SYLLABUS

(2025-26)

Bachelor Degree
In

Electronics & Communication Engineering

III & IV Semester

Out Come Based Education
With
Choice Based Credit System

[National Education Policy Scheme]

P.E.S. College of Engineering, Mandya - 571 401, Karnataka
[An Autonomous Institution affiliated to VTU, Belagavi,
Grant – in – Aid Institution (Government of Karnataka),
dited by NBA (All UG Programs), NAAC and Approved by AICTE, New Delhi]

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VISION

"PESCE shall be a leading institution imparting quality Engineering and Management education developing creative and socially responsible professionals."

MISSION

- *Provide state of the art infrastructure, motivate the faculty to be proficient in their field of specialization and adopt best teaching-learning practices.*
- *Impart engineering and managerial skills through competent and committed faculty using outcome based educational curriculum.*
- *Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs.*
- *Promote research, product development and industry-institution interaction.*

QUALITY POLICY

Highly committed in providing quality, concurrent technical education and continuously striving to meet expectations of stake holders.

CORE VALUES

***P**rofessionalism*
***E**mpathy*
***S**ynergy*
***C**ommitment*
***E**thics*

Department of Electronics and Communication Engineering

The department of Electronics and Communication Engineering was incepted in 1967 with an undergraduate program in Electronics and Communication Engineering. Initially, the program had an intake of 60 students, which increased to 120 in 2012, and further increased to 180 in 2019. Almost 200 students graduate every year, and the long journey of 50 years has seen satisfactory contributions to society, the nation, and the world. The alumni of this department have a strong global presence, making their alma mater proud in every sector they represent.

The department started its PG program in 2012 in the specializations of VLSI design and embedded systems. Equipped with well qualified and dedicated faculty, the department has a focus on VLSI design, embedded systems, and image processing. The quality of teaching and training has yielded a high growth rate of placement at various organizations. The large number of candidates pursuing research programs (M.Sc. and Ph.D.) is a true testimonial to the research potential of the department. The department is recognized as a research centre by VTU, and Mysore University offers a part-time and full-time Ph.D. Program.

Vision

The department of E & C would endeavour to create a pool of Engineers who would be extremely competent technically, ethically strong also fulfil their obligation in terms of social responsibility.

Mission

M1: Adopt the best pedagogical methods and provide the best facility, infrastructure and an ambience conducive to imbibe technical knowledge and practicing ethics.
M2: Group and individual exercises to inculcate habit of analytical and strategic thinking to help the Students to develop creative thinking and instil team skills.
M3: MoUs and Sponsored projects with industry and R & D organizations for collaborative learning.
M4: Enabling and encouraging students for continuing education and moulding them for life-long learning process.

Program Educational Objectives (PEOs)

PEO1: Graduates to exhibit knowledge in mathematics, engineering fundamentals applied to Electronics and Communication Engineering for professional achievement in industry, research and academia.
PEO2: Graduates to identify analyse and apply engineering concepts for design of Electronics and Communication Engineering systems and demonstrate multidisciplinary expertise to handle societal needs and meet contemporary requirements.
PEO3: Graduates to perform with leadership qualities, team spirit, management skills, attitude and ethics need for successful career, sustained learning and entrepreneurship.

Program 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 analyze 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: Analyze 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, reuse 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.

Program Specific Outcomes (PSOs)

Electronics and Communication Engineering Graduates will be able to

PSO1: An ability to understand the basic concepts in Electronics and Communication Engineering and to apply them in the design and implementation of Electronics and Communication Systems.

PSO2: An ability to solve complex problems in Electronics and Communication Engineering, using latest hardware and software tools, along with analytical skills to arrive at appropriate solutions.

Bachelor of Engineering Electronics & Communication Engineering (III –Semester)											
Sl. No	**Course Code**	**Course Title**	**Hrs/Week**			**Credit**	**Examination Marks and Duration**				**Total Marks**
			L	**T**	**P**		**Max. Marks CIE**	**Duration**	**Max. Marks SEE**	**Duration**	
1	P24MA301B	Series and Transforms	2	2	-	3	50	1.5	50	3	100
2	P24EC302	Analog Integrated Circuits	3	-	-	3	50	1.5	50	3	100
3	P24EC303	Network Theory and Analysis	3	-	-	3	50	1.5	50	3	100
4	P24EC304	Computer Organization	3	-	-	3	50	1.5	50	3	100
5	P24EC305	Digital Design and Verilog	3	-	-	3	50	1.5	50	3	100
6	P24EC306	Signals and Systems	3	-	-	3	50	1.5	50	3	100
7	P24ECL307	Analog Integrated Circuits Laboratory	-	-	2	1	50	1.5	50	3	100
8	P24ECL308	Digital Design and Verilog Laboratory	-	-	2	1	50	1.5	50	3	100
9	P24ECL309	Signals and Systems Laboratory	-	-	2	1	50	1.5	50	3	100
10	P24HSMC310A	Employability Enhancement Skills - III	1	-	-	1	50	1 MCQ	50	2 MCQ	100
11	P24NSS311	National Service Scheme	-	-	2	-	50	1 MCQ	50	2 MCQ	PP/NP
	P24YOG311	Yoga									
	P24PED311	Physical Education									
12		AICTE Activity Points									
		Total				22					
BRIDGE COURSE		B.E [Lateral Entry Students]									
13	P24MADIP301	Basic Engineering Mathematics - I	2	2	-	-	100				
14	P24HDIP308	Additional Communicative English - I		2	-	-	100				

Bachelor of Engineering – Electronics & Communication Engineering (IV –Semester)											
Sl. No	**Course Code**	**Course Title**	**Hrs/Week**			**Credit**	**Examination Marks and Duration**				**Total Marks**
			L	**T**	**P**		**Max. Marks CIE**	**Duration**	**Max. Marks SEE**	**Duration**	
1	P24MA401B	Statistical Techniques and Analysis	2	2	-	3	50	1.5	50	3	100
2	P24EC402	Principles of Communication Systems	3	-	-	3	50	1.5	50	3	100
3	P24EC403	Electromagnetic Field Theory	3	-	-	3	50	1.5	50	3	100
4	P24EC404	Digital Signal Processing	3	-	-	3	50	1.5	50	3	100
5	P24EC405	Advanced Digital Design and Verilog	3	-	-	3	50	1.5	50	3	100
6	P24EC406	ARM Processor	3	-	-	3	50	1.5	50	3	100
7	P24ECL407	Signal Processing and Communication Laboratory	-	-	2	1	50	1.5	50	3	100
8	P24ECL408	Advanced Digital Design and Verilog Laboratory	-	-	2	1	50	1.5	50	3	100
9	P24ECL409	ARM Processor Laboratory	-	-	2	1	50	1.5	50	3	100
10	P24HSMC410A	Employability Enhancement Skills - IV	1	-	-	1	50	1 MCQ	50	2 MCQ	100
11	P24NSS411	National Service Scheme	-	-	2	-	50	1 MCQ	50	2 MCQ	PP/NP
	P24YOG411	Yoga									
	P24PED411	Physical Education									
12		AICTE Activity Points									
		Total				22					
BRIDGE COURSE		B.E [Lateral Entry Students]									
13	P24MADIP401	Basic Engineering Mathematics - II	2	2	-	-	100				
14	P24HDIP408	Additional Communicative English - II		2	-	-	100				

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Series and Transforms (Common to Electronics Streams)		
Course Code: P24MA301B	**CIE Marks:50**	**CIE Weightage:50%**
Teaching hours/week (L:T:P): 2:2:0	**SEE Marks:50**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 40 Hours	**Exam Hours: 3 Hrs**	
Credits: 03		

Course Learning Objectives:

1	**Understand** the concept of infinite series; learn and apply Fourier series to represent periodical physical phenomena in engineering analysis.
2	To study, analyse and **apply** various transforms to solve engineering problems.

Unit	Syllabus content	No. of hours	
		Theory	**Tutorial**
I	**Infinite Series:** Introduction, limit, convergence, divergence and oscillation of a series, Series of positive terms, **Tests for convergence** – Comparison test, Ratio test, Raabe's test, Cauchy's root test (All tests without proof). Alternating series and power series: center and radius of convergence – Problems. **Self-study component:** Integral Test, Leibnitz's theorem – absolute and conditional convergence. Visualization by using **SageMath.**	06	02
II	**Fourier Series** Introduction, periodic function, even and odd functions, Dirichlet's conditions, Euler's formula for Fourier series (no proof). Fourier series for functions of arbitrary period of the form 2L (all particular cases) – problems. Practical harmonic analysis- Illustrative examples from engineering field. **Self-study**: Half Range Fourier series – Construction of Half range cosine and sine series and problems, Complex form of Fourier series, Visualization by using **SageMath.**	06	02
III	**Laplace Transforms:** **Definition** – Transforms of elementary functions. Properties of Laplace Transforms- linearity, change of scale, shifting, transform of a function multiplied by t^n and division by t (no proof) – Problems. Transforms of periodic function, unit step function (All results without proof)-Problems only. **Inverse Laplace Transforms**: Definition, evaluation using partial fraction method, convolution theorem (Statement Only). **Self-study component**- Transform of unit impulse function. Solution of ODE by Laplace method, Visualization by using **SageMath/MATLAB.**	06	02
IV	**Fourier Transforms**: **Complex Fourier Transform**: Infinite Fourier transforms and Inverse	06	02

	Fourier transforms. Properties of Fourier Transforms- linearity, change of scale, shifting and modulation (no proof)-Problems. Fourier sine, cosine transforms and Inverse Fourier sine, cosine transforms – Problems. Parseval's identities for Fourier Transforms (no proof)-problems. **Self-study**: Fourier integrals- Complex forms of Fourier integral. Convolution theorem. Visualization by (Fast) Fourier transform using **SageMath/MATLAB.**		
V	**Z-Transforms**: Definition, ROC (Region of convergence), Standard Z-transforms, Properties – linearity, Damping, Shifting, multiplication by *n*, initial and final value theorem-problems. Evaluation of inverse Z – transforms – problems. **Application to Difference Equations**: Solution of linear difference equations using Z- transforms. **Self-study**: Convolution theorem and problems, two-sided Z – transforms.	06	02

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: **Understand** the fundamental concepts of infinite series, transforms of functions.

CO2: **Apply** series and transform techniques to obtain series expansion, discrete and continuous transformation of various mathematical functions.

CO3: **Analyze** various signals using series expansions and differential, integral and difference equations using transforms.

CO4: **Evaluate** indefinite integrals, differential equations and difference equations subject to initial conditions using transforms and develop series for a discontinuous function.

TEACHING – LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXTBOOKS

1. B. S. Grewal, Higher Engineering Mathematics (44th Edition 2018), Khanna Publishers, New Delhi.
2. E. Kreysizig, Advanced Engineering Mathematics, John Wiley and sons, 10th Ed. (Reprint) 2016.

REFERENCE BOOKS

1. B. V. Ramana: Higher Engineering Mathematics, McGraw–Hill Education, 11th Ed.,
2. H. C. Taneja, Advanced Engineering Mathematics, Volume I&II, I. K. International Publishing House Pvt. Ltd., New Delhi.
3. N. P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint,2010.

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Flip Class 2. Seminar/ poster Presentation 3. Individual Role play/Team Demonstration/ Collaborative Activity 4. Case study 5. Learn by Doing

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3										
CO2	2	3										
CO3	3	2										
CO4	2	3										

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Analog Integrated Circuits		
Course Code: P24EC302	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P): 3:0:0	**SEE Marks: 50**	**SEE Weightage:50%**
Teaching Hours of Pedagogy:40 Hours	**Exam Hours: 03**	
Credits: 03		

Prerequisite:

Basic Electronics

Course learning Objectives:

CLO1: Understand the basic knowledge of Transistor and its device structure and characteristics.
CLO2: Analyse the MOSFET as an Amplifier and Switch.
CLO3: Understand the basic operation of Op–Amp and its operation as Inverting amplifier, Non–Inverting amplifier and Voltage follower
CLO4: Discuss the circuit Stability and frequency compensation methods for MOSFET and Op-amps.
CLO5: Analyse the operation of Op Amp based Voltage level detector and Schmitt trigger circuits.
CLO6: Know the applications of Op–Amps in Signal generators, Filters, Oscillators and Data converters.

Unit 1:	**Hrs: 08**

MOS Field-Effect Transistors (MOSFETs): Introduction, Device Structure and Physical Operation, Current–Voltage Characteristics, MOSFET Circuits at DC.
Text 1: 4.1, 4.2, 4.3.

Self-Study Content:
1. Simulate an n-MOSFET circuit and plot its transfer characteristic curve.
2. Simulate a p-MOSFET circuit and plot its transfer characteristic curve.

Unit 2:	**Hrs: 08**

MOS Field-Effect Transistors (MOSFETs): The MOSFET as an Amplifier and as a Switch, Biasing in MOS Amplifier Circuits, Small-Signal Operations and Models, Basic MOSFET Amplifier Configurations.
Text 1: 4.4, 4.5, 4.6. 4.7.1 – 4.7.3.

Self-Study Content:
1. Draw and Simulate a CMOS inverter and plot its transfer characteristic curve.
2. Draw and simulate a Common Source amplifier using an NMOS transistor with a resistive load..

Unit 3:	**Hrs: 08**

Introduction to Operational Amplifiers: IC Operational amplifier, The Voltage Follower Circuit, The Non-inverting amplifier, The inverting amplifier.
Operational Amplifiers Frequency Response and Compensation: Op-Amp Circuit Stability, Frequency Compensation Methods, Circuit Stability Precautions.
Switching Circuits: Op-amp in switching circuit, Voltage Level Detectors, Inverting Schmitt Trigger Circuit, and Non-inverting Schmitt Trigger Circuit.
Text 2: 1.1 to 1.4, 5.1, 5.2, 5.6, 8.1 to 8.4.

Self-Study Content:
1. Study of instrumentation amplifier.
2. Study of IC Voltage Comparator.

Unit 4:	**Hrs: 08**

Signal Processing Circuits: Limiting circuits, Clamping circuits, Peak detectors, Sample and Hold Circuits. **Signal Generators:** Triangular Wave Generator, Phase Shift and quadrature Oscillators, Colpitts and Hartley Oscillators. **Text 2: 9.3-9.6, 10.3, 11.1, 11.2.**
Self-Study Content: 1. Implement a Square wave oscillator using a Schmitt trigger. 2. Evaluate temperature sensitivity of an oscillator circuit by simulating across different temperatures in PSPICE.

Unit 5:	**Hrs: 08**
Active Filters: Filter types and characteristics, First order active filter, Second Order active filters. **DAC and ADC:** Analog/Digital Conversion Basics, Digital-To-Analog Conversion: Weighted Resistor DAC, R-2R DAC, Parallel ADC, ADC Counting Methods: Linear Ramp ADC, Dual-Slope Integrator ADC, Digital Ramp ADC. **Text 2: 12.1-12.3, 15.1-15.4 (Mentioned Topics)**	
Self-Study Content: 1. Design and simulate a Second-order low-pass active filter using an op-amp. 2. Design and simulate a 3-bit flash ADC using comparators and a priority encoder.	

Suggested Learning Resources:

Text books:

Sl.No.	Title	Author	Year & Edition	Publisher
1	Microelectronic Circuits	Adel S. Sedra Kenneth C. Smith	2013, 6th edition	Oxford
2	Operational Amplifiers and Linear IC's	David A. Bell	2011, 3rd edition	Oxford university Press
Reference Books:				
1	Fundamentals of Microelectronics	Behzad Razavi	2013, 2nd Edition	Wiley
2.	Linear Integrated Circuits	D. Roy Choudhury and Shail B. Jain	2006, 2nd edition	New Age International
3	Op – Amps and Linear Integrated Circuits	RamakantA. Gayakwad	4th edition	PHI

Web links and Video Lectures (e-resources):

1. Analog Electronic Circuit- https://youtu.be/pkIxCmaxWFg
2. Differential and Operational Amplifiers- https://youtu.be/LS8ne40mSTE
3. https://www2.mvcc.edu/users/faculty/jfiore/OpAmps/OperationalAmplifiersAndLinearICs_3E.pdf
4. https://books.google.co.in/books?id=aByz9D63wC&printsec=froage&q&f=false

Course Outcomes: On completion of this course, students are able to:			
COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Program Outcome Addressed (PO #) with BTL**
CO1	**Apply** the knowledge of mathematics and physics to describe the operation and characteristics of MOSFETs and Op-amps.	Applying	PO1(L3)
CO2	**Illustrate** the frequency response and stability concept of MOSFET and Op-amps.	Applying	PO1 (L3)
CO3	**Analyse** the working operation of MOSFET and Op-amp based application circuits.	Analyse	PO2 (L4)
CO4	**Design** the MOSFETs and Op-amps applications circuits for a given specification.	Creating	PO3 (L6)
CO5	**Design and Simulate** the MOSFETs and Op-amps applications circuits using any Modern tools.	Creating	PO3, PO5, PO8, PO9 (L6)

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
#1	**3**											**3**	
#2	**3**											**3**	
#3		**2**											**2**
#4			**2**										
#5			**2**		**1**			**1**	**1**				

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Flip Class 2. Seminar/ poster Presentation 3. Individual Role play/Team Demonstration/ Collaborative Activity 4. Case study 5. Learn by Doing

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Network Theory and Analysis		
Course Code: P24EC303	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P): 3:0:0	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy:40 hours	**Exam Hours: 03**	
Credits: 03		

Prerequisite:

1. Engineering physics.
2. Engineering Mathematics

Course learning Objectives:

CLO1: Understand electrical circuits, their analysis and solutions through node analysis and mesh analysis methods, various network theorems (ac and dc) to analyse complex circuits.

CLO2 Analyse the transient conditions that may occur in electrical networks by solving necessary differential equations.

CLO3: Provide explanation of Laplace transform and its application in solving circuit problems

CLO4: Examine the behaviour of two-port networks and learn about few special two-port networks.

CLO5: Discuss the various properties and synthesis methods for different one-port networks

Unit 1:	**Hrs: 8**

Introduction to Network Theorems (AC and DC): Mesh Analysis (AC and DC), Node Analysis (AC and DC), Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem (All theorems are DC).

Text: 2.3 to 2.6, 3.2 to 3.6, 6.1 to 6.3.

Self-Study Content:

1. Implement a digital simulation of Superposition, Thevenin, and Norton's theorems using software like LTspice**,** Multisim**, or** PSPICE**.**

Unit 2:	**Hrs:8**

Introduction to Resonance: Series Resonance, Parallel Resonance

Introduction to Transient Analysis: Initial Conditions, Resistor-Inductor Circuit, Resistor-Capacitor Circuit, Resistor-Inductor- Capacitor Circuit.

Text: 5.1 to 5.3, 10.1 to 10.5

Self-Study Content:

1. **Analyze the phase angle** behavior in R, L, and C components when excited by sinusoidal input

Unit 3:	**Hrs: 8**

Introduction to Laplace Transforms and its Applications: Laplace transforms of Periodic Functions, Waveform Synthesis, The Transformed Circuit, Resistor-Inductor Circuit, Resistor Capacitor Circuit, Resistor-Inductor- Capacitor Circuit, Response of RL Circuit to Various Functions, and Response of RC Circuit to Various Functions.

Text: 11.1, 11.5, 11.6, 11.10 to 11.15

Self-Study Content:

1. Write a program in MATLAB/PYTHON to synthesis the waveforms.

Unit 4:	**Hrs:8**

Introduction to Network Topology: Graph of a Network, Definitions Associated with a Graph, Incidence Matrix, Loop Matrix or Circuit Matrix, Cutset Matrix

Introduction to Two-Port Networks: Open-Circuit Impedance Parameters (Z Parameters), Short Circuit Admittance Parameters (Y Parameters), Transmission Parameters (ABCD Parameters), Hybrid Parameters (h parameters).

Text: 9.1 to 9.6, 13.1 to 13.4, 13.6

Self-Study Content: 1. Summarize the interrelationships between two-port parameters through examples	
Unit 5:	**Hrs: 8**
Introduction to Network Synthesis: Hurwitz Polynomials, Positive Real Functions, Elementary Synthesis Concepts, Realization of LC Functions, Realization of RL Functions, Realization of RC Functions. **Text: 16.1 to 16.7.**	
Self-Study Content: 1. Investigate the application of synthesis techniques in **modern analog filter design.**	

Suggested Learning Resources:

Textbooks:

Sl. No.	Title	Author	Year & Edition	Publisher
1	Network Analysis and Synthesis,	Ravish R Singh	2014 & 2nd Edition	McGraw Hill Education (India) Private Limited.
Reference Books:				
1	Network analysis	M. E. Van Valkenburg and T.S. Rathore	3rd Edition	Pearson Education
2	Engineering Circuit Analysis,	William H. Hayt Jr., Jack E. Kemmerly, Jamie D. Phillips, Steven M. Durbin	9th Edition	McGraw Hill Education (India) Private Limited.
3.	Problems and Solutions in Engineering Circuit Analysis,	William Hayt, Jack Kemmerly		McGraw Hill Education (India) Private Limited

Web links and Video Lectures (e-resources)

1.https://archive.nptel.ac.in/courses/108/105/108105159/
2.http://www.digimat.in/nptel/courses/video/108102042/L01.html

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Program Outcome Addressed (PO #) with BTL**
CO1	**Apply** the fundamental concepts of electrical networks to compute the value of the specified parameter.	Apply	PO1[L3]
CO2	**Analyze** linear circuits in both time and frequency domains.	Analyze	PO2 [L4]
CO3	**Design** and synthesize electrical networks to realize a given function.	Design	PO3[L5]
CO4	**Simulate** and **evaluate** network performance using appropriate engineering tools.	Evaluate	PO5,PO7, PO8,PO9[L6]

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
#1	**3**											**3**	
#2		**2**											**2**
#3			**2**										
#4					**1**		**1**	**1**	**1**				

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Flip Class 2. Seminar/ poster Presentation 3. Individual Role play/Team Demonstration/ Collaborative Activity 4. Learn by Doing

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Computer Organization		
Course Code: P24EC304	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P): 3:0:0	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy:40 hours	**Exam Hours: 03**	
Credits: 03		

Prerequisite:

Digital system design

Course learning Objectives:

CLO1: Conceptualize the basics of Organizational issues of a digital computer and compare the performance of machine instruction.
CLO2: Expose different ways of communication with I/O Devices.
CLO3: Notice how to perform computer arithmetic operation.
CLO4: Understand working of processing unit using different bus structures.
CLO5: Understand the basics of multicore architecture and the need for concurrency, and to compare multithreading on single-core, multi-core, and Hyper-Threading platforms.

Unit 1:	**Hrs: 8**

Basic Structure of Computers: Basic operational Concepts, Number representation and arithmetic operations, Character representation, Performance.
Instruction Set Architecture: Memory Location and Addresses, Memory Operations, Instruction and Instruction Sequencing, Addressing Modes, Assembly Language.
Text 1: Ch 1: 1.3 to 1.6, Ch 2: 2.1 to 2.5

Self-Study Content:
1. Prepare a short report on -Functional Units of Computer, Number representation and Arithmetic Operations, Character representation

Unit 2:	**Hrs:8**

Instruction Set Architecture (Continued): Stacks, Subroutines, Additional instructions.
Basic Input/Output: Accessing I/O Devices-I/O Device Interface, Program Controlled I/O, Interrupts-Enabling and Disabling Interrupts, Handling Multiple Devices, Exceptions.
Input/Output Organization: Bus Structure, Bus Operation-Synchronous Bus, Asynchronous Bus, Arbitration.
Text 1: Ch 2: 2.6 to 2.8, Ch 3: 3.1.1, 3.1.2, 3.2.1, 3.2.2, 3.2.6, Ch 7: 7.1, 7.2.1, 7.2.2, 7.3

Self-Study Content:
1**.** Collect the specification about the PCI local bus and PCI express.

Unit 3:	**Hrs: 8**

Basic Processing Unit: Some Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control
Text 1: Ch 5: 5.1 to 5.6.

Self-Study Content:
1. Compare and contrast the RISC and CISC Style Processors

Unit 4:	**Hrs: 8**

Arithmetic: Addition and subtraction of signed numbers, Design of fast adders, Multiplication of unsigned numbers, Multiplication of Signed Numbers, Fast Multiplication-Bit Pair Recoding of

Multipliers, Carry-Save Addition of Summands, Integer Division. **Text 1: Ch 9: 9.1 to 9.4, 9.5.1, 9.5.2, 9.6**
Self-Study Content: 1. Prepare a report on floating-point numbers and its operations

Unit 5:	**Hrs: 8**
Introduction to Multicore Architecture: Motivation for Concurrency in software, ParallelComputing Platforms, Parallel Computing in Microprocessors, Differentiating Multicore Architectures from Hyper Threading Technology, Multithreading on Single–Core versus Multi–Core Platforms Understanding Performance, Amdahl‟s Law, Growing Returns: Gustafson‟s Law. **Text 2: Ch 1**	
Self-Study Content: 1. Study and write a report onto Parallel Computing	

Suggested Learning Resources:

Textbooks:

Sl. No	Title	Author	Year & Edition	Publisher
1	Computer Organization and Embedded Systems	Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian	6th Edition, (Indian Edition)	McGraw Hill Education (India) Private Limited, ISBN-13: 978-93-5532-372-9
2	Multicore Programming, Increased Performance Through Software Multi–threading	Shameem Akhter and Jason Roberts,	2006	Intel Press,, ISBN 0-9764832-4-6.

Reference Books:

1.	Title	Author	Year & Edition	Publisher
1	Computer Organization & Architecture	William Stallings	11th Edition	Pearson Education, ISBN-13: 978-93-5606-159-0

Web links and Video Lectures (e-resources)

https://www.google.co.in/books/edition/_/zdiKcgAACAAJ?hl=en&sa=X&ved=2ahUKEwi_wtidmJ6GAxXRRmwGHUZ9Bt8Qre8FegQICxAE

1. https://nptel.ac.in/content/storage2/courses/106103068/pdf/coa.pdf
2. https://nptel.ac.in/courses/106/105/106105163/
3. https://nptel.ac.in/courses/106/106/106106092/
4. https://nptel.ac.in/courses/106/106/106106166/
5. https://nptel.ac.in/courses/106/103/106103068/
6. http://www.nptelvideos.in/2012/11/computer-organization.html

Course Outcomes: On completion of this course, students are able to:			
COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Program Outcome Addressed (PO #) with BTL**
CO1	**Interpret** the operation and organization of a digital computer system by applying knowledge of digital logic circuits and their functionality.	Apply	PO1(L3)
CO2	**Apply** concepts of Instruction Set Architecture (ISA) to develop efficient and accurate assembly language programs.	Apply	PO1(L3)
CO3	**Analyze** the performance of multicore architectures	Analyze	PO2(L4)
CO4	**Design and simulate** the functional units of a computer system using appropriate engineering tools	Design	PO3, PO5,PO8, PO9(L5)

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
#1	**3**											**3**	
#2	**3**											**3**	
#3		**3**											**3**
#4			**3**		**1**			**1**	**1**				

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Flip Class 2. Seminar/ poster Presentation 3. Case study

Academic Year: 2024-25	**Semester: III**	**Scheme: P24**
Course Title: Digital Design and Verilog		
Course Code: P24EC305	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L: T:P): 3:0:0	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy:40 hours	**Exam Hours: 03**	
Credits: 03		

Prerequisite:

Basic Electronics

Course learning Objectives:

CLO1: Apply simplification techniques such as K–map & QM method technique to solve Boolean Functions.
CLO2: Analyse the combinational and sequential logic circuits.
CLO3: Design and implement the combinational and sequential logic circuits.
CLO4:Understand the syntax and semantics of Verilog HDL
CLO5: Develop a Verilog HDL code for the given Functions/Specifications

Unit 1:	**Hrs: 8**

Simplification of Boolean Functions: The Map Method, Two-Variable, Three-Variable and Four Variable K-Maps, Product of Sums Simplification, NAND and NOR Implementation, Don't – Care Conditions, The Tabulation Method, Determination of Prime-Implicants. Selection of Prime-implicants.
Combinational Logic: Introduction, Design Procedure, Code Converter.
Text1: 3.1-3.3, 3.5, 3.6, 3.8-3.11, 4.1, 4.2,4.5.

Unit 2:	**Hrs: 8**

Overview of Digital Design with Verilog HDL: Typical Design Flow
Hierarchical Modelling Concepts: Design Methodologies,4-bit Ripple Carry Counter, Modules, Instances, Components of a Simulation
Basic Concepts: Lexical Conventions, Data Types, System Tasks and Compiler Directives**.**
Modules and Ports: Modules, Ports. Hierarchical Names.
Gate-Level Modeling: Gate Types, Gate Delays.
Text 2: 1.3,2(2.1-2.5),3.1, (3.1.1-3.1.7), 3.2 (3.2.1 - 3.2.9), 3.3(3.3.1-3.3.2), 4(4.1-4.3), 5(5.1-5.2).

Unit 3:	**Hrs: 8**

Combinational Logic: Binary Parallel Adder, Magnitude Comparator, Encoders, Decoders, Multiplexers, Demultiplexers
Sequential Logic: Introduction, Flip-Flops, Triggering of Flip-Flops.
Text1: 5.2, 5.4-5.6, 6.1-6.3.

Unit 4:	**Hrs: 8**

Sequential Logic: Flip-flop Excitation Tables, Design Procedure, Design of Counters, Design with State Equations.
Registers, Counters: Introduction, Registers, Shift Registers, Ripple Counters, Synchronous-counters.
Text 1: 6.6-6.9, 7.1-7.5.

Unit 5:	**Hrs: 8**

Dataflow Modelling: Continuous Assignments, Delays, Expressions, Operators and Operands, Operator Types, Examples.

Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, Conditional Statements, Multiway Branching, Loops, Sequential and Parallel Blocks, Examples.
Text 2: 6.1-6.5.3, 7.1.1- 7.7,7.9 and 7.9.3).

Suggested Learning Resources:

Textbooks:

Sl. No	Title	Author	Year & Edition	Publisher
1.	Digital Logic and Computer Design	M. Morris Mano	2016	Pearson India Education Services Pvt. Ltd
2	Verilog® HDL, A Guide to Digital Design and Synthesis	Samir Palnitkar	1996 & Second Edition	Pearson Education, ISBN 978-81-775-918-4.
Reference Books:				
1.	Digital logic applications and Design	John.M Yarbrough	2006	Pearson, Thomson Learning
2.	Advanced Digital Design with the Verilog HDL	Michael D. Ciletti	2011, 2nd	Pearson

Web links and Video Lectures (e-resources)

1. https://nptel.ac.in/courses/108105132
2. https://nptel.ac.in/courses/108105113
3. https://archive.nptel.ac.in/courses/108/106/108106177/

Course Outcomes: On completion of this course, students are able to:

COs	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Program Outcome Addressed (PO #) with BTL
CO1	**Solve** Boolean functions using Mapping and Tabulation Method	Apply[L3]	PO1
CO2	**Design** Logic Circuits for given function/specifications using discrete gates, MUX and DEMUX	Create[L6]	PO2, PO3
CO3	**Analyze** given logic circuit for functionality and timing.	Analyse [L4]	PO2
CO4	**Investigate** the given Verilog Code for functionality and style while recording the observations as a report.	Evaluate[L5]	PO1,PO2,PO4, PO9
CO5	**Develop** Verilog code for given specifications.	Create[L6]	PO2, PO3, PO5

Course Articulation Matrix (CAM)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
#1	**2**											**2**	
#2		**3**	**3**		**1**								**3**
#3		**3**											**3**
#4	**2**	**3**		**1**								**2**	**3**
#5		**2**	**2**		**2**								**2**

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Seminar/ poster Presentation 2. Individual Role play/Team Demonstration/ Collaborative Activity 3. Demonstration 4. Learn by Doing

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Signals and Systems		
Course Code: P24EC306	**CIE Marks: 50**	**CIE Weightage:50%**
Teaching hours/week (L:T:P): 3:0:0	**SEE Marks: 50**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 40 hours	**Exam Hours: 03**	
Credits: 03		

Prerequisite:

Basic knowledge on Engineering mathematics.

Course learning Objectives:

CLO1: Classify the signals and understand different operations on signals.
CLO2: Recognize the basic signals (both continuous- time and discrete-time) like impulse, unit step, ramp, sinusoids and exponentials, represented both in frequency and time domains.
CLO3: Characterize LTI system using impulse response and linear constant coefficient differential equations.
CLO4 Represent all types of signals (CT/DT, periodic/non-periodic) in terms of complex.
CLO5: Define relationship between Z transform and Fourier transform.
CLO6: Implement the systems (any order) in Direct-form-I and Direct-form-II.

Unit 1:	**Hrs: 8**

Continuous time and discrete time signals, transformations of the independent variable, exponential and sinusoidal signals, the unit impulse and unit step functions, Continuous-time and discrete-time systems, basic system properties.
Text1: 1.1,1.2,1.3,1.4, 1.5, 1.6

Self-Study Content:
1. Perform a case study to analyse various types of signals used in real-time applications and present the findings.

Unit 2:	**Hrs: 8**

Linear Time Invariant Systems: Discrete-time LTI systems- The Convolution sum, Continuous-time LTI systems- The Convolution integral, properties of linear time-invariant systems, Causal LTI systems described by differential and difference equations and Block diagram representations of first-order systems described by differential and difference equations. (Direct form-I and Direct form- II).
Text1: 2.1 to 2.4.3

Self-Study Content:
1. Develop a comprehensive understanding of Linear Time-Invariant (LTI) systems by studying the convolution integral for continuous-time systems and key properties of LTI systems.

Unit 3:	**Hrs: 8**

Fourier Series Representation of Periodic Signals: Fourier series representation of continuous-time periodic signals, Properties of Continuous–Time Fourier Series (Linearity, Time Shifting, Multiplication, Parseval's relation for CT periodic signals).
The CT Fourier Transform: Representation of Aperiodic signals: The continuous time Fourier transform, Properties of continuous- time Fourier Transform (Linearity, Time shifting, Time and Frequency scaling, Parseval's Relation), The Convolution property.
Text1: 3.3, 3.5, 4.1,4.3,4.3.1,4.3.5,4.3.7, 4.4

Self-Study Content:
1. Apply the properties of the Fourier Transform to determine the Inverse Fourier Transform of given

signals.
2. Develop a code to find the frequency response of LTI systems described by differential or difference equation.

Unit4:	**Hrs:8**

Fourier Series Representation of Discrete-Time Periodic Signal, Properties of Discrete-Time Fourier Series.
The Discrete-Time Fourier Transform: Representation of Aperiodic Signals: The Discrete-Time Fourier Transform, Properties of the Discrete-Time Fourier Transform, The Convolution Property, The Multiplication Property.
Text 1: 3.6, 3.7, 5.1, 5.3, 5.4, 5.5.

Self-Study Content:
1. Explore the process of finding the Inverse Discrete-Time Fourier Transform (IDTFT) using its fundamental properties and apply them to reconstruct time-domain signals from their frequency-domain representations..

Unit 5:	**Hrs: 8**

Sampling: Representation Of continuous-Time signals by its samples: The sampling theorem.
The Z–Transforms: The Z – transform, Properties of the region of convergence, Properties of the Z – transform, Inversion of the Z-transform, Computational structures for implementing discrete-time LTI Systems, The Unilateral Z transform.
Text1:7.1
Text 2: **7.1, 7.2, 7.3, 7.4, 7.5, 7.9, 7.10.**

Self-Study Content:
1. Study the Z-transform of standard discrete-time signals such as the unit impulse, unit step, and cosine signals and apply the differentiation property of the Z-transform to derive the transforms of selected signals.
2. Analysis and characterization of LTI systems using Z-transforms.

Suggested Learning Resources:

Textbooks:

	Title	Author	Year & Edition **(Latest)**	Publisher
1.	Signals and Systems	V.Oppenheim, Alan Willsky and A.Hamid Nawab	2nd edition, 2006	Pearson education asia ISBN: 9789332550230, 9332550239
2.	Signals and Systems	Simon Haykin and Barry Van Veen	2nd edition 2008	John Wiley & Sons ISBN:9788126512652, 8126512652
Reference Books:				
1.	Signals and systems	H.P.Hsu, R.Ranjan	2006	Schaum's outlines, TMH ISBN:9780070669185, 007066918X
2.	Signals and systems	A NagoorKani	2010	McGraw Hill ISBN: 9780070151390, 0070151393.
3.	Fundamentals of Signals and Systems	Michael J Roberts, Govind Sharma	2010	McGraw Hill ISBN: 0070702217, 9780070702219

Web links and Video Lectures (e-resources)
1. https://www.youtube.com/watch?v=879pXoml0XI 2. https://www.youtube.com/watch?v=DVuEYt0J11c 3. https://ocw.mit.edu/courses/res-6-007-signals-and-systems-spring-2011/video_galleries/video-lectures/ 4. https://www.youtube.com/playlist?list=PLBlnK6fEyqRhG6s3jYIU48CqsT5cyiDTO 5. **"Fundamentals of Signals & Systems", Benoit Boulet, Charles River Media 2006, ISBN:1-58450-381-5, eISBN: 1-58450-660-1.** https://mlichouri.files.wordpress.com/2013/10/fundamentals-of-signals-and-systems.pdf. 6. **"Signals and Systems", Michael D. Adams, 3rd edition, ISBN: 978-1-55058-674-9.** 7. https://www.ece.uvic.ca/~frodo/sigsysbook/downloads/signals_and_systems-3.0.pdf

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Program Outcome Addressed (PO #) with BTL**
CO1	**Apply** the basic knowledge of mathematics for signals and systems analysis.	Apply	PO1(L2)
CO2	**Analyze** and interpret the behavior of systems in time and frequency domains.	Analyze	PO2 (L4)
CO3	**Evaluate** system properties and frequency response for practical engineering applications.	Evaluate	PO3 (L4)
CO4	**Demonstrate** the knowledge of concepts of signals and systems either in team or Individually to address engineering problems using modern engineering tools.	Creating	PO5, PO7, PO8, PO9, PO11(L5)

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
#1	3											3	
#2		3											3
#3			3										
#4					2		1	1	1		1		

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning(Example)
1. Flip Class. 2. Individual /Team Demonstration/ Collaborative Activity. 3. Modern Tool Usage. 4. Experiential Learning/ project based learning.

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Analog Integrated Circuits Laboratory		
Course Code: P24ECL307	**CIE Marks: 50**	**CIE Weightage:50%**
Teaching hours/week (L:T:P): 0:0:2	**SEE Marks: 50**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 24 hours	**Exam Hours: 03**	
Credits: 01		

Prerequisite:

Fundamental understanding of Basic Electronic Components, Circuit Analysis techniques, Semiconductor Devices (such as diodes, transistor and Op-Amp), and the Principles of Analog Electronics.

Course learning Objectives:

CLO1: Provide the basic knowledge of how to use CRO, Signal generator, Bread board, Power Supply, Ammeter, Voltmeter and how to rig-up the circuits.
CLO2: Design Inverting, Non-inverting amplifiers and Schmitt trigger circuit using Op-Amp.
CLO3: Demonstrate the working of Integrator, Differentiating circuit, Precision half wave and full wave rectifier using 741 IC
CLO4: Analyze the characteristics of MOSFET and Op-amp.
CLO5: Design the RC phase shift oscillators using Op-amp.
CLO5: Understanding the working DAC using Op-Amp.
CLO6: Understand the working of Common Source MOSFET amplifier

Course Content

1. Design of Inverting and Non-Inverting amplifier using 741 IC.
2. Op-amp as Integrator and Differentiator circuit.
3. Determining the Characteristic parameters of Op-Amp 741 IC.
4. Design of inverting Schmitt trigger using 741 IC
5. Precision half wave and full wave rectifier using 741 IC.
6. Implement and Analysis of Op-Amp Based Clipping and Clamping Circuits
7. Design an Op-amp RC Phase shift oscillator.
8. 4 bit R-2R DAC using Op-amp 741 IC.
9. MOSFET drain and transfer characteristics.
10. Implement and test a Common-Source amplifier using a MOSFET.

Open Ended Experiments

1. Design the Voltage regulator circuit to produce a 12V output with a 50mA maximum load current.
2. Implement a MOSFET as a switch in a simple circuit.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Program Outcome Addressed (PO #) with BTL**
CO1	**Apply** the knowledge of basic circuit concepts to experiment for understanding the basic operation and characteristics of 741 IC and MOSFETs.	Apply	PO1(L3)
CO2	**Conduct** experiments to demonstrate concepts related to application of op-amps.	Analyze	PO2(L4)

CO3	**Design** the inverting and non-inverting amplifier, Schmitt trigger circuit, oscillator and voltage regulator for a given specification	Creating	PO3(L6)
CO4	**Investigate** to analyze and design the open ended experiment for a given specification.	Evaluating	PO4(L5)
CO5	**Ability** to work individual and in a team to analyze, to conduct an experiment and to write a report for a given problem statement	Analyze	PO7, PO8, PO9(L4)

Course Articulation Matrix (CAM)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
#1	**2**											**2**	
#2		**3**											**3**
#3			**2**										
#4				**1**									
#5							**1**	**2**	**2**				

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Digital Design and Verilog Laboratory		
Course Code: P24ECL308	**CIE Marks: 50**	**CIE Weightage:50%**
Teaching hours/week (L:T:P): 0:0:2	**SEE Marks: 50**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 24 hours	**Exam Hours: 03**	
Credits: 01		

Prerequisite:

Logic gates, Boolean equations

Course learning Objectives:

CLO1: Realize Logic functions using discrete gate IC's and MSI IC's.
CLO2: Design and implement the combinational logic circuits.
CLO3: Analyze the sequential elements and sequential circuits.
CLO4: Design and implement the sequential logic circuits.
CLO5: Develop Verilog code for given logic functional requirements.

Course Content

1. Realization of given logic function using basic gates
2. Analyze the given logic circuit for its functionality and structure.
3. Develop a logic function for the given specifications by using Mux/Demux (4 variable Boolean expression, Half adder/Subtractor, Full adder/Subtractor, Gray to binary and binary to Gray conversion)
4. Implement 2-bit up-down Synchronous/Asynchronous Counter
5. Develop logic circuit to compare 2-bit numbers in LabVIEW
6. Design and Simulate Modular Counter and shift register in LabVIEW
7. Analyze the given Verilog code for functionality and style of coding.
8. Develop a Verilog code for the given functionality and specification also Verify the developed code through the test bench.
9. Debug and fix the given Verilog code against the given requirement and specification.
10. Develop a Verilog code for the given functionality and specification (UDP/Sequential circuit). Also verify the developed code.
11. Develop a test bench to verify the functionality of a given function.
12. Simulate the given code and analyze the output waveforms and their correlation while identifying the functionality. (Report + team work)

Open Ended Experiments

Design and implement a Temperature sensor or elevator in LabView

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Program Outcome Addressed (PO #) with BTL**
CO1	Analyze the logic function (hardware circuit/ Verilog code) functionality	Analyse (L4)	PO1, PO2(L4)
CO2	Develop the logic function for given specifications	Create (L5)	PO3, PO5(L4)
CO3	Debug the Verilog code for functionality	Evaluate (L5)	PO4, PO5(L5)

CO4	Device a test bench and simulate using Modern tool to verify the given logic function	Apply (L3)	PO2, PO5(L3)
CO5	Apply and uphold professional ethics in the laboratory environment	Demonstrate (L3)	PO6, PO7(L3)

Course Articulation Matrix (CAM)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
#1	**3**	**3**										**3**	**3**
#2			**3**		**2**								
#3				**2**	**2**								
#4		**2**			**3**				**2**				**2**
#5						**1**	**1**						

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Signals and Systems Laboratory		
Course Code: P24ECL309	**CIE Marks: 50**	**CIE Weightage:50%**
Teaching hours/week (L:T:P): 0:0:2	**SEE Marks: 50**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 24 hours	**Exam Hours: 03**	
Credits: 01		

Prerequisite:

Mathematics Foundations: Calculus, Differential equations, Linear algebra basics, Complex numbers, Basic Electrical and Electronics Concepts, Programming Skills.

Course learning Objectives:

CLO1: Generate and analyze basic continuous-time and discrete-time signals using MATLAB for practical signal representation.
CLO2: Verify and interpret fundamental properties of linear time-invariant (LTI) systems through suitable MATLAB simulations.
CLO3: Perform convolution operations and model causal and non-causal systems using difference equations in MATLAB.
CLO4: Compute and analyze Fourier transforms, Fourier series, DTFT, and DTFS for comprehensive frequency-domain analysis.
CLO5: Apply Z-transform, inverse Z-transform, and sampling concepts to relate time-domain and frequency-domain signal analysis.

Course Content

1. Develop a MATLAB code to generate the CTS and DTS of basic signals such as Exponential Signals, Sinusoidal Signals, Exponentially Damped Sinusoidal Signals, Step signals, Impulse and Ramp functions, User defined functions.
2. Develop a MATLAB code to verify the properties of systems.
3. Write a MATLAB code to perform convolution of signals.
4. Model and simulate the behaviour of a causal discrete-time LTI system defined by a difference equation, and compare its response with a non-causal version using time-domain plots.
5. Write a MATLAB code to find the Fourier Transform of the given signal without using inbuilt functions.
6. Generate and plot the truncated Fourier series of a periodic signal (e.g., square, sawtooth) and analyse how increasing the number of harmonics improves signal reconstruction..
7. Write a MATLAB code to find the DTFS of the given signal.
8. Write a MATLAB code to find the DTFT of a given signal by applying suitable properties.
9. Write a MATLAB code to generate sampled signal of a Continuous-time signal.
10. Write a MATLAB code to find Z-transform and inverse of the Z-transform

Open Ended Experiments

Design, implement and experimentally evaluate a MATLAB-based digital signal processing chain (transmitter, channel, receiver) that generates, processes, and reconstructs signals while demonstrating signal-and-system concepts and meeting real-world constraints (noise, sampling, causality).

Course Outcomes: On completion of this course, students are able to:			
COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Program Outcome Addressed (PO #) with BTL**
CO1	Generate and analyze fundamental continuous-time and discrete-time signals using MATLAB for practical representation.	Apply (L2, L3)	PO1, PO2, PO5, PO10, PO11 (L2)
CO2	Verify system properties, perform convolution, and model causal/non-causal LTI systems through MATLAB simulation.	Analyze (L3, L4)	PO1, PO2, PO3, PO4, PO5, PO9
CO3	Compute Fourier transforms, Fourier series, DTFT, and DTFS to analyze signals in the frequency domain.	Evaluate (L4, L5)	PO1, PO2, PO4, PO5, PO6, PO8
CO4	Apply Z-transform, its inverse, and sampling concepts to analyze real-world communication and control systems.	Create (L5, L6)	PO1, PO2, PO5, PO7, PO11

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
#1	**3**	**3**			**3**					**2**	**1**	**3**	**3**
#2	**3**	**3**	**2**	**2**	**2**				**2**			**3**	**3**
#3	**3**	**3**		**2**	**2**	**2**		**1**				**3**	**3**
#4	**3**	**2**			**2**		**2**				**2**	**3**	**2**

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Employability Enhancement Skills – III (CSE/ISE/ECE/CSE(AIML)/CSDS/CSBS)		
Course Code: P24HSMC310A	**CIE Marks:50**	**CIE Weightage:50%**
Teaching hours/week (L:T:P): 0:2:0	**SEE Marks:50**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 40 Hours	**Exam Hours: 3 Hrs**	
Credits: 01		

Course Learning Objectives: This course will enable the students to:

- Calculations involving percentages, profit & loss and discounts.
- Explain concepts behind logical reasoning modules of direction sense and blood relations.
- Prepare students for Job recruitment process and competitive exams.
- Develop Problem Solving Skills.
- Apply programming constructs of C language to solve the real-world problem.

UNIT – I		**06 Hours**
Quantitative Aptitude: Number System – Divisibility & Remainder, Multiples & Factors, Integers, HCF & LCM, Decimal Fractions, Surds & Indices, Simplification.		
Self-study component:	Linear equations.	
UNIT – II		**06 Hours**
Quantitative Aptitude: Percentages, Profits, Loss and Discounts. **Logical Reasoning:** Blood Relations.		
Self-study component:	Inferred meaning, Chain rule.	
UNIT – III		**06 Hours**
Logical Reasoning: Direction Sense Test. **Verbal Ability:** Change of Speech and Voice, Sentence Correction.		
Self-study component:	Height & distance.	
UNIT – IV	**C-PROGRAMMING - I**	**06 Hours**
Introduction: Keywords and Identifier, Variables and Constants, Data Types, Input/Output, Operators, Simple Programs. **Flow Control:** If…else, for Loop, while Loop, break and continue, switch…case, goto, Control Flow Examples, Simple Programs. **Functions:** Functions, User-defined Functions, Function Types, Recursion, Storage Class, Programs **Arrays:** Arrays, Multi-dimensional Arrays, Arrays & Functions, Programs.		
Self-study component:	Evaluation of Expression.	

UNIT – V	C-PROGRAMMING - II	06 Hours

Pointers: Pointers, Pointers & Arrays, Pointers and Functions, Memory Allocation, Array & Pointer Examples.

Strings: String Functions, String Examples, Programs.

Structure and Union: Structure, Struct & Pointers, Struct & Function, Unions, Programs.

Programming Files: Files Input/output

Self-study component:	Error handling during I/O operations.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Exhibit amplified level of confidence to express themselves in English.	Applying	L3
CO2	Solve the problems based on Number systems, percentages, profit & loss and discounts.	Analyzing	L4
CO3	Solve logical reasoning problems based on direction sense and blood relations.	Analyzing	L4
CO4	Apply suitable programming constructs of C language and / or suitable data structures to solve the given problem.	Applying	L3

Text Book(s):

1. The C Programming Language (2nd edition) by Brian Kernighan and Dennis Ritchie.
2. C in Depth by S K Srivastava and Deepali Srivastava.
3. Quantitative aptitude by Dr. R. S Agarwal, published by S. Chand private limited.
4. Verbal reasoning by Dr. R. S Agarwal, published by S. Chand private limited.

Reference Book(s):

1. E. Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill. Brian W. Kernighan and Dennis M. Ritchie, The 'C' Programming Language, Prentice Hall of India.
2. Quantitative Aptitude by Arun Sharma, McGraw Hill Education Pvt Ltd.

Web and Video link(s):

1. Problem Solving through Programming in C - https://archive.nptel.ac.in/courses/106/105/106105171/

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1; Exhibit amplified level of confidence to express themselves in English.	1								2	3	1
CO2: Solve problems based on number systems, percentages, profit & loss and discounts.	3	3		2	1					2	1
CO3: Solve logical reasoning problems based on direction sense and blood relations.	2	3	2	2	1				1	2	
CO4: Apply suitable programming constructs of C language and / or suitable data structures to solve the given problem.	3	3	3	2	3				1	2	2

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: National Service Scheme		
Course Code: P24NSS311	**CIE Marks:50**	**CIE Weightage:50%**
Teaching hours/week (L:T:P): 0:0:2	**SEE Marks:50**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 20-24 Hrs	**Exam Hours: -**	
Credits: 00		

Course Outcomes (COs):

Upon successful completion of this course, students will be able to:

CO1: Analyze Indian agriculture and organic farming: Assess historical and current trends in Indian agriculture, focusing on organic farming's potential for sustainability and market access.

CO2: Design waste management systems: Apply the 5 R's to design and evaluate waste management solutions considering technical, economic, and environmental factors.

CO3: Develop women's empowerment strategies: Create plans for information-sharing platforms to address women's social and economic needs and promote community participation.

CO4: Apply engineering to sustainable development: Integrate engineering knowledge to develop practical solutions for organic farming, waste management, and community development.

CO5: Evaluate sustainable development impacts: Assess the social, economic, and environmental impacts of sustainable development initiatives.

Course Description: This course explores critical aspects of sustainable development, focusing on organic farming practices, effective waste management strategies, and initiatives for empowering women in social and economic spheres. It emphasizes practical application, problem-solving, and community engagement.

Course Content:

- Organic farming and its role in Indian agriculture (historical context, current practices, and future trends). Emphasis on connectivity for marketing organic produce.
- Waste management strategies across public, private, and governmental organizations, with a focus on the 5 R's (Reduce, Reuse, Recycle, Recover, Refuse).
- Establishing information-sharing platforms for women to address social and economic challenges.

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Physical Education		
Course Code: P24PED311	**CIE Marks:50**	**CIE Weightage:50%**
Teaching hours/week (L:T:P): 0:0:2	**SEE Marks:50**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 20-24 Hrs	**Exam Hours: -**	
Credits: 00		

Course Outcomes: At the end of the course, the student will be able to

1. Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional/state / national / international levels.
5. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.
6. Understand and practice of Traditional Games

Module I: Orientation 4 Hours

1. Lifestyle
2. Health & Wellness \
3. Pre-Fitness test.

Module II: General Fitness & Components of Fitness 4 Hours

1. Warming up (Free Hand exercises)
2. Strength – Push-up / Pull-ups
3. Speed – 30 Mtr Dash

Module III: Specific games (Any one to be selected by the student) 16 Hours

1. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
2. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Yoga		
Course Code: P24YOG311	**CIE Marks:50**	**CIE Weightage:50%**
Teaching hours/week (L:T:P): 0:0:2	**SEE Marks:50**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 20-24 Hrs	**Exam Hours: -**	
Credits: 00		

Course Outcomes (COs):

Upon successful completion of this course, students will be able to:

CO1: Understand Yoga's principles and philosophy: Explain the meaning, history, schools, aims, and importance of prayer in Yoga.

CO2: Perform basic Yoga practices safely: Execute Suryanamaskar and selected Asanas with proper technique, breathing, and safety awareness.

CO3: Analyze Yoga's benefits and contraindications: Explain the physiological and Psychological benefits and identify contraindications and precautions for various practices.

CO4: Apply Yoga for stress management and well-being: Integrate Yoga into daily life for Stress reduction, focus enhancement, and improved well-being.

CO5: Evaluate Yoga misconceptions: Identify and debunk common myths, promoting a Scientifically informed understanding of Yoga.

Course Description: This course introduces students to the fundamental principles and practices of Yoga, emphasizing its holistic benefits for physical, mental, and emotional well-being. It explores the philosophical underpinnings of Yoga, various techniques, and their practical application in daily life. The course also addresses common misconceptions and provides guidelines for safe and effective practice.

Course Content:

- **Introduction to Yoga:**
  - Meaning and Definitions of Yoga
  - Historical Overview and Different Schools of Yoga (e.g., Hatha, Raja, Karma, Bhakti)
  - Aim and Objectives of Yoga: Physical health, mental clarity, spiritual growth, stress management.
  - Importance of Prayer and its role in Yoga
- **Yogic Practices for Common Man:**
  - Brief introduction to various yogic practices suitable for beginners.
  - Focus on promoting positive health and stress reduction.
- **Rules and Regulations for Yogic Practices:**
  - Guidelines for safe practice (e.g., appropriate time, place, clothing, empty stomach).
  - Contraindications and precautions for specific conditions.
- **Misconceptions of Yoga:**
  - Addressing common myths and misunderstandings about Yoga.
  - Clarifying the scientific basis of Yoga's benefits.
- **Suryanamaskar (Sun Salutation):**
  - Suryanamaskar prayer and its meaning.
  - Need, importance, and benefits of Suryanamaskar.
  - Detailed breakdown of the 12 counts with proper breathing and movement coordination.

- Practice of 2 rounds.

- **Asanas (Postures):**
  - Meaning and importance of Asanas.
  - Detailed study of the following Asanas:
    - **Sitting:** Padmasana (Lotus Pose), Vajrasana (Thunderbolt Pose)
    - **Standing:** Vrikshasana (Tree Pose), Trikonasana (Triangle Pose)
    - **Prone:** Bhujangasana (Cobra Pose), Shalabhasana (Locust Pose)
    - **Supine:** Utthitadvipadasana (Raised Two-Legged Pose), Ardha Halasana (Half Plough Pose)
  - For each Asana:
    - Meaning of the name.
    - Step-by-step technique.
    - Breathing pattern.
    - Benefits.
    - Precautionary measures and contraindications.

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Basic Engineering Mathematics – I		
Course Code: P24MADIP301	**CIE Marks:100%**	**CIE Weightage:100%**
Teaching hours/week (L:T:P): 2:2:0		
Teaching hours of Pedagogy: 40 Hours		
Credits: 00		

Course Learning Objectives: to provide basic concepts of complex trigonometry, vector algebra, differential & integral calculus, vector differentiation and various methods of solving first order differential equations.

UNIT-I	
Complex Trigonometry: Complex Numbers: Definitions & properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof). Vector Algebra: Scalar and vectors. Vectors addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple products-simple problems Self-study components: De-Moivre's theorem (without proof). Roots of complex number - Simple problems.	12 Hrs
UNIT-II	
Differential Calculus: Polar curves –angle between the radius vector and the tangent pedal equation- Problems. Taylors series and Maclaurin's series expansions- Illustrative examples. Partial Differentiation: Elementary problems. Euler's theorem for homogeneous functions of two variables. Total derivatives-differentiation of composite and implicit function. Self-study components: Review of successive differentiation. Formulae for n^{th} derivatives of standard functions- Liebnitz's theorem (without proof). Application to Jacobians, errors & approximations.	10 Hrs
UNIT-III	
Integral Calculus: reduction formulae for $\sin^n x$, $\cos^n x$ and $\sin^m x \cos^n x$ and evaluation of these with standard limits-Examples. Applications of integration to area, length of a given curve, volume and surface area of solids of revolution. Self-study components: Differentiation under integral sign (Integrals with constants limits)-Simple problems.	10 Hrs
UNIT-IV	
Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl and Laplacian (Definitions only). Self-study components: Solenoidal and irrotational vector fields-Problems.	10 Hrs
UNIT-V	
Ordinary differential equations (ODE's): Introduction-solutions of first order and first-degree differential equations: homogeneous, exact, linear differential equations of order one and equations reducible to above types. Self-study components: Applications of first order and first-degree ODE's - Orthogonal	10 Hrs

trajectories of Cartesian and polar curves. Newton's law of cooling, R-L circuits- Simple illustrative examples from engineering field.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Demonstrate the fundamental concepts–in complex numbers and vector algebra to analyze the problems arising in related area of engineering field.
CO2	Identify–partial derivatives to calculate rate of change of multivariate functions
CO3	Apply-the acquired knowledge of integration and differentiation to evaluate double and triple integrals to compute length surface area and volume of solids of revolution and identify velocity, acceleration of a particle moving in a space
CO4	Find analytical solutions by solving first order ODE's which arising in different branches of engineering.

Text Book:

1. B. S. Grewal, Higher Engineering Mathematics (44thEdition2018), Khanna Publishers, New Delhi.

Reference books:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.
2. N. P. Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers, 7th Ed., 2007.

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Additional Communicative English – I		
Course Code: P24HDIP308	**CIE Marks: 100**	**CIE Weightage:100%**
Teaching hours/week (L:T:P): 0:2:0	**SEE Marks: -**	**SEE Weightage: -**
Teaching hours of Pedagogy: 30 Hours	**Exam Hours: 3 Hrs**	
Credits: 00		

Module-1

Introduction to Communication Skills **6 Hours**

Introduction to communication, Meaning and process, Channels of communication, Elements of communication, Barriers to effective communication. Activities - Making introductions, Sharing personal information, Describing feelings and opinions.

Module-2

Listening Skills I **4 Hours**

Hearing vs. Listening, Types of listening, Determinants of good listening, Active listening process, Barriers to listening, Activities - Listening for pronunciation practice, Listening for personal communication, Listening for communication - language functions

Module-3

Speaking Skills I **6 Hours**

Basics of speaking, Elements and Functions of speaking, Structuring your speech, Focusing on fluency, Homographs and Signpost words. Activities – Free Speech and Pick and Speak

Module-4

Reading Skills I **4 Hours**

Developing reading as a habit, Building confidence in reading, improving reading skills, Techniques of reading - skimming and scanning. Activities - understanding students' attitudes towards reading, countering common errors in reading, developing efficiency in reading.

Writing Skills I **4 Hours**

Improving writing skills, Spellings and punctuation, Letter and Paragraph writing. Activity – Writing your personal story

Module-5

Body Language and Presentation Skills **6 Hours**

Elements of body language, Types, Adapting positive body language, Cultural differences in body language. 4 Ps in presentations, Overcoming the fear of public speaking, Effective use of verbal and nonverbal presentation techniques. Activity – Group presentations

Course Outcomes: On completion of this course, students will be able to,

CO 1: Understand the role of communication in personal and professional success

CO 2: Comprehend the types of technical literature to develop the competency of students to Apprehend the nature of formal communication requirements.

CO 3: Construct grammatically correct sentences to strengthen essential skills in speaking & writing and to develop critical thinking by emphasizing cohesion and coherence

CO 4: Demonstrate effective individual and teamwork to accomplish communication goals.

Textbooks and Reference Books:

1. Communication Skills by Sanjay Kumar and Pushpa Lata, Oxford University Press - 2015.
2. Everyday Dialogues in English by Robert J. Dixson, Prentice-Hall of India Ltd., 2006.
3. Developing Communication Skills by Krishna Mohan& Meera Banerjee (Macmillan)

4. The Oxford Guide to Writing and Speaking, John Seely, Oxford.
5. English Language Communication Skills - Lab Manual cum Workbook by Rajesh Kumar Singh, Cengage learning India Pvt Limited – 2018

CO – PO – PSO Matrix

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1												2			
CO2										2					
CO3										2					
CO4									2						
CO									**2**	**2**		**2**			

Academic Year: 2025-26	**Semester: IV**	**Scheme: P24**
Course Title: Statistical Techniques and Analysis (Common to Electronics Streams)		
Course Code: P24MA401B	**CIE Marks:50**	**CIE Weightage:50%**
Teaching hours/week (L:T:P): 2:2:0	**SEE Marks:50**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 40 Hours	**Exam Hours: 3 Hrs**	
Credits: 03		

Course Learning Objectives:

1	**Familiarize** the importance of calculus of complex functions associated in dual plane, best fit curves and regression lines, random variables and probability distributions, use statistical methods to solve Engineering problems.
2	**Apply** C-R equations to find analytic, potential, stream functions, evaluate complex integrals, properties of regression lines, probability functions to analyse distributions, Statistical methods to draw valid conclusions.

Unit	**Syllabus content**	**No. of hours**	
		Theory	**Tutorial**
I	**Calculus of complex functions**: Introduction to complex variables. Definitions- limit, continuity, differentiability and Analytic functions of f(z): Cauchy- Riemann equations in Cartesian and polar forms (no proof)-Harmonic functions, construction of analytic functions when u or v is given: Milne-Thomson method – Problems. Applications to flow problems. Conformal transformations: Introduction, discussion of transformations for $w = z^2, w = z + \frac{1}{z};\ z \neq 0$. **Self-Study:** Derivation of Cauchy – Riemann equation in Cartesian and polar form. Discussion of transformations for $w = e^z$.	06	02
II	**Complex integration:** Bilinear Transformations, line integrals of complex function. Cauchy's theorem, Cauchy's integral formula. Taylor's and Laurent's series – Problems only. Singularities, poles and residues with examples, Cauchy's Residues theorem (statement & Problems only). **Self – Study:** Contour integration Type-I & Type-II problems	06	02
III	**Statistical Methods:** **Statistics:** Brief review of measures of central tendency and dispersion. Moments, skewness and kurtosis. Curve Fitting: Curve fitting by the method of least squares, fitting the curves of the forms $y = ax + b,\ \ y = ab^x$ and $y = ax^2 + bx + c$. **Correlation and regression**: Karl Pearson's coefficient of correlation and rank correlation- problems, Regression analysis, lines of regression and problems. **Self-Study**: Fit a curve of the form $y = ax^b,\ y = ae^{bx}$. Curve Fitting	06	02

	Using the Curve Fitting App in MATLAB, Pearson's Correlation Coefficient in MATLAB and Regression Analysis in MATLAB		
IV	**Probability and Distribution:** **Random variables and Probability Distributions:** Review of random variables. Discrete and continuous random variables- problems. Binomial, Poisson, Exponential, and Normal distributions (with usual notation of mean and variance) – problems. **Joint Probability Distributions:** Introduction, Joint probability and Joint distribution of discrete random variables and continuous random variables **Self-study:** Geometric and Gamma distributions – problems. Geometric and Gamma distributions – problems. Normal Distribution and Binomial Distribution and Probability Distributions using MATLAB.	06	02
V	**Stochastic Processes and sampling theory**: **Markov Chains**: Markov Chain: Introduction to Stochastic Process, Probability vector, Stochastic matrix, regular stochastic matrices, Markov chains, higher transition probabilities. **Testing of Hypothesis**: Sampling distributions-introduction. Standard error, Type-I and Type-II errors. Testing of hypothesis and confidence intervals for means. Student's t –distribution and Chi-square distribution as a test of goodness of fit - Illustrative examples only. **Self-study**: Classification of Stochastic process, Bernoulli Process, Poisson Process.	06	02

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: **Understand** fundamental concepts in calculus of complex functions, statistics, probability and special functions.

CO2: **Apply** tools taught to analyze transformations arising in engineering field and evaluate complex integrals and draw statistical inferences.

CO3: Analyze problems in engineering field by employing special functions, complex functions and statistical methods.

CO4: Evaluate integrals of complex functions, regression and correlation coefficient, probability of a discrete and continuous variable, series solution of special differential equations.

TEACHING – LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXTBOOKS

1. B. S. Grewal, Higher Engineering Mathematics (44th Edition 2018), Khanna Publishers, New Delhi.
2. E. Kreysizig, Advanced Engineering Mathematics, John Wiley and sons, 10th Ed. (Reprint) 2016.

REFERENCE BOOKS

1. B. V. Ramana: Higher Engineering Mathematics, McGraw–Hill Education, 11th Ed.,
2. H. C. Taneja, Advanced Engineering Mathematics, Volume I & II, I. K. International Publishing House Pvt. Ltd., New Delhi.
3. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Flip Class 2. Seminar/ poster Presentation 3. Individual Role play/Team Demonstration/ Collaborative Activity 4. Case study 5. Learn by Doing

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3										
CO2	3	3										
CO3	3	2										
CO4	2	3										

Academic Year: 2025-26	Semester: IV	Scheme: P24
Course Title: Principles of Communication Systems		
Course Code: P24EC402	**CIE Marks: 50**	**CIE Weightage: 50 %**
Teaching hours/week (L:T:P): 3:0:0	**SEE Marks: 50**	**SEE Weightage: 50 %**
Teaching hours of Pedagogy:40 hours	**Exam Hours: 03**	
Credits: 03		

Prerequisite:

1. Basic Knowledge of Mathematics
2. Basic understanding of signals and systems
3. Familiarity with electrical circuits and frequency-domain analysis

Course learning Objectives:

CLO1: Understand the fundamental building blocks of communication systems and their roles in information transmission.
CLO2: Explore various analog and digital modulation techniques and their applications in modern communication systems.
CLO3: Gain familiarity with analog, pulse modulation, and baseband transmission concepts
CLO4: Apply the principles of probability and noise analysis to evaluate the performance of modulation and detection schemes.
CLO5: Introduce advanced digital communication concepts such as M-ary modulation, synchronization, and spread spectrum techniques relevant to current and future communication technologies

Unit 1:	Hrs: 8

Introduction : The Block Diagram of a Communication System, channel characteristics
BASIC MODULATION TECHNIQUES: Linear Modulation, angle modulation, Interference, Feedback Demodulators: The Phase- Locked Loop
Text1: 1.1,1.2, 3.1 to 3.4

Self-Study Content:
1. Explore applications of Phase-Locked Loop (PLL) in Modern Electronics and present the findings.

Unit 2:	Hrs:8

Basic Modulation Techniques : Analog Pulse Modulation, Delta Modulation and PCM, Multiplexing
Principles of Baseband Digital Transmission: Baseband Digital Data Transmission Systems, Line Codes and Their Power Spectra, Effects of Filtering of Digital Data: ISI, Pulse Shaping: Nyquist's Criterion for Zero ISI, Eye Diagrams, Carrier Modulation of Baseband Digital Signals
Text1: 3.5 to 3.7, 4.1 to 4.5, 4.6,4.8

Self-Study Content:
1. Study Eye Diagrams using MATLAB/Python and produce a report.

Unit 3:	Hrs: 8

Overview of Probability and Random Variables: What is Probability?, Random Variables and Related Functions, Statistical Averages, Some Useful pdfs
Noise in Modulation Systems: Signal-to-Noise Ratios, Noise and Phase Errors in Coherent Systems, Noise in Angle Modulation, Threshold Effect in FM Demodulation, Noise in Pulse-Code Modulation
Text1: 5.1 to 5.4, 7.1 to 7.5

Self-Study Content:
1. Explore how noise affects signal quality in wireless communication systems such as Wi-Fi (IEEE 802.11) or LTE. Study and report on the techniques employed in these systems to mitigate the impact of noise and maintain reliable data transmission.

Unit4:	Hrs:8
PRINCIPLES OF DATA TRANSMISSION IN NOISE: Baseband Data Transmission in White Gaussian Noise, Binary Data Transmission with Arbitrary Signal Shapes, Modulation Schemes Not Requiring Coherent References, M-ary PAM, Comparison of Digital Modulation System **Text1:** 8.1 to 8.5	
Self-Study Content: 1. Conduct a case study on how devices use non-coherent detection to save power and cost.	
Unit 5:	**Hrs:8**
ADVANCED DATA COMMUNICATIONS TOPICS: M-ary Data Communications Systems, Power Spectra for Quadrature Modulation Techniques, Synchronization, Spread-Spectrum Communication Systems. **Text1:** 9.1 to 9.4	
Self-Study Content: 1. List the challenges and applications of Spread Spectrum in GPS	

Suggested Learning Resources:

Textbooks:

Sl. No.	Title	Author	Year & Edition	Publisher
1.	Principles of Communications Systems, Modualtion and Noise	Rodger E Ziemer, William H Tranter	2009, Sixth Edition	John Wiley and Sons, Inc.
Reference Books:				
1.	An Introduction to Analog and Digital communications	Simon Haykin, Michael Moher	2007, Second Edition	John Wiley and Sons Pte Ltd
2.	Modern Digital and Analog Communication Systems	B. P. Lathi, Zhi Ding	2010, Fourth Edition	Oxford University Press

Web links and Video Lectures (e-resources)

1. http://www.digimat.in/nptel/courses/video/117105143/L01.html
2. https://onlinecourses.nptel.ac.in/noc21_ee74/preview
3. https://onlinecourses.nptel.ac.in/noc25_ee68/preview

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Program Outcome Addressed (PO #) with BTL**
CO1	**Apply** fundamental mathematics and engineering principles to model the basic architecture of communication systems.	Understand and Apply	PO1, PO2 (L2)
CO2	**Analyze** and **Evaluate** a broad spectrum of analog and digital modulation schemes—	Apply and Analyze	PO1,PO3 (L3-L4)

	including M-ary signalling, synchronization, and spread-spectrum techniques—under noisy conditions using signal-space and error-probability metrics		
CO3	**Investigate** the challenges in digital baseband and passband data transmission and interpret performance of systems using signal space representation and detection strategies.	Evaluate	PO2 (L4)
CO4	**Demonstrate** effective teamwork and strong communication in conducting case studies and implementing experiments/ mini projects related to basics of communication systems.	Apply and demonstrate	PO5,PO7,PO9 (L3-L5)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
#1	3	2										3	2
#2	1		2									1	
#3		3											3
#4					2		2		1				

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)

1. Think pair share
2. Simulation based Hands on Learning
3. Flipped Classroom
4. Chalk and Talk
5. Demonstration-Based Teaching/ Expert talk

Academic Year: 2025-26	**Semester: IV**	**Scheme: P24**
Course Title: Electromagnetic Field Theory		
Course Code: P24EC403	**CIE Marks: 50**	**CIE Weightage: 50 %**
Teaching hours/week (L:T:P): 3:0:0	**SEE Marks: 50**	**SEE Weightage: 50 %**
Teaching hours of Pedagogy:40 hours	**Exam Hours: 03**	
Credits: 03		

Prerequisite:

Vector Calculus, Differential Equations, Physics Fundamentals.

Course learning Objectives:

CLO1: Provide the basic knowledge of electromagnetic fields and waves of radio communication.
CLO2: Describe the basic laws, properties and equations of static electric field using 3– dimensional vector method.
CLO3: Understand the basic laws, properties and equations of static magnetic field using 3 – dimensional vector method.
CLO4: Apply the Maxwell's equations to time varying electromagnetic waves.
CLO5: Study the properties of electromagnetic waves

Unit 1:	**Hrs: 8**

Vectors and Co-ordinate systems: Cartesian coordinates, Cyclindrical coordinates, Spherical Coordinates. **Electrostatic Fields Part1:** Coulomb's law and Field intensity, Electric fields due to Continuous charge distributions- line charge, surface charge, Electric Flux density, divergence of a vector and divergence theorem, Gauss law, Application of Gauss's Law: Point charge, Infinite Line charge.

Text1:2.2 to 2.4, 3.6, 4.2 to 4.6.

Self-Study Content:

1. Study the applications of Electromagnetics in communication.
2. Application of Gauss's Law to Determine the Electric Field Due to an Infinite Sheet of Charge.

Unit 2:	**Hrs:8**

Electrostatic Fields Part 2: Electric potential, Del operator, gradient of a scalar, Relationship between E and V, An Electric Dipole and Flux lines.

Electric Fields in material Space: Convection and Conduction current, Continuity equations and Relaxation time, Boundary conditions.

Electrostatic Boundary–value Problems: Poisson's and Laplace's equations, Uniqueness Theorem

Text1: 3.4, 3.5, 4.7 to 4.9, 5.3, 5.8, 5.9, 6.2 to 6.3.

Self-Study Content:

1. Understand and analyze the concept of energy stored per unit volume in electrostatic fields, including its mathematical formulation and physical significance.

Unit 3:	**Hrs: 8**

Magnetostatics Fields: Biot–Savart's law, Ampere's circuital law, applications of Ampere's law, magnetic flux density, Curl of a vector and Stroke theorem, Maxwell's equations for static fields, Magnetic scalar and vector potentials.

Magnetic Forces: Forces due to magnetic fields, A magnetic dipole, magnetic boundary conditions.

Text 1:7.2-7.7, 3.7, 8.2, 8.4, 8.7

Self-Study Content:

1. Understand the concepts of magnetic dipole moment and torque experienced by a current-

carrying loop in a magnetic field, including their mathematical formulation and physical interpretation	
Unit4:	**Hrs:8**
Maxwell's Equation: Faradays Law, Transformer and Motional Electromotive Forces, Displacement current, Maxwell's equations in final forms, Time Varying Potential. **Electromagnetic Wave Propagation:** Introduction, Waves in general, Wave propagation in Lossy dielectrics, Plane waves in free space, Wave Polarization, Power and Poynting Vector. **Text 1: 9.2-9.6, 10.2, 10.3, 10.5,10.7, 10.8**	
Self-Study Content: 1. Understand the propagation of plane electromagnetic waves through good conductors, with emphasis on wave attenuation, phase velocity, and penetration depth. 2. Study the interaction of plane waves with material interfaces under normal incidence, focusing on the derivation and interpretation of reflection coefficients.	
Unit 5:	**Hrs: 8**
Basics of Wave Propagation: Introduction, Definition and Broad Categorization, Basic Definition, Guided Waves, Unguided Waves, Different modes of wave propagation, Wave application, Noise. **Ground Wave Propagation:** Introduction, Space Wave and Surface Wave, Transition between Surface and Space Wave, Tilt of Wave Front due to Ground Losses. **Space Wave Propagation:** Introduction, Field Strength Relation, Effects of Imperfect Earth, Effects of Curvature of Earth, Effects of Interference Zone, Shadowing Effect of Hills and Buildings. **Sky Wave Propagation:** Introduction, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF of Virtual Height and Skip Distance, Relation between MUF and the Skip Distance. **Text 2: 22.1-22.2, 22.5, 22.6, 22.7, 23.1, 23.3 to 23.5, 24.1 to 24.6, 25.1, 25.4, 25.5, 25.6.**	
Self-Study Content: 1. Study the Structural Details of the Ionosphere. 2. Understand the sources and effects of Electromagnetic Interference (EMI), and explore the principles and practices of Electromagnetic Compatibility (EMC) in electronic systems.	

Suggested Learning Resources:

Textbooks:

Sl. No.	Title	Author	Year & Edition	Publisher
1	Principles of Electromagnetics	Matthew N.O. Sadiku, S.V Kulkarni	6th Edition, 2018	Oxford University Press
2	Antennas and Wave Propagation	John D Kraus, Ronald J Marhefka and Ahmed S Khan	4th Edition, 2015	Tata McGraw Hill

Reference Books:

1.	Electromagnetics with Application	John Kraus and Daniel .A. Fleischer	5th Edition 1999	McGraw Hill
2.	Electromagnetics	Joseph A Edminister, Adapted by: Vishnu priye	2nd Edition, 2013	McGraw–Hill
3	Engineering Electromagnetics	William H. Hayt Jr. John A. Buck and M JaleelAkhtar	8th edition, 2015	McGraw–Hill

Web links and Video Lectures (e-resources)
1. https://archive.nptel.ac.in/courses/108/104/108104087/ 2. http://www.digimat.in/nptel/courses/video/115101005/L05.html

Course Outcomes: On completion of this course, students are able to:			
COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Program Outcome Addressed (PO #) with BTL**
CO1	**Apply** the knowledge of physics and vector calculus to compute parameters of static Electric and Magnetic fields.	Apply	PO1(L3)
CO2	**Analyze** Electric and Magnetic fields	Analyze	PO2(L4)
CO3	**Evaluate** the time-varying electromagnetic fields and waves as governed by Maxwell's equations.	Evaluate	PO2 (L5)
CO4	**Simulate** the applications of electromagnetism in electronic circuits/communication systems	Simulate	PO5, PO7,PO8, (L6)

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

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Flip Class 2. Seminar 3. Team Demonstration 4. Learn by Doing

Academic Year: 2025-26	**Semester: IV**	**Scheme: P24**
Course Title: Digital Signal Processing		
Course Code: P24EC404	**CIE Marks: 50**	**CIE Weightage: 50 %**
Teaching hours/week (L:T:P): 3:0:0	**SEE Marks: 50**	**SEE Weightage: 50 %**
Teaching hours of Pedagogy: 40 hours	**Exam Hours: 03**	
Credits: 03		

Prerequisite:

Basic knowledge on Engineering mathematic, Signals and Systems

Course learning Objectives:

CLO1: Provide the knowledge of DFT/ IDFT and its various properties.
CLO2: Explain the different Fast–Fourier–Transform (FFT) algorithms along with its applications.
CLO3: Understand the design procedure of IIR filters and FIR filters using different techniques.
CLO4: Design the IIR filters from analog filters using different methods.
CLO5: Implementation scheme of IIR and FIR filters using different methods.
CLO6: Exposure to different applications of DSP.

Unit 1:	**Hrs: 8**

Discrete Fourier Transforms (DFT): Frequency Domain Sampling and Reconstruction of discrete-time Signals, Discrete Fourier Transforms, DFT as a linear transformation, its relationship with other transforms. Properties of DFT– Periodicity, linearity and Symmetry Properties, Multiplication of two DFTs–the circular convolution, use of DFT in linear filtering, overlap–save and overlap–add method.
Text1: 7.1.1 ,7.1.2, 7.1.3, 7.1.4, 7.2.1 7.2.2, 7.2.3, 7.3.1

Self-Study Content:
1. Explore the Additional properties of DFT (circular-time shift, Circular- frequency shift, Time reversal, circular convolution, Parseval's relation).
2. Discuss the application of DFT.

Unit 2:	**Hrs:8**

Fast–Fourier–Transform (FFT) Algorithms: Efficient computation of the DFT (FFT algorithms), Direct computation of DFT, Goertzel algorithm, and chirp–z transform. Radix–2 FFT algorithm for the computation of DFT and IDFT–decimation in–time and decimation–in –frequency algorithms.
Text1: 8.1, 8.1.1, 8.1.2,8.1.3, 8.1.5, 8.1.6, 8.2

Self-Study Content:
1. Using different tools develop simulations for applications of FFT algorithm.

Unit 3:	**Hrs: 8**

FIR Filter Design: Characteristics of Practical Frequency Selective filters, FIR filter design: Introduction to FIR filters, design of FIR filters using–Bartlett, Rectangular, Hamming and Kaiser Windows, FIR filter design using frequency sampling technique
Text1: 10.1.2, 10.2.1, 10.2.2, 10.2.3, 10.4

Self-Study Content:
1. Explore the concept of Hanning window, Blackmann window

Unit 4:	**Hrs:8**

Design of IIR Filters From Analog Filters (Butterworth and Chebyshev): Characteristics of commonly used analog filters – Butterworth and Chebyshev filters, analog to analog frequency transformations. Impulse invariance method. Mapping of transfer functions: Approximation of derivative (Bilinear transformation) method.

Text1:10.3.1, 10.3.2, 10.3.3,10.3.4,10.4.1 **Text1:**7.1, 9.1 to 9.5	
Self-Study Content: 1. Understand the concept Matched z transforms. 2. Understand and design the transform the analog filter H(S)= $\frac{S+3}{(S+1)(S+2)}$ to a digital filter using Matched Z-Transform (T=0.5sec).	
Unit 5:	**Hrs: 8**
Implementation of Discrete–Time Systems: Structures for IIR and FIR systems–direct form I and direct form II systems, cascade and parallel realization, Lattice and Lattice Ladder structures for IIR systems, Application of Multirate DSP, Applications of DSP **Text1:**9.1, 9.2, 9.3 **Text2:** 9.9,12.1 to 12.8	
Self-Study Content: 1. Understand the concept Speech processing with different application.	

Suggested Learning Resources:

Textbooks:

Sl. No.	Title	Author	Year & Edition	Publisher
1	Digital Signal Processing–Principles Algorithms and Applications	Proakis & Monalakis	4th Edition, New Delhi, 2007	PHI / Pearson Education ISBN:978-81-317-1000-5.
2	Digital Signal Processing	A. NagoorKani	2nd edition, 2012	McGraw Hill education, ISBN-13: 978-0-07-008665-4, ISBN-10: 0-07-008665-6.

Reference Books:

1.	Discrete Time Signal Processing	Oppenheim and Schaffer	2003	PHI, ISBN -10:9332535035, ISBN-13:9789332535039.
2	Digital Signal Processing	S. K. Mitra	3rd Edition, 2007.	Tata Mc–Graw Hill ISBN: 9780070667563, ISBN-007066756X.
3	Digital Signal Processing	Lee Tan	2007	Elsevier publications ISBN 9780124 59822, ISBN97801 24158931
4	Digital Signal Processing using MATLAB	Sanjit K Mitra	2001	TMH
5	Digital Signal Processing using MATLAB	J.G.Proakis& Ingle	2000	MGH

Web links and Video Lectures (e-resources)
1. http://acl.digimat.in/nptel/courses/video/117102060/L01.html 2. http://libgen.rs/book/index.php?md5=8FA146CE83BC35BE9171560760124653 3. http://libgen.rs/book/index.php?md5=D4D60EB785E913243C06C021246C2EE4

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Program Outcome Addressed (PO #) with BTL**
CO1	**Apply** the knowledge of signals and system to the solve the DFT, FFT and any digital signal processing challenges.	Apply	PO1(L3)
CO2	**Analyze** the differences between DFT, FFT, IDFT, and IFFT algorithms and filtering techniques in terms of computational complexity, accuracy, and suitability for various signal processing applications	Analyze	PO2(L4)
CO3	**Design** the FIR & IIR filters to meet the desired specifications.	Evaluate & Design	PO2(L2),PO3(L5)
CO4	**Utilize** modern digital signal processing tools and simulation platforms to implement, test, and validate discrete-time systems and filter designs.	Analyze	PO4(L4), PO5(L4), PO9(L2),PO109(L2)

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
# 1	**2**											**2**	
# 2	**3**											**3**	
# 3		**2**	**2**										**2**
# 4				**1**	**2**				**1**	**1**			

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Flip Class 2. Individual /Team Demonstration/ Collaborative Activity 3. Tool Usage 4. Learn by Doing

Academic Year: 2024-25	**Semester: IV**	**Scheme: P24**
Course Title: Advanced Digital Design and Verilog		
Course Code: P24EC405	**CIE Marks: 50**	**CIE Weightage: 50 %**
Teaching hours/week (L:T:P): 3:0:0	**SEE Marks: 50**	**SEE Weightage: 50 %**
Teaching hours of Pedagogy: 40 hours	**Exam Hours: 03**	
Credits: 03		

Prerequisite:

Digital electronics.

Course learning Objectives: This course will enable the students to:

CLO1: Analyze given state machine for the possible state transitions, state reductions and outputs
CLO2: Design the Logic circuit for the given state Machine.
CLO3: Understand the delay models, PLI and Task & functions in Verilog HDL.
CLO4: Develop a Switch Level Verilog HDL code for the given functions.
CLO5: Infer the gate level netlist of logic synthesis in Verilog HDL.

Unit 1:	**Hrs: 8**

State Machines: State Tables and Graph, General Models of Sequential Circuits, Design of a Sequence detector, More Complex Design Problems, Guidelines for Construction of State Graphs, Elimination of Redundant States, Equivalent States, Equivalent Sequential Circuits, Reducing incompletely Specified State Tables, Derivation of Flip-Flop Input Equations.
Text 1: 13.3-13.4, 14.1-14.3, 15.1,15.2, 15.4-15.6.

Self-Study Content:
1. Delay elements, Watchdog timer.

Unit 2:	**Hrs: 8**

Sequential Circuit Design: Design Example-Code Converter, Design of Iterative Circuit, Design of a Comparator.
Circuits for Arithmetic Operations: Serial Adder with Accumulator, Design of a Parallel Multiplier, Design of a Binary Divider.
Text 1: 16.2-16.3,18.1-18.3.

Self-Study Content:
1. Digital Camera Controller State Machine, Bluetooth Controller

Unit 3:	**Hrs: 8**

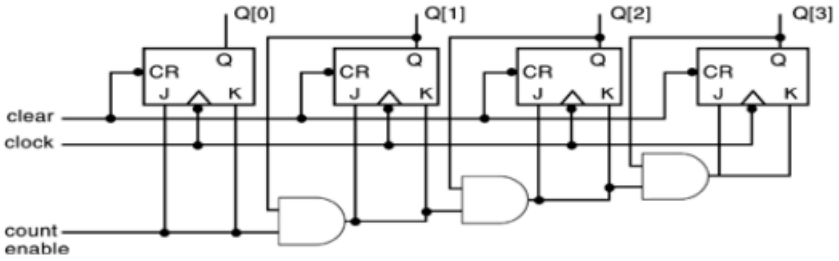
Tasks and Functions: Difference between Tasks and Functions, Tasks, Functions.
Useful Modeling Techniques: Procedural Continuous Assignments, Overriding Parameters, Conditional Compilation and Execution, Time Scales. Useful System Tasks.
Timing and Delays: Types of Delay Models, Path Delay Modeling, Timing Checks, Delay Back Annotation.
Text 2: 8(8.1-8.3), 9 (9.1-9.5), 10 (10.1-10.4)

Self-Study Content:
1. Create a design that uses the full adder example above. Use a conditional compilation(`ifdef). Compile the full add4 with defparam statements if the text macro DPARAM is defined by the `define statement; otherwise, compile the fulladd4 with module instance parameter values.
2. Switch Level Verilog Description for XOR gate.

Unit 4:	**Hrs: 8**

Switch Level Modeling: Switching-Modeling Elements, Examples.
Programming Language Interface: Uses of PLI, Linking and Invocation of PLI Tasks. Internal Data Representation, PLI Library Routines-Access Routines, Utility Routines
Text 2: 11 (11.1-11.2),13(13.1-13.4).

Self-Study Content:
1. Design the 4-bit synchronous counter shown below (Use the UDP jk_ff).



Unit 5:	**Hrs: 8**

Logic Synthesis with Verilog HDL: What is Logic Synthesis?, Impact of Logic Synthesis, Verilog HDL Synthesis, Synthesis Design Flow, Verification of the Gate-Level Netlist, Modeling Tips for Logic Synthesis, Example of Sequential Circuit Synthesis**.**
Text 2: 14(14.1.1-14.7).

Self-Study Content:
1. A 1-bit full subtractor has three inputs x, y, and z (previous borrow) and two outputs D(difference) and B(borrow). The logic equations for D and B are as follows:
   - D = x'y'z + x'yz' + xy'z' + xyz
   - B = x'y + x'z +yz
2. Write the Verilog RTL description for the full subtractor. Synthesize the full subtractor, using any technology library available to you. Optimize for fastest timing. Apply identical stimulus to the RTL and the gate-level netlist and compare the output.

Suggested Learning Resources:

Textbooks:

Sl.No.	Title	Author	Year & Edition **(Latest)**	Publisher
1.	Fundamentals of Logic Design	Charles H. Roth, Jr. Larry L. Kinney	2014, 7th	Cengage Learning
2.	Verilog® HDL, A Guide to Digital Design and Synthesis	Samir Palnitkar	1996 & Second Edition	Pearson Education, ISBN 978-81-775-918-4.

Reference Books:

1.	Advanced Digital Design with the Verilog HDL	Michael D Ciletti	2010 & First Edition	Pearson Education, ISBN:978-0-13-601928-2.
2.	A Verilog HDL Primer	J. Bhaskar	Second Edition	BS Publications, ISBN: 9788178000145, 8178000148

Web links and Video Lectures (e-resources)
1. https://youtu.be/vHLBO05TeyU 2. https://youtu.be/IXjNLK7GC70 3. https://archive.nptel.ac.in/courses/108/105/108105132/ 4. https://archive.nptel.ac.in/courses/117/106/117106114/ 5. https://archive.nptel.ac.in/courses/117/106/117106086/

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Program Outcome Addressed (PO #) with BTL**
CO1	**Draw** the state diagram and derive state equations for the given specifications	Apply	PO1, PO2 [L3]
CO2	**Analyze** the digital circuit for possible combinational and sequential logic.	Analyze	PO1,PO2 [L4]
CO3	**Design** sequential logic circuit for given functionality.	Creating	PO3[L6]
CO4	**Model** verilog code for the given functionality.	Creating	PO3,PO5[L6]
CO5	**Evaluate** the given Verilog code for possible output and its related functionality.	Evaluate	PO4, PO8, PO9, PO11 [L5]

Course Articulation Matrix (CAM)

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
#1	**3**	**3**										**3**	**3**
#2	**3**	**3**										**3**	**3**
#3			**3**										
#4			**3**		**2**								
#5				**3**				**2**	**2**		**2**		

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Flip Class 2. Seminar Presentation 3. Individual Role play/Team Demonstration/ Collaborative Activity 4. Quiz 5. Learn by Doing

Academic Year: 2025-26	**Semester: IV**	**Scheme: P24**
Course Title: ARM Processor		
Course Code: P24EC406	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P): 3:0:0	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy:40 hours	**Exam Hours: 03**	
Credits: 03		

Prerequisite:

1. Digital design.
2. Microcontroller architecture and programming.
3. Computer organization.

Course learning Objectives:

CLO1:Provide the basic knowledge of embedded systems.
CLO2: To study architecture and basics of ARM Cortex-M3/M4 processors.
CLO3:Make use of the instruction sets and addressing modes for writing programs
CLO4: Understand working and applications of interrupts.
CLO5:To study software development for systems based on Cortex-M3/M4 Processor

Unit 1:	**Hrs: 8**

Embedded Electronic Systems and Microcontrollers: What and where are embedded systems, Approaches to Embedded Systems, Small Microcontrollers, Anatomy of a Typical Small Microcontroller, Memory, and Software.
Introduction to ARM Cortex-M Processors: Advantages and Applications of the ARM Cortex - M processors, Resources for using ARM processors and ARM Microcontrollers, Architecture versions and Thumb ISA.
Text2:1.1,1.2, 1.3, 1.4, 1.5, 1.6.
Text1: 1.2, 1.3, 1.4, 1.5.3.

Self-Study Content:

1. Understand the concepts of Introduction to Embedded Software Development flow and Software flow.

Unit 2:	**Hrs: 8**

Technical Overview: General information about the Cortex-M3 and Cortex-M4 processors, Features of the Cortex-M3 and Cortex-M4 processors.
Architecture: Introduction to the architecture, Programmer's model.
Text1: 3.1, 3.2, 4.1, 4.2.

Self-Study Content:

1. Learn Inputs-outputs and peripherals accesses for Embedded Software Development.

Unit 3:	**Hrs: 8**

Architecture: Behaviour of the application program status register (APSR), Memory system, Exceptions and interrupts, System control block (SCB), Debug, Reset and reset sequence.
Text1: 4.3, 4.4, 4.5, 4.6, 4.7, 4.8.

Self-Study Content:

1. Explore Low-Power Modes and Energy Efficiency in ARM Cortex-M Processors.

Unit 4:	**Hrs: 8**

Instruction Set: Understanding the assembly language syntax, Use of a suffix in instructions, Unified assembly language (UAL), Instruction Set, Cortex-M4 specific instructions, Barrel shifter.

Text1: 5.3, 5.4, 5.5, 5.6, 5.7, 5.8.	
Self-Study Content: 1. Study Bit-band operations and Memory system in a microcontroller. 2. Design and develop an assembly level program to generate pseudorandom stream of bits using shift register.	
Unit 5:	**Hrs: 8**
Exceptions and Interrupts: Overview of exceptions and interrupts, Exception types, Definitions of priority, Vector table and vector table relocation, Interrupt inputs and pending behaviours, Exception sequence overview, Details of NVIC registers for interrupt control, Details of SCB registers for exception and interrupt control, Details of special registers for exception or interrupt masking, Example procedures in setting up interrupts, Software interrupts. **Text1:** 7.1, 7.2, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10, 7.11, 7.12	
Self-Study Content: 1. Study and present the journal paper "Oyetoke, O. O. (2017). A practical application of ARM cortex-M3 processor core in embedded system engineering. *International Journal of Intelligent Systems and Applications*, *9*(7), 70" with DOI: https://doi.org/10.5815/ijisa.2017.07.08	

Suggested Learning Resources:

Textbooks:

Sl. no.	Title	Author	Year & Edition **(Latest)**	Publisher
1.	The Definitive Guide to ARM CORTEX M3 AND CORTEX M4 PROCESSORS	Joseph yiu	2014- ISBN: 978-93-5107-175-4	Newnes (Elsevier Science)
2.	MSP430 Microcontrollers Basics	John.H.Davies	2016, ISBN: 978-0-7506-8276-3	Newnes (Elsevier Science)

Reference Books:

1.	The Definitive Guide to ARM Cortex M3	Joseph yiu	2010- ISBN: 978-0-12-382090-7	Newnes (Elsevier Science)
2.	ARM System Developer's Guide	Andrew N Sloss, Dominic Symes, Chris Wright	2004- ISBN 1-55860-874-5	Newnes (Elsevier Science)

Web links and Video Lectures (e-resources)

1. https://www.youtube.com/watch?v=l6M7aqN6dmo
2. **https://www.academia.edu/38330666/MSP430_Microcontroller_Basics_John_H_Davies**

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Program Outcome Addressed (PO #) with BTL**
CO1	**Apply** the knowledge of logic design to understand the concept of 32-bit	Applying	PO1(L3)

	Microcontroller (MC), its instruction set, addressing modes and other features.		
CO2	**Analyze** the working of different peripheral components associated with ARM Cortex M3 and M4	Analyze	PO2 (L4)
CO3	**Develop** logical skills to write programs using ARM instruction set and by using 'C' for the given Engineering Problems.	Creating	PO3 (L6)
CO4	**Investigate** to analyze and write a software code using modern tool for a given specification.	Evaluating	PO4, PO5,PO8,PO9(L5)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
#1	**2**											**2**	
#2		**3**											**3**
#3			**2**										
#4				**1**	**2**			**1**	**1**				

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Flip Class 2. Seminar 3. Individual Role play/Team Demonstration/ Collaborative Activity 4. Case study 5. Learn by Doing

Academic Year: 2025-26	**Semester: IV**	**Scheme: P24**
Course Title: Signal Processing and Communication Laboratory		
Course Code: P24ECL407	**CIE Marks: 50**	**CIE Weightage: 50 %**
Teaching hours/week (L:T:P) :0:0:2	**SEE Marks: 50**	**SEE Weightage: 50 %**
Teaching hours of Pedagogy: 24 hours	**Exam Hours: 03**	
Credits:01		

Prerequisite:

Fundamental understanding of Signal processing, Digital Communication systems, Basics of information theory, Basics of signals and systems.

Course learning Objectives:

CLO1: To study various modulation, demodulation and Multiplexing Techniques.
CLO2: To understand and implement sampling techniques, verify the sampling theorem, and demonstrate aliasing effects.
CLO3: To simulate and interpret signal constellations (e.g., QPSK, QAM) and assess modulation scheme performance under noise.
CLO4: To design and analyse filters for typical signal processing applications.
CLO5: To analyse signals in time and frequency domains

Course Content

1. Develop MATLAB code to perform convolution of two signals and verify properties of convolution.
2. Develop MATLAB code for computation of the N-point DFT and IDFT of a given sequence and to plot magnitude and phase spectrum.
3. Develop MATLAB code to implement sampling theorem and demonstrate aliasing effect.
4. Develop MATLAB code to design and analyze FIR filters using windowing techniques.
5. Develop MATLAB code to design and analyze IIR filters using Butterworth/ Chebyshev methods.
6. Study and Implementation of Digital Modulation Techniques: ASK, FSK, and PSK.
7. Generation of DPSK signal and detection of data using DPSK transmitter and receiver.
8. Develop MATLAB/Simulink model to generate QPSK modulation and demodulation and analyze the constellation diagram.
9. Generation and Detection of Time Division Multiplexed PAM.
10. Analog and Digital Fibre optic links. Attenuation, Bending loss and Numerical aperture measurement of optical fibre.

Open Ended Experiments

1. Generate 8-QAM Modulation and obtain the QAM constellation, Compare it with other techniques like 16- QAM/32- QAM.
2. Design and simulate a real-time voice transmission system using MATLAB/Simulink

Course Outcomes: On completion of this course, students are able to:			
COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Program Outcome Addressed (PO #) with BTL**
CO1	**Analyse** the fundamental principles of sampling, modulation, and multiplexing techniques in analyzing real time signals and communication systems operation.	Analyse	PO1, PO2(L3)
CO2	**Implement** and evaluate digital modulation techniques and compare their performance	Analyse	PO2(L3)
CO3	**Design** and implement filters and modulation schemes for communication applications.	Analyse	PO3, PO5(L3)
CO4	**Investigate** and interpret system performance through experimental setup and simulations, including open-ended exploration	Evaluate	PO4(L4)
CO5	**Demonstrate** the ability to work in teams to conduct experiments ethically and effectively, and communicate findings through reports, discussions and presentations.	Apply	PO5, PO7, PO9(L4)

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
#1	**2**	**1**										**2**	**1**
#2		**3**											**3**
#3			**2**		**2**								
#4				**2**									
#5					**1**		**1**		**1**				

Academic Year: 2025-26	**Semester: IV**	**Scheme: P24**
Course Title: Advanced Digital Design and Verilog Laboratory		
Course Code: P24ECL408	**CIE Marks: 50**	**CIE Weightage: 50 %**
Teaching hours/week (L:T:P) :0:0:2	**SEE Marks: 50**	**SEE Weightage: 50 %**
Teaching hours of Pedagogy: 24 hours	**Exam Hours: 03**	
Credits:01		

Prerequisite:

Digital electronics.

Course learning Objectives:

CLO1:Apply the knowledge of digital design and Verilog code.
CLO2:Infer/Interpret the requirements and develop a Verilog code.
CLO3:Develop test benches for verifying the design RTL.
CLO4:Apply the fundamentals of digital design Verilog coding to evaluate the given Verilog code.

Course Content

1. Develop a Verilog code for 16 bit ALU, implementing the given logic and arithmetic functions.
2. Develop a Verilog code to control the operation of processor for the given control functionality.
3. Develop a Verilog code for the given algorithm.
4. Develop a Verilog code for sorting data packets.
5. Develop a UDP model for a given functionality.
6. Develop a test bench to verify the operation of the given DUT against the specification.
7. Analyse the Verilog code for functionality through simulation.
8. Debug the given Verilog code while enlisting the compilation and runtime error along with the approach highlighting the changes in the code.
9. Evaluate the given Verilog code for timing and functionality.

Open Ended Experiments

1. Develop a verilog code for digital lock with password protection and incorrect attempt tracking.
2. Design and implement a digital circuit in Verilog that controls a simple traffic light system. The system should have the following features:
   1. Three colors: Red, Yellow, and Green
   2. Timed transitions between colors (e.g., Green for 10 seconds, Yellow for 2 seconds, Red for 10 seconds)
   3. Optional: Include pedestrian signals or emergency override functionality

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Program Outcome Addressed (PO #) with BTL**
CO1	Applying the fundamentals of digital design and Verilog language basics and Analyze given Verilog code for functionality and structure/style	Apply	PO1, PO3,PO5[L3]
CO2	Develop Verilog code for given requirements and verify the design.	Apply	PO1,PO3,PO5[L3]

CO3	Debug the given Verilog code for compilation and run time errors, record observations and report.	Understand	PO2, PO4, PO5,PO9[L2]
CO4	Evaluate the Verilog code for timing and functionality. Record observations and report	Understand	PO3,PO4,PO5, PO9[L2]
CO5	Upload professional ethics, safety and societal responsibility.	Remember	PO6,PO7[L1]

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
#1	**3**		**3**		**2**							**3**	
#2	**3**		**3**		**2**							**3**	
#3		**3**		**2**	**2**				**1**				**3**
#4			**2**	**2**	**2**				**1**				
#5						**1**	**1**						

Academic Year: 2025-26	**Semester: IV**	**Scheme: P24**
Course Title: ARM Processor Laboratory		
Course Code: P24ECL409	**CIE Marks: 50**	**CIE Weightage: 50 %**
Teaching hours/week (L:T:P) :0:0:2	**SEE Marks: 50**	**SEE Weightage: 50 %**
Teaching hours of Pedagogy: 24 hours	**Exam Hours: 03**	
Credits:01		

Prerequisite:

1. Digital design.
2. Microcontroller architecture and programming.
3. Computer organization

Course learning Objectives:

CLO1: Understand ARM Processor Architecture
CLO2: Make use of the instruction sets and addressing modes for writing programs
CLO3: Understand working and applications of subroutine.
CLO4: To study software development for systems based on Cortex-M3/M4 Processor.

Course Content

1. Write a program to perform Arithmetic operation- Addition, Subtraction, multiplication, division
2. Write a program to perform Data transfer – Block move and exchange, sorting set of given numbers, finding largest and smallest element in an array.
3. Write a program to perform logical instructions
4. Write a program to find odd or even, positive or negative number.
5. Write a program to find square and cube of a number
6. Write a subroutine program for a given specification
7. Write a program to perform Stepper motor interface and speed control of stepper motor.
8. Write a program to blink the LED's for a given sequence.
9. Write a program to perform Interfacing with LCD unit
10. Interface a 7 Segment LED Counter and write a program in C to display 2-Digit, 3-Digit and 4-Digit count value.

Open Ended Experiments

1. Write a program to generate delay using Timer.
2. Write a program to generate waveform using DAC.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Program Outcome Addressed (PO #) with BTL**
CO1	Develop and execute assembly language programs for ARM to perform arithmetic, logical, and data transfer operations.	Apply	PO1,PO5 (L3)
CO2	Independently develop assembly level programs in ARM Processor for the given problem	Analyze	PO2,PO5 (L4)

CO3	Interface hardware modules to ARM Processor and develop interfacing programs in 'C' language	Evaluate	PO3,PO5(L5)
CO4	Ability to work individual and in a team effectively to analyze and write a report for a given problem	Analyze	PO8, PO9 (L4)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
#1	3				2							3	
#2		3			2								3
#3			2		2								
#4								2		2			

Academic Year: 2025-26	**Semester: IV**	**Scheme: P24**
Course Title: Employability Enhancement Skills – III (CSE/ISE/ECE/CSE(AIML)/CSDS/CSBS)		
Course Code: P24HSMC410A	**CIE Marks:50**	**CIE Weightage:50%**
Teaching hours/week (L:T:P): 1:0:0	**SEE Marks:50**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 40 Hours	**Exam Hours: 3 Hrs**	
Credits: 01		

Course Learning Objectives: This course will enable the students to:

- Calculations involving simple and compound interest, averages, allegations & mixtures, proportions, variations and partnership.
- Explain concepts behind logical reasoning modules of series, coding & decoding, seating and data arrangements.
- Develop problem solving skills through Data structures.

UNIT – I		**06 Hours**

Quantitative Aptitude: Simple and Compound Interest, Averages.

Logical Reasoning: Series, Coding & Decoding.

Self-study component:	Mensuration

UNIT – II		**06 Hours**

Quantitative Aptitude: Allegations and Mixtures, Ratios, Proportions and Variations.

Logical Reasoning: Seating Arrangement, Data Arrangement.

Self-study component:	Types of cryptarithm

UNIT – III		**06 Hours**

Quantitative Aptitude: Partnership.

Verbal Ability: Sentence Completion, Ordering of Sentences.

Self-study component:	Game based assessments

UNIT – IV	**DATA STRUCTURES I - Problem Solving Techniques and Object-Oriented Programming**	**06 Hours**

Recursion: Introduction to recursion, Principle of mathematical induction, Fibonacci numbers, Recursion using arrays, Recursion using strings, Recursion using 2D arrays.

Time and Space Complexity: Order complexity analysis, Theoretical complexity analysis, Time complexity analysis of searching and recursive algorithms, Theoretical space complexity, Space complexity analysis of merge sort.

Backtracking: Introduction to Backtracking, Rat In a Maze, N-queen, Word Search.

Basics of OOP: Introduction to oops, Creating objects, Getters, and setters, Constructors and related concepts, Inbuilt constructor and destructor, Example classes.

Advance Concepts of OOP: Static members, Function overloading and related concepts, Abstraction, Encapsulation, Inheritance, Polymorphism, Virtual functions, Abstract classes, Exception handling.

Self-study component:	Examples of Abstract Data Type	
UNIT – V	**DATA STRUCTURES II – Linear Data Structures and Tress**	**06 Hours**

Linked Lists: Introduction to linked list, Inserting node in linked list, Deleting node from linked list, Midpoint of linked list, Merge two sorted linked lists, merge sort of a linked list, Reversing a linked list.

Stacks and Queues: Introduction to stacks, Stack using arrays, Dynamic Stack class, Stack using linked list, Inbuilt stack, Queue using arrays, Dynamic queue class, Queue using linked list, Inbuilt queue.

Generic Trees: Introduction to Trees, Making a tree node class, Taking a tree as input and printing, Tree traversals, Destructor for tree node class.

Binary Trees: Introduction to Binary Trees, Taking a binary tree as input and printing, Binary Tree traversals, Diameter of binary tree.

Binary Search Trees: Introduction to Binary Search Trees, Searching a node in BST, BST class, Inserting and Deleting nodes in BST, Types of balanced BSTs.

Self-study component:	Huffman tree, Expression Trees.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Solve the problems based on simple and compound interests, averages, allegations & mixtures, ratios, proportions, variations and partnerships.	Applying	L3
CO2	Solve logical reasoning problems based on seating arrangements, data arrangement and verbal ability skills of sentence corrections and ordering of sentences.	Applying	L3
CO3	Analyze and represent various data structures and its operations.	Analyzing	L4
CO4	Develop programs with suitable data structure based on the requirements of the real-time applications	Applying	L3

Text Book(s):

1. Data Structures and Algorithms Made Easy by Narasimha Karumanchi
2. Data Structures through C in Depth by by S K Srivastava and Deepali Srivastava
3. Quantitative aptitude by Dr. R. S Agarwal, published by S. Chand private limited.
4. Verbal reasoning by Dr. R. S Agarwal, published by S. Chand private limited.

Reference Book(s):

1. Aaron M Tenenbaum, Yedidyah Langsam and Moshe J Augenstein, "Data Structures using C", 2014, low price edition ,Pearson education.
2. Seymour Lipschutz ,"Data Structures with C (Schaum's Outline Series)" , July 2017, McGraw Hill Education.
3. Quantitative Aptitude by Arun Sharma, McGraw Hill Education Pvt Ltd.

CO ↓ / PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1: Solve problems on simple & compound interest, averages, alligations & mixtures, ratios, proportions, variations, partnerships.	3	3		2	1					1	2
CO2: Solve logical reasoning & verbal ability problems (arrangements, sentence ordering).	2	3	1	1					1	3	1
CO3: Analyze & represent various data structures and their operations.	3	3	3	3	3					1	1
CO4: Develop programs with suitable data structures for real-time applications.	3	3	3	2	3				1	1	2

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: National Service Scheme		
Course Code: P24NSS411	**CIE Marks:50**	**CIE Weightage:50%**
Teaching hours/week (L:T:P): 0:0:2	**SEE Marks:50**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 20-24 Hrs	**Exam Hours: -**	
Credits: 00		

Course Outcomes (COs):

Upon successful completion of this course, students will be able to:

CO1: Analyze and propose water conservation: Assess water resource issues and recommend conservation strategies considering stakeholder roles.

CO2: Develop rural business proposals: Create actionable business proposals for increasing village income, including market analysis and implementation plans.

CO3: Enhance educational outcomes and access: Design and implement initiatives to improve school performance and promote higher/technical/vocational education enrolment.

CO4: Apply engineering to community development: Integrate engineering knowledge to develop solutions for water conservation, business development, and educational initiatives.

CO5: Evaluate community development impacts: Assess the social, economic, and environmental impacts of community development projects.

Course Description: This course focuses on practical strategies for community development, covering water conservation techniques, business development in rural areas, and educational enhancement initiatives. It emphasizes stakeholder engagement, project planning, and implementation.

Course Content:

- Water conservation techniques, the role of different stakeholders (e.g., government, communities, NGOs), and implementation strategies.
- Developing actionable business proposals to increase village income and outlining implementation approaches.
- Supporting local schools to improve academic results and increase enrolment in higher/technical/vocational education.

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Physical Education		
Course Code: P24PED411	**CIE Marks:50**	**CIE Weightage:50%**
Teaching hours/week (L:T:P): 0:0:2	**SEE Marks:50**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 20-24 Hrs	**Exam Hours: -**	
Credits: 00		

Course Outcomes: At the end of the course, the student will be able to

1. Understand the ethics and moral values in sports and athletics
2. Perform in the selected sports or athletics of student's choice.
3. Understand the roles and responsibilities of organisation and administration of sports and games.

Module I: Ethics and Moral Values 4 Hours

1. Ethics in Sports
2. Moral Values in Sports and Games

Module II: Specific Games (Any one to be selected by the student) 16 Hours

1. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.
2. Athletics (Track Events) – Any event as per availability of Ground

Module III: Role of Organization and administration 4 Hours

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Yoga		
Course Code: P24YOG411	**CIE Marks:50**	**CIE Weightage:50%**
Teaching hours/week (L:T:P): 0:0:2	**SEE Marks:50**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 20-24 Hrs	**Exam Hours: -**	
Credits: 00		

Course Outcomes (COs):

Upon successful completion of this course, students will be able to:

CO1: Understand Yoga's ethics and philosophy: Explain Patanjali's Ashtanga Yoga (Yamas and Niyamas) and their relevance to personal and professional life.

CO2: Perform Yoga practices safely: Execute Suryanamaskar, selected Asanas, Kapalabhati, and Pranayama techniques with correct technique, breathing, and safety awareness.

CO3: Analyze Yoga's effects: Describe the benefits and contraindications of practiced techniques, explaining their impact on body and mind.

CO4: Apply Yoga for well-being: Integrate Yoga for stress management, focus, mindfulness, and overall well-being.

CO5: Understand Yoga's interconnectedness: Articulate the relationship between physical practices,
mental states, and ethical principles in Yoga.

Course Description: This course introduces students to the ancient practice of Yoga, focusing on its physical, mental, and ethical dimensions. It covers key components of Patanjali's Ashtanga Yoga, including Yamas and Niyamas, along with practical training in Asanas, Suryanamaskar, Pranayama, and Shatkarmas like Kapalabhati. The course aims to equip students with tools for stress management, improved focus, and overall well-being.

Course Content:

- **Patanjali's Ashtanga Yoga:** Yama (Ahimsa, Satya, Asteya, Brahmacharya, Aparigraha), Niyama (Shaucha, Santosha, Tapas, Svadhyaya, Ishvarapranidhana)
- **Suryanamaskar:** 12 counts, 4 rounds
- **Asanas:**
  - Sitting: Sukhasana, Paschimottanasana
  - Standing: Ardhakati Chakrasana, Parshva Chakrasana
  - Prone: Dhanurasana
  - Supine: Halasana, Karna Peedasana
- **Kapalabhati:** 40 strokes/min, 3 rounds
- **Pranayama:** Suryanuloma-Viloma, Chandranuloma-Viloma, Suryabhedana, Chandra Bhedana, Nadishodhana

Meaning, Need, importance of Pranayama. Di fferent types. Meaning by name, technique, precautionary measures and benefits of each Pranayama

Academic Year: 2025-26	**Semester: IV**	**Scheme: P24**
Course Title: Basic Engineering Mathematics – II		
Course Code: P24MADIP401	**CIE Marks:100**	**CIE Weightage:100%**
Teaching hours/week (L:T:P): 2:2:0		
Teaching hours of Pedagogy: 40 Hours		
Credits: 00		

Course Objectives: To provide essential concepts of linear algebra, introductory concepts of second & higher order differential equations along with various techniques/methods to solve them, Laplace & inverse Laplace transforms and elementary probability theory.

UNIT-I	
Linear Algebra: Introduction - Rank of matrix by elementary row operations - Echelon form of a matrix. Consistency of system of linear equations - Gauss elimination method. Gauss-Jordan and LU decomposition methods. Eigen values and Eigen vectors of a square matrix. Self-study Components: Application of Cayley-Hamilton theorem (without proof) to compute the inverse of a matrix-Examples.	10 Hrs
UNIT-II	
Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators and variation of parameters. Solution of Cauchy's homogeneous linear equation and Legendre's linear differential equation. Self-study Components: Method of undetermined coefficients	14 Hrs
UNIT-III	
Multiple Integrals: Double and triple integrals-region of integration. Evaluation of double integrals by change of order of integration. Vector Integration: Vector Integration: Integration of vector functions. Concept of a line integrals, surface and volume integrals. Green's, Stokes's and Gauss theorems (without proof) problems. Self-study Components: Orthogonal curvilinear coordinates.	10Hrs
UNIT-IV	
Laplace transforms: Laplace transforms of elementary functions. Transforms of derivatives and integrals, transforms of periodic function and unit step function-Problems only. Inverse Laplace transforms: Definition of inverse Laplace transforms. Evaluation of Inverse transforms by standard methods. Self-study Components: Application to solutions of linear differential equations and simultaneous differential equations.	12Hrs
UNIT-V	
Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability – illustrative examples. Self-study Components: State and prove Bayes's theorem.	06 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply matrix theory for solving systems of linear equations in the different areas of linear algebra.
CO2	Solve second and higher order differential equations occurring in electrical circuits, damped/un-damped vibrations.
CO3	Identify-the technique of integration evaluates double and triple integrals by change of variables, and vector integration technique to compute line integral
CO4	Explore the basic concepts of elementary probability theory and apply the same to the problems of decision theory,

Text Book:

1. B. S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi,43rd Ed.,2015.

Reference books:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.
2. N. P. Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers, 7th Ed., 2007.

Academic Year: 2025-26	**Semester: III**	**Scheme: P24**
Course Title: Additional Communicative English – II		
Course Code: P24HDIP408	**CIE Marks: 100**	**CIE Weightage:100%**
Teaching hours/week (L:T:P): 0:2:0	**SEE Marks: -**	**SEE Weightage: -**
Teaching hours of Pedagogy: 30 Hours	**Exam Hours: 3 Hrs**	
Credits: 00		

Module-1

Listening Skills II — **2 Hours**

Levels of listening, Active listening, Techniques of listening. Activity: Listening for main ideas and Listening for specific information

Speaking Skills II — **6 Hours**

Language of discussion – Giving opinion, agreeing / disagreeing, asking questions, making suggestions. Sentence stress – content and structure words, Speaking situations, Intonations and Summarizing skills

Module-2

Reading Skills II — **2 Hours**

Guessing meaning from the context, Understanding graphical information, Summarizing. Activity: Book review

Writing Skills II — **4 Hours**

Linkers and connectives, Sentence and paragraph transformation, Mind mapping techniques, Letter writing, Essay writing

Module-3

Email Etiquette — **4 Hours**

Parts of an email, Writing an effective subject line, email language and tone. Activity: Email writing practice - Scenario based emails

Group Presentations — **2 Hours**

Group presentations by the students

Module-4

Goal Setting — **2 Hours**

Defining goals, types of goals, Establishing SMART goals, Steps in setting goals, Goal setting activity

Individual Presentations — **4 Hours**

Individual presentation by the students

Module-5

Teamwork — **4 Hours**

Defining teams, Team vs. Group, Benefits and challenges of working in teams, Stages of team building, Building effective teams, Case studies on teamwork

Course Outcomes: On completion of this course, students will be able to,

CO 1: Understand the role of communication in personal and professional success

CO 2: Comprehend the types of technical literature to develop the competency of students to apprehend the nature of formal communication requirements.

CO 3: Construct grammatically correct sentences to strengthen essential skills in speaking & writing and to develop critical thinking by emphasizing cohesion and coherence

CO 4: Demonstrate effective individual and teamwork to accomplish communication goals.

Textbooks and Reference Books:

1. Communication Skills by Sanjay Kumar and Pushpa Lata, Oxford University Press - 2015.
2. Everyday Dialogues in English by Robert J. Dixson, Prentice-Hall of India Ltd., 2006.
3. Developing Communication Skills by Krishna Mohan& Meera Banerjee (Macmillan)
4. The Oxford Guide to Writing and Speaking, John Seely, Oxford.
5. English Language Communication Skills - Lab Manual cum Workbook by Rajesh Kumar Singh, Cengage learning India Pvt Limited – 2018
6. The 7 Habits of Highly Effective People by Stephen R Covey, Simon & Schuster – 2020
7. You Are the Team: 6 Simple Ways Teammates Can Go from Good to Great by Michael G. Rogers

CO – PO – PSO Matrix

CO	PO												PSO		
	PO1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1												2			
CO2										2					
CO3										2					
CO4									2						
CO									**2**	**2**		**2**			