need for modulation. Amplitude modulation: modulation index, average power, equation and spectrum of AM signal. Angle modulation-frequency and phase modulation. FM frequency spectrum, modulation index, equation Comparison of AM and FM.	9
2	**Digital Communication:** Principles of digital communication – sampling theorem, Nyquist criterion, quantization, encoding techniques-unipolar, bipolar and Manchester. Pulse modulation techniques- sampling process - PAM, PWM and PPM concepts, block diagram of PCM encoder and Decoder, Digital Modulation Schemes – ASK, FSK and PSK.	9
3	**Satellite communication:** Introduction to satellite communication, types of satellite orbits. Space segment - introduction, power supply, Attitude and Orbit Control System (AOCS), thermal control subsystem, TT&C subsystem, transponders, antenna subsystem. Earth segment - types of earth station, Multiple Access (MA) techniques - FDMA, TDMA, CDMA, SDMA.	9
4	**Cellular Communication:** Basic concepts, frequency reuse, interference, cell splitting, sectoring, cell system layout, Hand off-types and strategies, Bluetooth, Zig-Bee, GPS, Wi-Fi, Wi-Max based communication. **Diversity Technologies & MIMO Communications:** Diversity - Receiver Diversity - Transmitter Diversity - SISO, SIMO, MISO, MIMO model.	9

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	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 basic elements of AM and FM communication systems.	**K2**
CO2	Understand the concepts of digital communication systems.	**K2**
CO3	Understand various subsystems and multiple access techniques used in satellite communication systems	**K2**
CO4	Explain the fundamental concepts of cellular communication and diversity techniques in wireless communication	**K2**

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *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	Electronic Communication Systems	Kennedy G.	McGraw-Hill, New York,	6th edition, 2017
2	Digital Communications	Bernard Sklar	Pearson	2nd edition, 2009
3	Satellite Communication	Dennis Roddy	McGraw-Hill	4th edition 2017
4	Wireless Communication Principles and practice	Theodore S Rappaport	Pearson	2nd edition, 2010

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Electronic Communication Systems	William Scheweber	Prentice Hall of India LTD, New Delhi	4th edition, 2004
2	Electronic Communication Systems	Wayne Tomasi	Prentice Hall of India LTD, New Delhi, 2004.	5th edition, 2003
3	Electronic Communication	Roody and Coolen	Prentice Hall of India	4th edition, 2008
4	Communication Systems	Simon Haykins	John Wiley	4th edition, 2006

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	http://acl.digimat.in/nptel/courses/video/117105143/L16.html
2	https://nptel.ac.in/courses/117101051
3	https://archive.nptel.ac.in/courses/117/105/117105131
4	https://nptel.ac.in/courses/106106167

SEMESTER S4

BASIC VLSI DESIGN

Course Code	**24SJPEERT 412**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. To bring circuits and system views on design together.
2. To understand the design of digital VLSI circuits for hardware design.
3. To develop the skill to design various VLSI circuits.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Overview of CMOS device fundamentals. The CMOS inverter: - Voltage Transfer Characteristics, Static Behavior - Switching Threshold - Noise Margins, Dynamic behavior - Device Capacitances - Propagation Delay - Power Consumption-SPICE code of an Inverter	**9**
2	CMOS fabrication Processes: -N-Tub, P-Tub and Twin Tub. Layout design of static MOS circuits -MOS Circuit Layout – Use of Stick diagrams, Layout design rules, Transistor layout - PMOS and NMOS, Gate Layout - Inverter, NAND, NOR.	**9**
3	Combinational logic Circuits: - Static MOS - Complementary MOS - Ratioed logic - Pass Transistor logic - Differential Pass Transistor Logic - Transmission gate logic, Dynamic MOS - Basic Principles - Speed and power Dissipation, Domino Logic	**9**
4	Design of the Memory Core - Read Only Memories - Non-volatile Read Write Memories - Read Write memories - SRAM and DRAM. Scaling of MOS circuits: scaling models and scaling factors for device parameters.	**9**

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	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	Explain static and dynamic characteristics of CMOS Inverters	**K2**
CO2	Explain physical layout for various MOS Circuits	**K2**
CO3	Explain various Combinational Logic Circuits	**K2**
CO4	Explain various types of Memory Elements	**K2**

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *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	Digital Integrated Circuits- A Design Perspective	J.M. Rabaey, A. Chandrakasan and B. Nikolic	Pearson	Second Edition, 2003
2	Basic VLSI Design	Douglas A. Pucknell & Kamran Eshraghian	PHI	Third Edition, 1995
3	CMOS digital integrated circuits: Analysis and design	Sung-Mo Kang, Yusuf Lablebici	TATA McGraw-Hill	Third Edition, 2002

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	CMOS Logic Circuit Design	John P. Uyemura	Springer India Pvt. Ltd	First Edition, 1999
2	CMOS VLSI Design, a Circuits and Systems Perspective	Neil H. E. Weste, David Money Harris	PEARSON	4th Edition, 2015

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/117106092
2	https://onlinecourses.nptel.ac.in/noc22_ee08/preview
3	https://nptel.ac.in/courses/117106092
4	https://onlinecourses.nptel.ac.in/noc22_ee08/preview

SEMESTER S4

BIOMEDICAL SIGNALS &TRANSDUCERS

Course Code	**24SJPEERT 413**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. This course is intended to provide students an insight into cellular electrophysiology and various biomedical transducers used for signal acquisition

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Cell Potentials**: Cell membrane- Action potentials – ionic basis of generation – Nernst potential, Goldman Hodgkin Katz equation. Auto rhythmic cells - cardiac action potentials. Synapses & Neuronal Integration Synaptic potentials – EPSP & IPSP -Neurotransmitters – types	9
2	**Biosignals and Acquisition Methods:** ECG- Generation of cardiac action potentials -Characteristics of ECG Signal -Lead systems- Clinical applications of ECG. EEG- Brain action potentials- characteristics of signal- Electrode system - Clinical applications of EEG. EMG-Electrical activity of muscles –Characteristics of EMG signal- Clinical applications of EMG	9
3	**Biosensors:** Photochemistry of vision--Hearing- endo cochlear potentials. Biosensors-Types-Bio recognition elements in biosensors-immobilization methods-ISFET- Enzyme electrodes. Nanomaterial based biosensors-Applications of biosensors-Biosensors for clinical diagnostics **Biomedical Transducers and Electrodes**: Temperature transducers- Displacement &Pressure transducers- piezo electric transducers- Electrodes for biopotential measurement- catheter tip transducers	9
4	**Diagnostic Radiology**: Production of diagnostic X-ray-X-ray tubes-principle of image formation-Functional blocks of X-ray machine – tubes for various applications.	9

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	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 cellular mechanism of production of action potentials	**K2**
CO2	Understand the characteristics of bio signals and biomedical signal acquisition systems	**K2**
CO3	Understand the fundamentals of biosensors and its applications	**K2**
CO4	Apply the knowledge of electrodes& transducers for various biomedical measurements	**K3**
CO5	Understand the basic principles of diagnostic radiology	**K2**

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *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	Text book of Medical Physiology	Guyton and Hall:	Saunders, an imprint of Elsevier Inc.	12thedn, 2011
2	Principles of Biomedical Instrumentation and measurements	Richard Aston:		
3	Biosensors Fundamentals and Applications,	Bansi Dhar Malhotra, Chandra Mouleypandy:	Smithersrapra,	Ist edn,2017

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Biosensors an introductory text book,	Jagrithi Narang, Chandrashekhar Pundir	Pan Stanford Publishing,	Istedn, 2017
2	Hand book of biomedical Instrumentation,	R S Khandpur:	Mc Graw Hill, 2nd edition	2nd edition
3	Principles of Applied Biomedical Instrumentation,	Geddes and Baker:	Wiley Inter science publications,	1989
4	A Manual of radiographic equipment,	Sybil M Stockly;	Churchil Living Stone,	, 1986

SEMESTER S4

FOUNDATIONS OF MACHINE LEARNING

Course Code	**24SJPEERT 414**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. Understand the basic principles of machine learning
2. To study the basics of supervised and unsupervised learning.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to Machine Learning**- Machine learning paradigms- supervised, semi-supervised, unsupervised, reinforcement learning. Features: Types of Data (Qualitative and Quantitative), Scales of Measurement (Nominal, Ordinal, Interval, Ratio), Concept of Feature, Feature Construction, Feature Selection and Transformation.	**9**
2	**Supervised Learning** - Classification: K-Nearest Neighbour, Naïve Bayes, Decision Tree algorithm ID3, Support Vector Machine, Regression: Linear regression, logistic regression, Neural Networks- The Perceptron, Activation Functions, Training Feed Forward Network by Back Propagation.	**9**
3	**Unsupervised Learning** - Clustering Methods - K-means clustering, Hierarchical Clustering Methods, Density based clustering. Dimensionality Reduction Techniques- Principal component analysis, Linear Discriminant Analysis.	**9**
4	**Evaluating model performance**-Confusion matrices, Precision and recall, Sensitivity and specificity, F-measure, ROC curves, Cross validation, K-fold cross validation, Bootstrap sampling. Improving model performance - Bagging, Boosting, Random forests.	**9**

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	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	Illustrate Machine Learning concepts (Cognitive Knowledge Level: Understand)	**K2**
CO2	Illustrate the concepts of classification methods (Cognitive Knowledge Level: Apply)	**K3**
CO3	analyze clusters using different methods (Cognitive Knowledge Level: Apply)	**K3**
CO4	Evaluate & improve the performance of machine learning classification models (Cognitive Knowledge Level: Apply)	**K3**

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *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	Introduction to Machine Learning,	Ethem Alphaydin	MIT Press	3*rd* Edition, MIT Press,2014
2	Machine Learning	Mitchell, Tom	New York, NY: McGraw-Hill	1997. ISBN: 978007042 8072

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer	2006
2	Machine Learning: A Probabilistic Perspective	Kevin P. Murphy.	MIT Press	2012
3	Elements of Machine Learning,	P. Langley	Morgan Kaufmann	1995
4	Data Mining and Analysis: Fundamental Concepts and Algorithms	Mohammed J. Zaki and Wagner Meira	Cambridge University Press,	First South Asia edition, 2016
5	Introduction to Machine Learning with Python: A Guide for Data Scientists	Andreas Muller and Sarah Guido,	Shroff/O'Reilly	2016

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://www.youtube.com/watch?v=fC7V8QsPBec&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=2 https://www.youtube.com/watch?v=9vMpHk44XXo&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=5
2	https://www.youtube.com/watch?v=OTAR0kT1swg&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=3 https://www.youtube.com/watch?v=_M7Km1XZERU&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=9 https://www.youtube.com/watch?v=yG1nETGyW2E
3	https://www.youtube.com/watch?v=HTSCbxSxs-g https://www.youtube.com/watch?v=tlIv3IT_hHk
4	https://www.youtube.com/watch?v=sosZp0cUsIk&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=45 https://www.youtube.com/watch?v=9Iq6pz9XJ7w&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=46 https://www.youtube.com/watch?v=foWzsWFAmas&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=54 https://www.youtube.com/watch?v=NrdtKndsC1I&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=55 https://www.youtube.com/watch?v=6K48CbOm99Y&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=57

SEMESTER 4

OBJECT ORIENTED PROGRAMMING USING JAVA

Course Code	**24SJPEERT416**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	24SJGXEST204 – Programming in C	**Course Type**	Theory

Course Objectives:

1. Understand and apply foundational object-oriented programming concepts in Java, including classes, objects, inheritance, polymorphism, encapsulation, and abstraction.
2. Design and implement Java applications that leverage OOP principles to achieve modularity, reusability, and scalability in software development.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Object-Oriented concepts, Introduction to Java - Java programming and Runtime Environment, Development Platforms- Java Virtual Machine (JVM), Java compiler, Bytecode, Java Buzzwords, Java program structure, Comments. Primitive Data types - Integers, Floating Point Types, Characters, Boolean. Literals, Operators - Arithmetic Operators, Bitwise Operators, Relational Operators, Boolean Logical Operators, Assignment Operator, Conditional (Ternary) Operator, Operator Precedence. Control Statements - Selection Statements, Iteration Statements and Jump Statements.	9
2	Object Oriented Programming in Java - Class Fundamentals, Declaring Objects, Introduction to Methods, Constructors, this Keyword, Method Overloading, Using Objects as Parameters, Returning Objects. Static Members, Final Variables, Inner Classes. Inheritance - Super Class, Sub Class, The Keyword super, protected Members, Calling Order of Constructors, Method Overriding, the Object class, Abstract Classes and Methods, using final with Inheritance.	9

	Packages and Interfaces - Defining Package, CLASSPATH, Access Protection, Importing Packages, Interfaces.	
3	Exception Handling - Checked Exceptions, Unchecked Exceptions, try Block and catch Clause, Multiple catch Clauses, Nested try Statements, throw, throws and finally. Java Library - String Handling – String Constructors, String Length, Special String Operations -Character Extraction, String Comparison, Searching Strings, Modifying Strings. Multithreaded Programming - The Java Thread Model, The Main Thread, Creating Thread, Creating Multiple Threads, Synchronization, Suspending, Resuming and Stopping Threads.	**9**
4	Event handling - Event Handling Mechanisms, Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces. Swings fundamentals-Swing Controls, Components and Containers, Swing Packages, Event Handling in Swings, Swing Layout Managers, Exploring Swings –JFrame, JLabel, Swing Buttons, JText Field. Java Database Connectivity (JDBC) - JDBC overview, Creating and Executing Queries – create table, delete, insert, select.	**9**

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**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 fundamental Java programming concepts, including the runtime environment, primitive data types, operators, and control statements, to develop efficient and well-structured Java applications.	**K2**
CO2	Apply key object-oriented programming principles in Java, leveraging packages and interfaces effectively to design and implement Java applications.	**K3**
CO3	Demonstrate handling Java exceptions, manipulating strings effectively, and implementing multithreaded programming techniques.	**K3**
CO4	Develop Java applications that integrate event handling, Swing-based graphical user interfaces, and JDBC database connectivity to create robust and user-friendly software solutions.	**K3**

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *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	Java: The Complete reference	Herbert Schildt	Tata McGraw Hill	8/e, 2011.
2	Java How to Program, Early Objects	Paul Deitel, Harvey Deitel	Pearson	11/e, 2018

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Java Programming	Y. Daniel Liang	Pearson	7/e, 2013
2	Programming JAVA a Primer	Balagurusamy E	Tata McGraw Hill	5/e, 2014
3	Core Java: An Integrated Approach	Nageswararao R	Dreamtech Press	2008
4	Java in A Nutshell	Flanagan D	O'Reilly	5/e, 2005

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc24_cs105
2	https://onlinecourses.nptel.ac.in/noc24_cs105
3	https://onlinecourses.nptel.ac.in/noc24_cs105
4	https://onlinecourses.nptel.ac.in/noc24_cs105

SEMESTER 4

JAVA PROGRAMMING AND APPLICATION DEVELOPMENT

Course Code	**24SJPEERT415**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3-0-0-2	**ESE Marks**	60
Credits	5	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	24SJGXEST204 – Programming in C	**Course Type**	Theory

Course Objectives:

1. Understand and apply foundational object-oriented programming concepts in Java, including classes, objects, inheritance, polymorphism, encapsulation, and abstraction.
2. Design and implement Java applications that leverage OOP principles to achieve modularity, reusability, and scalability in software development.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Object-Oriented concepts, Introduction to Java - Java programming and Runtime Environment, Development Platforms- Java Virtual Machine (JVM), Java compiler, Bytecode, Java Buzzwords, Java program structure, Comments. Primitive Data types - Integers, Floating Point Types, Characters, Boolean. Literals, Operators - Arithmetic Operators, Bitwise Operators, Relational Operators, Boolean Logical Operators, Assignment Operator, Conditional (Ternary) Operator, Operator Precedence. Control Statements - Selection Statements, Iteration Statements and Jump Statements.	9
2	Object Oriented Programming in Java - Class Fundamentals, Declaring Objects, Introduction to Methods, Constructors, this Keyword, Method Overloading, Using Objects as Parameters, Returning Objects. Static	9

	Members, Final Variables, Inner Classes. Inheritance - Super Class, Sub Class, The Keyword super, protected Members, Calling Order of Constructors, Method Overriding, the Object class, Abstract Classes and Methods, using final with Inheritance. Packages and Interfaces - Defining Package, CLASSPATH, Access Protection, Importing Packages, Interfaces.	
3	Exception Handling - Checked Exceptions, Unchecked Exceptions, try Block and catch Clause, Multiple catch Clauses, Nested try Statements, throw, throws and finally. Java Library - String Handling – String Constructors, String Length, Special String Operations -Character Extraction, String Comparison, Searching Strings, Modifying Strings. Multithreaded Programming - The Java Thread Model, The Main Thread, Creating Thread, Creating Multiple Threads, Synchronization, Suspending, Resuming and Stopping Threads.	9
4	Event handling - Event Handling Mechanisms, Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces. Swings fundamentals-Swing Controls, Components and Containers, Swing Packages, Event Handling in Swings, Swing Layout Managers, Exploring Swings –JFrame, JLabel, Swing Buttons, JText Field. Java Database Connectivity (JDBC) - JDBC overview, Creating and Executing Queries – create table, delete, insert, select.	9

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	*Internal Ex*	*Evaluate*	*Analyse*	*Total*
5	**15**	**10**	**10**	**40**

Criteria for Evaluation (Evaluate and Analyse): 20 marks Assignment: 20 Marks

Students should design and implement a real-world application using object-oriented programming principles, evaluate and refine their class structures and relationships, provide a conclusion on the effectiveness of their design, and demonstrate the functionality of their application using Java.

Criteria for evaluation:

1. ***Problem Definition (K4 - 4 points)***
    1. *Clearly defines the real-world problem.*
    2. *Examine and identifies relevant contextual factors (constraints, resources, objectives).*
2. ***Problem Analysis (K4 - 4 points)***
    1. *Break-down and presents a well-reasoned solution approach.*
    2. *Compare and justify the proposed solutions with evidence and logical reasoning.*
3. ***Evaluate (K5 - 4 points)***
    1. *Thoroughly evaluate the proposed solutions.*
    2. *Compares trade-offs, advantages, and disadvantages.*
    3. *Considers feasibility, scalability, and practical implications.*
4. ***Implementation (K5 - 4 points)***
    1. *Select the most feasible solution by implementing the proposed solutions.*
    2. *Successfully translates the chosen solution into code.*
    3. *Demonstrates proficiency in coding practices (readability, efficiency, error handling).*
5. ***Conclusion (K4- 2 points, K5 – 2 points)***
    1. *Summarizes findings and insights. State which solution is most appropriate for the problem.* ***(K4)***
    2. *Reflects critical thinking and informed decision-making.* ***(K5)***

Scoring:

1. ***Accomplished (4 points)****: Exceptional analysis, clear implementation, and depth of understanding.*
2. ***Competent (3 points)****: Solid performance with minor areas for improvement.*
3. ***Developing (2 points)****: Adequate effort but lacks depth or clarity.*
4. ***Minimal (1 point)****: Incomplete or significantly flawed.*

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)**	• 2 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. Each question carries 9 marks. **(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 fundamental Java programming concepts, including the runtime environment, primitive data types, operators, and control statements, to develop efficient and well-structured Java applications.	Apply
CO2	Apply key object-oriented programming principles in Java, leveraging packages and interfaces effectively to design and implement Java applications.	Apply
CO3	Demonstrate handling Java exceptions, manipulating strings effectively, and implementing multithreaded programming techniques.	Apply
CO4	Develop Java applications that integrate event handling, Swing-based graphical user interfaces, and JDBC database connectivity to create robust and user-friendly software solutions.	Analysis
CO5	Evaluate any real-world problem and propose a solution using the concepts learned in this course.	Evaluate

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *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	Java: The Complete reference	Herbert Schildt	Tata McGraw Hill	8/e, 2011.
2	Java How to Program, Early Objects	Paul Deitel, Harvey Deitel	Pearson	11/e, 2018

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Java Programming	Y. Daniel Liang	Pearson	7/e, 2013
2	Programming JAVA a Primer	Balagurusamy E	Tata McGraw Hill	5/e, 2014
3	Core Java: An Integrated Approach	Nageswararao R	Dreamtech Press	2008
4	Java in A Nutshell	Flanagan D	O'Reilly	5/e, 2005

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/106/105/106105191/
2	https://archive.nptel.ac.in/courses/106/105/106105191/
3	https://archive.nptel.ac.in/courses/106/105/106105191/
4	https://archive.nptel.ac.in/courses/106/105/106105191/

SEMESTER S4

ENGINEERING ETHICS AND SUSTAINABLE DEVELOPMENT

Course Code	**24SJICHUT347**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	2:0:0:0	**ESE Marks**	50
Credits	2	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. Equip with the knowledge and skills to make ethical decisions and implement gender-sensitive practices in their professional lives.
2. Develop a holistic and comprehensive interdisciplinary approach to understanding engineering ethics principles from a perspective of environment protection and sustainable development.
3. Develop the ability to find strategies for implementing sustainable engineering solutions.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Fundamentals of ethics** - Personal vs. professional ethics, Civic Virtue, Respect for others, **Profession and Professionalism,** Ingenuity, diligence and responsibility, Integrity in design, development, and research domains, Plagiarism, a balanced outlook on law - challenges - case studies, **Technology and digital revolution**-Data, information, and knowledge, Cybertrust and cybersecurity, Data collection & management, **High technologies: connecting people and places**-accessibility and social impacts, **Managing conflict**, Collective bargaining, **Confidentiality**, Role of confidentiality in moral integrity, **Codes of Ethics**. **Basic concepts in Gender Studies** - sex, gender, sexuality, gender spectrum: beyond the binary, gender identity, gender expression, gender stereotypes, **Gender disparity and discrimination in education**,	**6**

	employment and everyday life, History of women in Science & Technology, Gendered technologies & innovations**, Ethical values and practices in connection with gender** - equity, diversity & gender justice, **Gender policy and women/transgender empowerment initiatives.**	
2	**Introduction to Environmental Ethics:** Definition, importance and historical development of environmental ethics, key philosophical theories (anthropocentrism, biocentrism, ecocentrism). **Sustainable Engineering Principles:** Definition and scope, triple bottom line (economic, social and environmental sustainability), life cycle analysis and sustainability metrics. **Ecosystems and Biodiversity:** Basics of ecosystems and their functions, Importance of biodiversity and its conservation, Human impact on ecosystems and biodiversity loss, An overview of various ecosystems in Kerala/India, and its significance. **Landscape and Urban Ecology:** Principles of landscape ecology, Urbanization and its environmental impact, Sustainable urban planning and green infrastructure.	**6**
3	**Hydrology and Water Management:** Basics of hydrology and water cycle, Water scarcity and pollution issues, Sustainable water management practices, Environmental flow, disruptions and disasters. **Zero Waste Concepts and Practices:** Definition of zero waste and its principles, Strategies for waste reduction, reuse, reduce and recycling, Case studies of successful zero waste initiatives. **Circular Economy and Degrowth:** Introduction to the circular economy model, Differences between linear and circular economies, degrowth principles, Strategies for implementing circular economy practices and degrowth principles in engineering. **Mobility and Sustainable Transportation:** Impacts of transportation on the environment and climate, Basic tenets of a Sustainable Transportation design, Sustainable urban mobility solutions, Integrated mobility systems, E-Mobility, Existing and upcoming models of sustainable mobility solutions.	**6**

4	**Renewable Energy and Sustainable Technologies:** Overview of renewable energy sources (solar, wind, hydro, biomass), Sustainable technologies in energy production and consumption, Challenges and opportunities in renewable energy adoption. **Climate Change and Engineering Solutions:** Basics of climate change science, Impact of climate change on natural and human systems, Kerala/India and the Climate crisis, Engineering solutions to mitigate, adapt and build resilience to climate change. **Environmental Policies and Regulations:** Overview of key environmental policies and regulations (national and international), Role of engineers in policy implementation and compliance, Ethical considerations in environmental policy-making. **Case Studies and Future Directions:** Analysis of real- world case studies, Emerging trends and future directions in environmental ethics and sustainability, Discussion on the role of engineers in promoting a sustainable future.	6

Course Assessment Method

(CIE: 50 marks, ESE: 50)

Continuous Internal Evaluation Marks (CIE):

Continuous internal evaluation will be based on individual and group activities undertaken throughout the course and the portfolio created documenting their work and learning. The portfolio will include reflections, project reports, case studies, and all other relevant materials.

- The students should be grouped into groups of size 4 to 6 at the beginning of the semester. These groups can be the same ones they have formed in the previous semester.
- Activities are to be distributed between 2 class hours and 3 Self-study hours.
- The portfolio and reflective 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 various courses.

Sl. No.	Item	Particulars	Group/Individual (G/I)	Marks
1	Reflective Journal	Weekly entries reflecting on what was learned, personal insights, and how it can be applied to local contexts.	I	5
2	Micro project (Detailed documentation of the project, including methodologies, findings, and reflections)	1 a) Perform an Engineering Ethics Case Study analysis and prepare a report 1 b) Conduct a literature survey on 'Code of Ethics for Engineers' and prepare a sample code of ethics	G	8
		2. Listen to a TED talk on a Gender-related topic, do a literature survey on that topic and make a report citing the relevant papers with a specific analysis of the Kerala context	G	5
		3. Undertake a project study based on the concepts of sustainable development* - Module II, Module III & Module IV	G	12
3	Activities	2. One activity* each from Module II, Module III & Module IV	G	15
4	Final Presentation	A comprehensive presentation summarising the key takeaways from the course, personal reflections, and proposed future actions based on the learnings.	G	5
		Total Marks		**50**

*Can be taken from the given sample activities/projects

Evaluation Criteria:

- **Depth of Analysis**: Quality and depth of reflections and analysis in project reports and case studies.
- **Application of Concepts**: Ability to apply course concepts to real-world problems and local contexts.
- **Creativity**: Innovative approaches and creative solutions proposed in projects and reflections.
- **Presentation Skills**: Clarity, coherence, and professionalism in the final presentation.

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Develop the ability to apply the principles of engineering ethics in their professional life.	**K3**
CO2	Develop the ability to exercise gender-sensitive practices in their professional lives	**K4**
CO3	Develop the ability to explore contemporary environmental issues and sustainable practices.	**K5**
CO4	Develop the ability to analyse the role of engineers in promoting sustainability and climate resilience.	**K4**
CO5	Develop interest and skills in addressing pertinent environmental and climate-related challenges through a sustainable engineering approach.	**K3**

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						✓	✓	✓	✓		✓
CO2		✓				✓	✓	✓	✓		✓
CO3						✓	✓	✓	✓		✓
CO4		✓				✓	✓	✓	✓		✓
CO5						✓	✓	✓	✓		✓

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Ethics in Engineering Practice and Research	Caroline Whitbeck	Cambridge University Press & Assessment	2nd edition & August 2011
2	Virtue Ethics and Professional Roles	Justin Oakley	Cambridge University Press & Assessment	November 2006
3	Sustainability Science	Bert J. M. de Vries	Cambridge University Press & Assessment	2nd edition December 2023
4	Sustainable Engineering Principles and Practice	Bhavik R. Bakshi,	Cambridge University Press & Assessmen	2019
5	Engineering Ethics	M Govindarajan, S Natarajan and V S Senthil Kumar	PHI Learning Private Ltd, New Delhi	2012
6	Professional ethics and human values	RS Naagarazan	New age international (P) limited New Delhi	2006.
7	Ethics in Engineering	Mike W Martin and Roland Schinzinger,	Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi	4" edition, 2014

Suggested Activities/Projects:

Module-II

- Write a reflection on a local environmental issue (e.g., plastic waste in Kerala backwaters or oceans) from different ethical perspectives (anthropocentric, biocentric, ecocentric).
- Write a life cycle analysis report of a common product used in Kerala (e.g., a coconut, bamboo or rubber-based product) and present findings on its sustainability.
- Create a sustainability report for a local business, assessing its environmental, social, and economic impacts
- Presentation on biodiversity in a nearby area (e.g., a local park, a wetland, mangroves, college campus etc) and propose conservation strategies to protect it.
- Develop a conservation plan for an endangered species found in Kerala.
- Analyze the green spaces in a local urban area and propose a plan to enhance urban ecology using native plants and sustainable design.
- Create a model of a sustainable urban landscape for a chosen locality in Kerala.

Module-III

- Study a local water body (e.g., a river or lake) for signs of pollution or natural flow disruption and suggest sustainable management and restoration practices.
- Analyse the effectiveness of water management in the college campus and propose improvements - calculate the water footprint, how to reduce the footprint, how to increase supply through rainwater harvesting, and how to decrease the supply-demand ratio
- Implement a zero-waste initiative on the college campus for one week and document the challenges and outcomes.
- Develop a waste audit report for the campus. Suggest a plan for a zero-waste approach.
- Create a circular economy model for a common product used in Kerala (e.g., coconut oil, cloth etc).
- Design a product or service based on circular economy and degrowth principles and present a business plan.
- Develop a plan to improve pedestrian and cycling infrastructure in a chosen locality in Kerala

Module-IV

- Evaluate the potential for installing solar panels on the college campus including cost-benefit analysis and feasibility study.
- Analyse the energy consumption patterns of the college campus and propose sustainable alternatives to reduce consumption - What gadgets are being used? How can we reduce demand using energy- saving gadgets?
- Analyse a local infrastructure project for its climate resilience and suggest improvements.
- Analyse a specific environmental regulation in India (e.g., Coastal Regulation Zone) and its impact on local communities and ecosystems.
- Research and present a case study of a successful sustainable engineering project in Kerala/India (e.g., sustainable building design, water management project, infrastructure project).
- Research and present a case study of an unsustainable engineering project in Kerala/India highlighting design and implementation faults and possible corrections/alternatives (e.g., a housing complex with water logging, a water management project causing frequent floods, infrastructure project that affects surrounding landscapes or ecosystems).

SEMESTER S4

COMPUTER NETWORKING LAB

Course Code	**24SJPCERL407**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	0:0:3:0	**ESE Marks**	50
Credits	2	**Exam Hours**	2Hrs.30Min.
Prerequisites (if any)	GBEST204	**Course Type**	Lab

Course Objectives:

1. To analyze and implement various network communication and flow control protocols.
2. To simulate network congestion control and routing mechanisms alongside studying traffic analysis to develop skills in identifying and mitigating network congestion issues in diverse network environments...

Expt. No.	Experiments
1	Familiarize and understand basics of network configuration files, networking commands and the functioning of system calls used for network programming in Linux.*
2	Implement client-server communication using socket programming and TCP as transport layer protocol.*
3	Implement client-server communication using socket programming and UDP as transport layer protocol.*
4	Implement the framing methods employed in Datalinklayer.* a. Bit stuffing b. Character stuffing
5	Simulate sliding window flow control protocols.* a. Stop and Wait b. Go back N c. Selective Repeat
6	Implement and simulate algorithm for Distance Vector Routing protocol.*
7	Implement Simple Mail Transfer Protocol.
8	Implement File Transfer Protocol.*
9	Understanding the Wireshark tool.*
10	Implement congestion control using a leaky bucket algorithm.*
11	Study of NS2 simulator*
12	Design and configure a network with multiple subnets with wired and wireless LANs using required network devices. Configure commonly used services in the network.

Course Assessment Method

(CIE: 50 marks, ESE: 50marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports/Record (Continuous Assessment)	Internal Examination	Total
5	25	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

- Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record
- Endorsement by External Examiner: The external examiner shall endorse the record

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Familiarize the fundamentals of networking commands, configuration files, and the use of system calls for network programming.	K2
CO2	Implement client-server communication through socket programming, employing TCP and UDP as transport layer protocols.	K3
CO3	Implement simulation of sliding window flow control protocols, routing protocols and framing methods using programmatic approach.	K3
CO4	Implement file transfer protocols and congestion control algorithms for networking	K3
CO5	Familiarize network configuration tools for configuring network with multiple subnets	K3

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

CO-PO Mapping (Mapping of Course Outcomes with Program Outcomes)

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

1:Slight(Low),2:Moderate(Medium),3:Substantial(High),-:NoCorrelation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Computer Networks	Andrew S. Tanenbaum	PHI (Prentice Hall India)	4/e,2008
2	Data Communication and Networking	Behrouz A Forouzan	Tata McGraw Hill	4/e,2007

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Computer Networking and the Internet	Fred Halsall	Addison-Wesley.	5/e,2005
2	Computer Networking: A Top-Down Approach	James F. Kurose, Keith W. Ross	Pearson Education	6/e,2012
3	TCP/IP Sockets in C	Michael J Donahoo	Morgan Kaufmann Publishers	2/e
4	Hands-On Network Programming with C	Lewis Van Winkle	Packt Publishing	2019

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/106105183
2	https://nptel.ac.in/courses/106106091
3	https://onlinecourses.swayam2.ac.in/cec21_cs04/preview
4	https://onlinecourses.nptel.ac.in/noc22_cs19/preview

Continuous Assessment (25 Marks)

1. Preparation and Pre-Lab Work (7 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 (7 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 (6 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 (10Marks)**
   - 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 logical approach 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.
   - Skill in answering questions related to both theoretical and practical aspects of the subject.
5. **Record (5 Marks)**
   - Completeness, clarity, and accuracy of the lab record submitted.

SEMESTER S4

INTEGRATED CIRCUITS LAB

Course Code	24SJPCERL 408	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:3	ESE Marks	50
Credits	2	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	PBERT 304: Electronic Devices and Circuits	Course Type	Lab

Course Objectives:

1. To impart ability to handle the various electronic instruments and trouble shoot circuits.
2. To gain hands-on experience in designing electronic circuits using integrated circuits, transistors and diodes.

Expt. No.	Experiments
	Part A
1	Measurement of current, voltage, frequency and phase shift of signal in a RC network using oscilloscope.
2	Rectifier circuits with and without C filter.
3	Clipping and clamping circuits using diodes.
4	RC coupled amplifier using BJT in CE Configuration – Plotting of frequency response and measurement of gain and BW.
5	Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.
6	Common source amplifier using MOSFET – Plotting of frequency response and measurement of gain and BW.
7	Op-amp circuits – Design and set up of inverting and non-inverting amplifier
8	Op-amps circuits – adder, integrator, and differentiator.
9	Precision rectifier using Op-amps.
10	Phase shift oscillator and Wien's Bridge oscillator using Op-amps.
11	Waveform generation– Square, triangular and saw tooth waveform generation using Op-amps.
12	Basic comparator and Schmitt trigger circuits using Op-amp
13	Astable and Monostable circuits using 555 IC.
14	D/A Converters - R-2R ladder circuit.

Part B Simulation experiments [The experiments shall be conducted using SPICE]	
15	Simulation of any three circuits from Experiments 2 – 6.
16	Simulation of any three circuits from Experiments 7 – 14.

Course Assessment Method

(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

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

- *Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.*
- ***Endorsement by External Examiner:*** *The external examiner shall endorse the record*

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Use the various electronic instruments for conducting experiments	Apply
CO2	Design and develop various electronic circuits using diodes.	Apply
CO3	Design and implement amplifier and oscillator circuits using BJT	Apply
CO4	Design and implement basic circuits using IC (OPAMP and 555 timers).	Apply

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

CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)

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

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	Electronic Devices and Circuit Theory	R E Boylstead and L Nashelsky	Pearson Education	11/e, 2015
2	Pulse, digital and Switching Waveforms,	Millman and Taub	Tata McGraw Hill	2007
3	Opamps and Linear Integrated circuits	Coughlin & Driscoll	Prentice Hall	6/e, 2009
4	Linear Integrated Circuits,	Choudhury R.,	New Age International Publishers	4/e, 2017

Video Links (NPTEL, SWAYAM…)	
Sl. No.	**Link ID**
1	archive.nptel.ac.in/courses/108/108/108108111

Continuous Assessment (25 Marks)

1. **Preparation and Pre-Lab Work (7 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.
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   - 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 (6 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)**
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   - 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

Programme Outcomes (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyse complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyse and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behaviour and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Department of
Electronics and Computer Engineering

Vision

Develop into a center of excellence in Electronics and Computer Engineering for training technically competent professionals catering to the needs of Industry, Academia and Society.

Mission

- To pursue continuous improvement in learning, creativity and innovation among both faculty and students by enhanced infrastructure, state-of-the art laboratories and a unique learning environment.
- To inculcate in both faculty and students, technical and entrepreneurial skills by professional activities to create socially relevant and sustainable solutions in the domain of electronics and computer engineering.

Program Specific Outcomes (PSOs):

PSO1: Ability to apply domain knowledge to analyze and design hardware and software systems so as to understand and solve problems in Electronics and Computer Engineering.

PSO2: Ability to effectively use modern software/hardware tools to design, analyze and communicate technical details in the electronics and computer engineering domain.

ST. JOSEPH'S
COLLEGE OF ENGINEERING AND TECHNOLOGY, - PALAI -
AUTONOMOUS

Vision

Developing into a world class, pace setting institute of Engineering and Technology with distinct identity and character, meeting the goals and aspirations of the society.

Mission

- To maintain a conducive infrastructure and learning environment for world class education.
- To nurture a team of dedicated, competent and research-oriented faculty.
- To develop students with moral and ethical values, for their successful careers, by offering variety of programs and services.