



**GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA
(JHAJJAR)
An Autonomous Institute**

‘A’ GRADE ACCREDITED BY NAAC

**Evaluation Scheme & Syllabus for 3rd Year
Bachelor of Technology Electronics & Communication Engineering
A - SCHEME
(Academic Session: 2026-27)**



APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

DEFINITION OF CREDIT

1	1 Hr. Lecture (L) per week	1 Credit
2	1 Hr. Tutorial (T) per week	1 Credit
3	2 Hr. Practical (Lab) per week	1 Credit
4	2 Hr. Project per Week	1 Credit

1. RANGE OF CREDIT

A range of credits from 160 to 170 for a student to be eligible to get Under Graduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 18-20 credit. These could be acquired through MOOCs.

2. STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM (B.TECH)

Sr. No.	Category	Breakup of Credits
1	Professional Core Courses	69
2	Professional Elective Courses (Relevant to chosen specialization/branch)	12
3	Multidisciplinary Open Elective Courses	09
4	Basic Science Courses	21
5	Engineering Science Courses	25
6	Humanities and Social Sciences including Management courses	12
7	Training/Seminar/Internship/Project	19
8	Value Added Courses	3
9	Mandatory Courses	Non-Credit
	Total Credits	170

3. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Professional Core Courses (Theory Courses)	PCC
2	Professional Core Courses (Lab Courses)	LC
3	Professional Elective Courses (Relevant to chosen specialization/branch)	PEC
4	Multidisciplinary Open Elective Courses	OEC
5	Basic Science Courses	BSC
6	Engineering Science Courses	ESC
7	Humanities and Social Sciences including Management courses	HSMC
8	Training	PT
9	Seminar	SM
10	Internship	INT
11	Project	PROJ
12	Value Added Courses	VAC
13	Mandatory Courses (Non Credit)	MC

General Notes:

1. Students will be required to obtain passing marks in Mandatory Non-Credit Courses.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

**GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA,
JHAJJAR (HR.)**

Scheme of Studies and Examination

B.Tech (Electronics & Communication Engineering) – 5th Semester

W.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Lectures per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in Hours
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-ECE-301A	Electromagnetic & Microwave Engineering	3	0	0	3	3	40	60	-	100	3
2	Professional Core courses	PCC-ECE-303A	Communication Engineering	3	1	0	4	4	40	60	-	100	3
3	Professional Core courses	PCC-ECE-305A	Control System Engineering	3	1	0	4	4	40	60	-	100	3
4	Professional Core courses	PCC-ECE-307A	Computer Organization & Architecture	3	0	0	3	3	40	60	-	100	3
5	Professional Core courses	PCC-ECE-309A	Measurement, Instrumentation & Sensors	3	0	0	3	3	40	60	-	100	3
6	Professional Elective Courses	Refer to Annexure II	Professional Elective (Table-II)	3	0	0	3	3	40	60	-	100	3
7	Professional Core Courses	LC-ECE-321A	Measurement, Instrumentation & Sensors Lab	0	0	2	2	1	25	-	25	50	-
8	Professional Core Courses	LC-ECE-323A	Electromagnetic & Microwave Engineering Lab	0	0	2	2	1	25	-	25	50	-
9	Training	*PT-ECE-325A	Practical Training-I	0	0	2	2	1	25	-	25	50	-
10	Project	PROJ-327A	Mini Project -I	0	0	2	2	1	25	-	25	50	-
Total Credits								24				800	

Note 1:*PT-ECE-325A:-The evaluation will be based on seminar, viva-voce and report submitted by the students. Students must secure the prescribed minimum passing marks to successfully complete the course. Those who fail to obtain the minimum passing marks shall be required to repeat Practical Training-I.

Note 2: Students must choose one course from the Professional Elective-II category (Table 2). They may also opt for Massive Open Online Courses (MOOCs) offered through SWAYAM, SWAYAM Plus, or NPTEL platforms subject to approval by the concerned Chairperson, Board of Studies (BoS)/Head of the Department.

Annexure-II
Professional Elective Courses (Table-II)

S. No	Course Code	Course Name
1	PEC-ECE-311A	Introduction to MEMS
2	PEC-ECE-313A	VHDL & Digital Design
3	PEC-ECE-315A	Speech and Audio Processing
4	PEC-ECE-317A	Introduction to Artificial Intelligence
5	PEC-ECE-319A	Wireless Sensor Network
6	-----	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms

**GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA,
JHAJJAR (HR.)**

Scheme of Studies and Examination

B.Tech (Electronics & Communication Engineering) – 6th Semester

W.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Lectures per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in Hours
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-ECE-302A	Digital Signal Processing	3	1	0	4	4	40	60	-	100	3
2	Professional Core Courses	PCC-ECE-304A	Antenna & Wave Propagation	3	1	0	4	4	40	60	-	100	3
3	Professional Core Courses	PCC-ECE-306A	CMOS Design	3	0	0	3	3	40	60	-	100	3
4	Professional Core Courses	PCC-ECE-308A	Advance Mobile Communication Technologies	3	0	0	3	3	40	60	-	100	3
5	Professional Elective Courses	Refer to Annexure-III	Professional Elective (Table–III)	3	0	0	3	3	40	60	-	100	3
6	Open Elective Courses	Refer to Annexure-III	Open Elective (Table –IV)	3	0	0	3	3	40	60	-	100	3
7	Professional Core Courses	LC-ECE-320A	Digital Signal Processing Lab	0	0	2	2	1	25	-	25	50	-
8	Professional Core Courses	LC-ECE-322A	CMOS Design Lab	0	0	2	2	1	25	-	25	50	-
9	Project	PROJ-324A	Mini Project - II	0	0	2	2	1	25	-	25	50	-
10	Seminar	SM-ECE-326A	Seminar	0	0	2	2	1	50	-	-	50	-
Total Credits								24				800	

Note 1: At the end of 6th semester each student has to undergo Practical Training of 6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester.

Note 2: Students must choose one course from the Professional Elective–III category (Table III) and one course from the Open Elective–I category (Table IV). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

Annexure-III
Professional Elective Courses (Table-III)

S. No	Course Code	Course Name
1	PEC-ECE-310A	Fiber Optic Communication
2	PEC-ECE-312A	High speed electronics
3	PEC-ECE-314A	Adaptive Signal Processing
4	PEC-ECE-316A	Wireless Communication
5	PEC-ECE-318A	Telecommunication & Switching Network
6	-----	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms

Open Elective Courses - 1 (Table-IV)

Sr. No.	Code	Subject	Offered by	Departments Eligible to Choose the Course
1	OEC-01A	Engineering Ethics	Department of Electronics and Communication Engineering	All Engineering Departments
2	OEC-02A	Waste Management	Department of Civil Engineering	All Engineering Departments except the Department of Civil Engineering
3	OEC-03A	Internet of Things and Edge Computing	Department of Computer Science and Engineering	All Engineering Departments
4	OEC-04A	Project Management	Department of Mechanical Engineering	All Engineering Departments
5	OEC-05A	Renewable Energy Resources	Department of Electrical Engineering	All Engineering Departments
6	OEC-06A	United Nation's Sustainable Development Goals	Department of Electronics and Communication Engineering	All Engineering Departments
7	OEC-07A	Computer Aided Risk Analytics	Department of Fire Technology and Safety	All Engineering Departments
8	OEC-08A	Health, Safety and Environment	Department of Fire Technology and Safety	All Engineering Departments except the Department of Fire Technology and Safety
9	OEC-09A	Fundamentals of Additive Manufacturing	Department of Mechanical Engineering	All Engineering Departments except the Department of Mechanical Engineering
10	-----	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

Course Code	PCC-ECE-301A				
Category	Professional Core Courses				
Course Title	ELECTROMAGNETIC & MICROWAVE ENGINEERING				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	0	0	3	
Course Objectives	The objectives of this course are to • To introduce fundamentals of microwave engineering, waveguides, and transmission line concepts. • To study microwave components, ferrite devices, and classical microwave tubes with performance analysis. • To understand solid-state microwave devices and their applications in modern systems. • To study electrostatics, transmission lines, and electromagnetic wave propagation with energy flow analysis				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to:

COs	Skills Demonstrated
CO1	Differentiate various waveguide propagation modes used in microwave systems for efficient signal transmission.
CO2	Apply various techniques for measuring parameters of microwave signals to optimize the performance of microwave devices.
CO3	Identify and explain the working operations of microwave components used for transmitting the microwave signal.
CO4	Analyze the impact of microwave systems on electromagnetic compatibility and human safety.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Electrostatics: Introduction to electric fields, Gauss law and applications, electrostatic potential and energy density, Equations of voltage and current on TX line, Propagation constant and characteristic impedance. Electromagnetic Wave Propagation Wave equations in media, plane waves, Reflection and refraction at interfaces (including Brewster angle, critical angle, total internal reflection), Poynting vector.

Unit-II	Waveguides: Introduction to Microwaves-History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI, EMC, comparison with transmission lines, rectangular wave guide, TE & TM modes, cutoff frequency, dominant mode, characteristic impedance, introduction to circular waveguides and planar transmission lines .
Unit-III	Microwave Components: Directional couplers, tees, S-parameters, attenuators, cavity resonators (Q-factor, bandwidth), mixers & detectors, matched Load and Ferrite devices, Isolators, circulators. Microwave Tubes: Active microwave tubes, Construction, operation and properties of Klystron amplifier, reflex Klystron, magnetron, TWT, Noise figure and gain analysis of microwave tubes.
Unit-IV	Microwave Solid State Devices: Schottky diode, GUNN diode and PIN diodes, GaAs MESFET, HEMT, PHEMT, MMIC devices. Microwave Measurements: Measurement of SWR and VSWR, impedance matching, frequency wavelength and Vector Network Analyzer (VNA), Microwave bridges.

Suggested Readings:

- Microwave devices and circuits by Samuel Liao, PHI
- Microwave Circuits by R.E. Collins, McGraw Hill
- Microwave Circuits by K.C. Gupta and I.J. Bahl, Artech house
- Elements of Electromagnetics by Matthew N.O. Sadiku,, Oxford Univ. Press, 3rd Ed., 2001

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Microwave Frequency bands	https://www.youtube.com/watch?v=8Sdp1PYeboU
	TE & TM modes	https://www.youtube.com/watch?v=dYKGsJGPsDo
Unit-II	Directional couplers	https://www.youtube.com/watch?v=4poo1q3GvTg
	Reflex Klystron	https://www.youtube.com/watch?v=59xw9DsMniY
Unit-III	PHEMT	https://www.youtube.com/watch?v=h-4PuqmTbm8
Unit-IV	Gauss law	https://www.youtube.com/watch?v=qerz-Z-OQiI
	Poynting vector	https://www.youtube.com/watch?v=oW9GO5mVJkY

Course Code	PCC-ECE-303A				
Category	Professional Core Courses				
Course Title	COMMUNICATION ENGINEERING				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	1	0	4	
Course Objectives	The objectives of this course are to • To develop signal analysis using Fourier and sampling techniques. • To explore entropy, channel capacity, coding, and noise concepts. • To develop probability-based analysis of random signals and variables. . • To investigate random processes and coding techniques.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Examine the spectral analysis of signals using Fourier series and transforms.
CO2	Define and understand information theory concepts and methods used to enhance the efficiency of communication systems..
CO3	Implement random theory principles to model and predict system behavior in communication networks.
CO4	Classify filter techniques for detection and performance improvement processes in different communication networks.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Spectral Analysis: Basics of spectral analysis and frequency domain representation of signals. Fourier Series and Fourier Transforms for analysis of periodic and non-periodic signals. Convolution Theorem and its applications in signal processing. Correlation, Cross-Correlation, and Autocorrelation of signals. Sampling Theorem, signal reconstruction, and aliasing effects.
Unit-II	Information Theory: Introduction to information and entropy, channel capacity for discrete and continuous channels, Shannon's Theorem, Shannon-Hartley Theorem, Noisy channels, coding theory : Shannon-Fano coding, minimum redundancy coding, maximization of entropy of a continuous message transmission rate, effect of medium on the information, selection of channels ,effect of noise and its minimization.

Unit-III	Random Signal Theory: Representation of random signals, concept of probability and probability of joint occurrence, conditional probability, discrete probability theory, continuous random variables, probability distribution function, probability density function and joint probability density functions.
Unit-IV	Random Processes and Coding Techniques: Statistical average and moments, Ergodic processes, correlation Function, power spectral density, central limit theory, response of linear system to random signals. Error function Covariance relation among the spectral densities of the two input-output random processes. Cross spectral densities, optimum filters. Introduction to Linear Block Code and cyclic Codes.

Suggested Readings:

- Principles of Communication Systems by Taub Schilling; TMH
- Communication Systems by Singh and Sapre ; TMH
- Communication Systems by A Bruce Carlson; TMH
- Communication Engineering by Sanjay Sharma by S.K. Kataria & Sons
- Communication Systems by Simon Haykin by Pearson

Useful Video Links:

Unit No	Topics	Links
Unit-I	Convolution Theorem	https://www.youtube.com/watch?v=AILISc73eqs
	Fourier series	https://www.youtube.com/watch?v=CDeT2yV_CbM&list=PLU6SqdYcYsfJfRHH0K1CgNkheUKk2fBb6
	Fourier transforms	https://www.youtube.com/watch?v=GtXmS5YH7XM
Unit-II	Shannon's Theorem	https://www.youtube.com/watch?v=7nrIkh0B3Xo
	Shannon-Hartley Theorem	https://www.youtube.com/watch?v=lQHjREaGJVc
	Shannon-Fano coding	https://www.youtube.com/watch?v=g2UIDNamG84
Unit-III	conditional probability	https://www.youtube.com/watch?v=w4B_S_DFqfg
	concept of probability	https://www.youtube.com/watch?v=WyUfvnfa3aw
	distribution function	https://www.youtube.com/watch?v=qQvGv9NREBg
Unit-IV	Ergodic processes	https://www.youtube.com/watch?v=j8FhEZ8nXmA
	Power spectral density	https://www.youtube.com/watch?v=Cg0_k1Dy0b4
	Linear Block Code	https://www.youtube.com/watch?v=dTPzZ3X-wLA

Course Code	PCC-ECE-305A					
Category	Professional Core Courses					
Course Title	CONTROL SYSTEM ENGINEERING					
Scheme and Credits	L	T	P	Credits	Semester-V	
	3	1	0	4		
Course Objectives	The objectives of this course are • To introduce basic control systems. • To explain time domain response and stability. • To apply frequency domain analysis and design. • To explore state space methods and system properties.					
Assessment	40 Marks					
End Semester Examination	60 Marks					
Total	100 Marks					
Duration of Exam	03 Hours					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define feedback and open-loop control architectures and explain the robustness and stability requirements in control design.
CO2	Determine transfer functions using block-diagram reduction and Mason's gain formula and compute transient and steady-state responses to standard inputs.
CO3	Analyze system stability using the Routh–Hurwitz criterion and interpret root-locus plots for closed-loop pole movement and controller design.
CO4	Model LTI systems in state-space form and analyze frequency response using Bode and Nyquist plots for stability and performance.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Basic of Control System : Transfer function, Basic of a control system, Introduction: open-loop control system, close-loop control system, Block diagram, Signal flow graphs, Modeling a control system, Electrical network and Mechanical System, DC and AC servo Systems-Synchronous -Multivariable control system.
Unit-II	Time Response Analysis and Stability Concept: Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and PID controller. Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability,Root Locus and its Application in Control Design.

Unit-III	Frequency Domain Analysis : Bode Plot - Polar Plot- Nyquist Stability Criterion, Relative Stability – Gain and Phase Margins, Design of compensators using Bode Plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation.
Unit-IV	Control System Analysis Using State Variable Methods: Concept of state space representation, Block diagram for a state equation, Solution of state equation, Transfer matrix, Controllability, and Observability. Transfer function of discrete data system, State equations of linear discrete data system, Stability of discrete data system, Steady state error analysis of discrete data control system, Equivalence between transfer function and state variable representations.

Suggested Readings:

- Control Systems Principles and Design by Gopal M, Tata McGraw-Hill.
- Automatic Control Systems by B.C. Kuo, Prentice Hall, Sixth Edition
- Modern Control Engineering, by Katsuhiko Ogata Prentice Hall, Second Edition
- Modern Control Engineering by Nagrath & Gopal, New Age International.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Basic of a control system	https://www.youtube.com/watch?v=XMfH2P2Fc6Q&list=PLWPirh4EWFpGpH_Rb6Q4iQ6vGGRA6MORZ
	Signal flow graphs	https://www.youtube.com/watch?v=vr4Hc0SNghQ
Unit-II	PID controller	https://www.youtube.com/watch?v=R8ldRXmqhMo&t=196s
Unit-III	Bode Plot	https://www.youtube.com/watch?v=vcV7kSFLf7k&list=PLgwJf8NK-2e7ocyYBq-Tv3tb2lR154p2H
Unit-IV	State space representation	https://www.youtube.com/watch?v=PGW2laCpvJ0&list=PLgwJf8NK-2e6zb5ztH0FEnYHKj1HqQxQC
	Controllability and Observability	https://www.youtube.com/watch?v=X0kKlkycwI

Course Code	PCC-ECE-307A					
Category	Professional Core Courses					
Course Title	COMPUTER ORGANIZATION & ARCHITECTURE					
Scheme and Credits	L	T	P	Credits	Semester-V	
	3	0	0	3		
Course Objectives	The objectives of this course are • To develop understanding of data representation and coding. • To gain knowledge of computer organization and CPU architecture. • To build insight into pipelining and parallel processing. • To acquire familiarity with I/O organization and memory hierarchy.					
Assessment	40 Marks					
End Semester Examination	60 Marks					
Total	100 Marks					
Duration of Exam	03 Hours					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Apply data representation techniques, register transfer and micro-operations for efficient data processing.
CO2	Analyze instruction codes, registers, memory operations, and I/O mechanisms in optimizing CPU-I/O communication efficiency.
CO3	Apply architectural concepts and parallel processing principles in designing of CPU.
CO4	Describe the hierarchy, types, and operational mechanisms of memory organization for system optimization.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Data representation: Data Types, Complements, Fixed-Point Representation, Conversion of Fractions, Floating-Point Representation, Gray codes, Decimal codes, Alphanumeric codes, Error Detection Codes Register Transfer and Microoperations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit.

Unit-II	Basic Computer Organization and Design : Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instruction, Input-Output Instruction, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic. Central Processing Unit : General Register Organization, Stack organization, Instruction Format, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC, CISC.
Unit-III	Pipeline and Vector Processing: Introduction to Parallel Processors, Amdahl's Law, parallel bus architectures, Parallelism via Instructions -Instruction-Level Parallelism (ILP) Thread-Level Parallelism (TLP) ,Data-Level Parallelism (DLP) Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors, SIMD Array Processors, Pipeline Hazards.
Unit-IV	Input-output Organization: I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, Privileged and Non-Privileged Instructions, Software Interrupts. Memory organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Writing into Cache, Cache Initialization, Virtual Memory.

Suggested Readings:

- Computer System Architecture by M.Morris Mano, Pearson
- Computer Organization and Design: The Hardware/Software Interface by David A. Patterson and John L. Hennessy, Elsevier.
- Computer Organization and Embedded Systems by Carl Hamacher, McGraw Hill Higher Education.
- Computer Architecture and Organization by latest edition by John P. Hayes, WCB/McGraw-Hill
- Computer Organization and Architecture: Designing for Performance by William Stallings, Pearson Education
- Computer System Design and Architecture by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Useful Video Links:

Unit No.	Topics	Links
Unit I	Data Types	https://www.youtube.com/watch?v=0OoNpd41ZiI
	Error Detection Codes	https://www.youtube.com/watch?v=U7-h2hyM1Dc
	Floating-Point Representation	https://www.youtube.com/watch?v=4gNs7B4ZTjc
	Register Transfer and Microoperations	https://www.youtube.com/watch?v=mNNywW00eEc
Unit II	Instruction Cycle	https://www.youtube.com/watch?v=_W4Yd-yiyog
	Design of Accumulator Logic	https://www.youtube.com/watch?v=Veas4VD5b54
	RISC, CISC	https://www.youtube.com/watch?v=ZW1gb3h-f9k
	Addressing Modes	https://www.youtube.com/watch?v=_CH4cm5PhK8
Unit III	Pipeline and Vector Processing	https://www.youtube.com/watch?v=QLmDUABw0dE
	Array Processors	https://www.youtube.com/watch?v=WIQqig_awGw
	Amdahl's Law	https://www.youtube.com/watch?v=2dYV_IADfFI
Unit IV	Privileged & Non-Privileged Instructions	https://www.youtube.com/watch?v=z0URQryCbI0
	Memory organization	https://www.youtube.com/watch?v=IKVu02WjhoI
	Memory Hierarchy	https://www.youtube.com/watch?v=zwovvWfkuSg

Course Code	PCC-ECE-309A				
Category	Professional Core Courses				
Course Title	MEASUREMENT, INSTRUMENTATION & SENSORS				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	0	0	3	
Course Objectives	The objectives of this course are to • To understand measurement principles and instrumentation systems. • To study transducers and sensors used in measurement systems. • To learn signal conditioning and measurement analysis techniques. • To explore digital instruments and virtual instrumentation systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Apply fundamental principles and characteristics to analyze errors through proper calibration and standardized measurement methods.
CO2	Select and use appropriate analog and digital instruments to measure and display electrical parameters of electronic systems.
CO3	Interpret and apply suitable transducers and bridge circuits for accurate measurement of unknown electrical and non electrical parameters.
CO4	Analyze the signal and its harmonic components in time and frequency domain by using signal analyzers.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Science of Measurement Measurement System – Instrumentation – Characteristics of measurement systems – Static and Dynamic – Errors in Measurements – Calibration and Standards Transducers Classification of Transducers – Variable Resistive transducers – Strain gauges , Thermistor, RTD-Variable Inductive transducers- LVDT, RVDT,- Variable Capacitive Transducers – Capacitor microphone- Photo electric transducers – Piezo electric transducers – Thermocouple – IC sensors - Fiber optic sensors – Smart/intelligent sensors.
Unit-II	Signal Conditioning and Signal Analyzers DC and AC bridges – Wheatstone, Kelvin, Maxwell, Hay and Schering. Pre- amplifier –Isolation amplifier – Filters – Data acquisition systems. Spectrum Analyzers – Wave analyzers – Logic analyzers

Unit-III	Digital Instruments Digital Voltmeters – Millimeters – automation in Voltmeter – Accuracy and Resolution in DVM - Guarding techniques – Frequency counter- Data Loggers – Introduction to IEEE488/GPIB Buses.
Unit-IV	Data Display Recording and Systems Dual trace CRO – Digital storage and Analog storage oscilloscope. Analog and Digital Recorders and printers. Virtual Instrumentation - Block diagram and architecture –Applications in various fields. Measurement systems applied to Micro and Nanotechnology.

Suggested Readings:

- Modern Electronic Instrumentation and Measurement Techniques by Albert D. Helfrick and William D. Cooper, Prentice Hall of India, latest edition
- A course in Electrical & Electronics Measurements & Instrumentation by A.K. Sawhney; Dhanpat Rai & Sons.
- Electronic Instrumentation and Measurements by JB Gupta, Katson Publication.
- Electrical and Electronic Measurements and Instrumentation by R.K Rajput, S.Chand Publications.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Measurement System	https://www.youtube.com/watch?v=pFM9K9JrsU4&list=PLm_MS_Clsnwm8QtyYpwmQpXjp1XnvuKcRk
	Transducers Classification of Transducers	https://www.youtube.com/watch?v=CzafQ5GWz4s
	LVDT	https://www.youtube.com/watch?v=zkixSsT2p7w
Unit-II	AC bridges introduction	https://www.youtube.com/watch?v=5gHei6Bx1JU&list=PLU0veo5_-xYDK6GGasYOLChoFbgJYnYsX
	Maxwell LC bridge	https://www.youtube.com/watch?v=wbhWgqoY8U0&list=PLU0veo5_-xYDK6GGasYOLChoFbgJYnYsX&index=9
	Spectrum Analyzers	https://www.youtube.com/watch?v=8Zhufd64rGg
Unit-III	Digital Voltmeters	https://www.youtube.com/watch?v=rgacCQJulEE
Unit-IV	DVM	https://www.youtube.com/watch?v=Q8SQzc7Yj-0
	Digital storage oscilloscope block diagram and working	https://www.youtube.com/watch?v=0DbpIoJyskk

Course Code	PEC-ECE-311A					
Category	Professional Elective Courses					
Course Title	INTRODUCTION TO MEMS					
Scheme and Credits	L	T	P	Credits	Semester-V	
	3	0	0	3		
Course Objectives	The objectives of this course are • To introduce fundamentals of MEMS, microsystems, scaling, and their applications. • To provide knowledge of MEMS fabrication and micromachining techniques. • To develop understanding of mechanical behavior in MEMS structure. • To familiarize with modeling and analysis of MEMS devices.					
Assessment	40 Marks					
End Semester Examination	60 Marks					
Total	100 Marks					
Duration of Exam	03 Hours					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define MEMS concepts, scaling principles and applications of micro/nano sensors and actuators.
CO2	Explain MEMS fabrication and micromachining techniques for development of microsystems.
CO3	Apply fundamental stress, strain, and energy principles to analyze the mechanical behavior of MEMS structures.
CO4	Analyze MEMS devices using finite element and coupled electromechanical approaches.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Overview of MEMS and Microsystems: Introduction Microsystems vs. MEMS, Microsystems and Microelectronics, the Multidisciplinary Nature of Microsystems design and manufacture, Application of MEMS in various industries.
Unit-II	Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching. Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.
Unit-III	Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes law, Poisson effect, Linear, Thermal Expansion, Bending; Energy methods. Introduction to Scaling, Scaling in Geometry, Rigid Body dynamics, Electrostatic forces, Electromagnetic forces, Electricity, Fluid Mechanics, Heat Transfer.

Unit-IV	Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems: Electrostatics, Coupled electro mechanics.
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Suggested Readings:

- Microsystem Design by Stephen D.Senturia, Kluwer academic publisher,2001.
- Micro-Electromechanical systems by S.E.Lyshevski .
- Fundamentals of Nano-and Microengineering by M. Madou, CRC press, 2005.
- Fundamentals of Microfabrication by M. Madou, CRC Press, 1997.
- Micromachined Transducers Sourcebook by G. Kovacs, McGraw-Hill, Boston, 1998.
- Micromechanical Transducers by M.H. Bao , New York, 2000.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to MEMS & Microsystems MEMS Introduction and Applications	https://www.youtube.com/watch?v=j9y0gfN9WMg onlinecourses.nptel.ac.in
Unit-II	MEMS Fabrication	https://onlinecourses.nptel.ac.in/noc19_ee40/preview
Unit-III	Mechanics of Solids	https://nptel.ac.in/courses/105104160
Unit-IV	A brief Introduction of Micro-Sensors	http://digimat.in/nptel/courses/video/108106165/108106165.html

Course Code	PEC-ECE-313A				
Category	Professional Elective Courses				
Course Title	VHDL & Digital Design				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand the fundamentals of CAD tools and hardware description languages. • To learn VHDL coding techniques to model combinational and sequential circuits. • To get the knowledge of design with programmable logic devices. • To learn the concept of Finite State Machines in VHDL.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain the fundamental concepts of digital electronics and VHDL for digital system design.
CO2	Develop and implement VHDL models for combinational and sequential circuits.
CO3	Analyze the architecture, structure, behaviour and operational functionality of digital systems.
CO4	Implement design logics on programmable logic devices and finite state machines to develop, validate and optimize digital circuits.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction: Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL data objects, classes and data types, Operators, Overloading, logical operators. Types of delays, Generics, Packages and Libraries, Entity and Architecture declaration.
Unit-II	VHDL Statements: Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Subprograms: Functions and Procedures, Structural Modelling, component declaration, structural layout.

Unit-III	Combinational & Sequential Circuit Design: VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders , code converters, comparators, implementation of Boolean functions etc.VHDL Models and Simulation of Sequential Circuits such as Shift Registers, Counter, ALU,RAM, ROM.
Unit-IV	VHDL Programmable logic devices: PLAs, PALs, GAL,PEEL, CPLDs and FPGA. Design of FSM: Moore FSM , Mealy FSM, Moore Mealy variants, Finite State Machine, Modeling of FSM using VHDL.

Suggested Readings:

- VHDL Primer by J Bhasker, Pearson Education/PHI 3rd Edition.
- Digital System Design using VHDLby Charles. H.Roth ; PWS latest edition
- Modern Digital Electronics by III Edition: R.P Jain; TMH latest edition
- VHDL-Analysis & Modelling of Digital Systems by Navabi Z; McGraw Hill
- Fundamentals of Digital Logic with VHDL Design by Brown and Vranesic, TMH latest edition
- VHDLby Perry; TMH latest edition
- Digital System Design with VHDL by Mark Zwolinski, latest edition

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to VHDL	https://www.youtube.com/watch?v=mwJ3uMWvJX0
	Basic Components in VHDL	https://www.youtube.com/watch?v=k6eHc6kUJkk
	Operators, Types of Delays	https://www.youtube.com/watch?v=kXnHbLFEBHw https://www.youtube.com/watch?v=SKiGzphYJ1Q
Unit-II	Basic Structure of VHDL code	https://www.youtube.com/watch?v=PEViqQ_1i1c
	Sequential Statements and Loops	https://www.youtube.com/watch?v=Kta7Svp9dBg
	Sequential and Concurrent Statements	https://www.youtube.com/watch?v=6PWifdwJTzw
	Functions and Procedures in VHDL	Functions and Procedures in VHDL
Unit-III	Multiplexer, Decoders, PLA	https://www.youtube.com/watch?v=3LHNvx9PMQg
	Code Converters	https://www.youtube.com/watch?v=kgL5UaSVuro
	VHDL Modeling of up/down Counter	https://www.youtube.com/watch?v=P-nOuzQEg4Q
	Shift register in VHDL	Shift Registers in VHDL 4 Bit Shift Registers Tutorial with VHDL
Unit-IV	Digital System Design with PLDs and FPGAs	http://www.digimat.in/limesurvey/index.php/117108040
	Design of Finite State Machines	https://www.youtube.com/watch?v=YgtJIUXdCjI https://www.youtube.com/watch?v=XCLmatskK5w

Course Code	PEC-ECE-315A				
Category	Professional Elective Courses				
Course Title	SPEECH & AUDIO PROCESSING				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand speech production and coding techniques. • To analyze speech signals using prediction and quantization. • To study LPC-based speech coding methods. • To learn CELP techniques and speech coding standards.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Identify key concepts of speech production, auditory perception and classification of speech coding techniques.
CO2	Understand speech processing methods including spectral analysis, autocorrelation and linear prediction models.
CO3	Implement speech quantization and coding techniques such as LPC-based methods for speech compression.
CO4	Analyze and compare advanced speech coding techniques like CELP and evaluate speech coding standards based on quality, delay, and robustness.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness.
Unit-II	Speech Signal Processing- pitch estimation, speech filters, convolution, spectral analysis, autoregressive modeling, and autocorrelation estimation. Linear Prediction of Speech - linear prediction concepts, prediction analysis, Levinson–Durbin algorithm, and long-/short-term prediction models. Speech Quantization- scalar and vector quantization, adaptive and differential quantizers, distortion measures, and codebook design.

Unit-III	Scalar Quantization of LPC- Spectral distortion measures, Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF. Linear Prediction Coding- LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model.
Unit-IV	Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis technique. Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero- state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP. Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729 standards

Suggested Readings:

- Digital Speech by A.M.Kondoz
- Speech Coding Algorithms: Foundation and Evolution of Standardized Coders by W.C.Chu, Wiley Inter science
- Fundamentals of Speech Recognition, by Lawrence Rabiner, Bing-Hwang Juang and B. Yegnanarayana, Pearson Publications, 1st Edition
- Speech and Audio Signal Processing by Ben Gold and Nelson Morgan
- Audio Signal Processing and Coding by Andreas Spanias, Ted Painter, and Venkatraman Atti

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Speech Coding: Objectives and Requirements	https://www.youtube.com/watch?v=MBxFVBAzdMc
	Audio Coding: Basic Concepts	https://www.youtube.com/watch?v=aCvceLLrE0k
Unit-II	Linear Prediction of Signals	https://www.youtube.com/watch?v=1k7FPs-6X88
	Basics of Scalar Quantization	https://www.youtube.com/watch?v=CmEV6HdexKc
	Vector Quantization	https://www.youtube.com/watch?v=CKNjEp_38GI
Unit-III	Scalar Quantization -The Quantization Problem	https://www.youtube.com/watch?v=hL1untZ1wwE
	Linear Prediction, Formants	https://www.youtube.com/watch?v=NtTYdYffalY
	LPC for speech synthesis	https://www.youtube.com/watch?v=Sayks31FLXM
Unit-IV	Speech Coding III	https://www.youtube.com/watch?v=y0iIZ8LZ1jc
	Code excited LPC and Residual Excited LPC	https://www.youtube.com/watch?v=7qbxqFIUAI

Course Code	PEC-ECE-317A					
Category	Professional Elective Courses					
Course Title	INTRODUCTION TO ARTIFICIAL INTELLIGENCE					
Scheme and Credits	L	T	P	Credits	Semester-V	
	3	0	0	3		
Course Objectives	The objectives of this course are • To understand the fundamentals of artificial intelligence. • To study AI search and problem-solving techniques. • To learn knowledge representation and logical reasoning methods. • To explore planning and probabilistic reasoning in AI systems.					
Assessment	40 Marks					
End Semester Examination	60 Marks					
Total	100 Marks					
Duration of Exam	03 Hours					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
CO2	Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.
CO3	Analyze Supervised Learning Vs. Learning Decision Trees.
CO4	Design and Implement the applications of Probabilistic Reasoning and Bayesian Networks.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction to AI - Intelligent Agents, Problem-Solving Agents, Searching for Solutions - Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.
Unit-II	Games - Optimal Decisions in Games, Alpha-Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, LogicPropositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.
Unit-III	First-Order Logic - Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution. Knowledge Representation: Ontological Engineering, Categories and Objects, Events.

Unit-IV	Planning - Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning. Probabilistic Reasoning: Acting under Uncertainty, Basic Probability Notation Bayes' Rule and Its Use, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions.
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Suggested Readings:

- Introduction to Artificial Intelligence by Rajendra Akerkar, PHI Publications.
- Artificial Intelligence: A modern approach by Stuart Russell & Peter Norvig, Pearson Publications Fourth Edition.
- Modern Microeconomics: Theory and Applications by H.L. Ahuja, S. Chand & Company Pvt. Ltd.
- Introduction to Artificial Intelligence and Machine Learning by Dr. Swapna, Dr, Bharat Kumar GJ, Dr. Bhoomeshwar Bala, Walnut publications.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Artificial Intelligence	https://www.youtube.com/watch?v=uB3i-qV6VdM&list=PLxCzCOWd7aiHGhOHV-nwb0HR5US5GFKFI
Unit-II	Constraint Satisfaction Problem (CSP) in AI with Example Constraint Satisfaction Algorithm Works	https://www.youtube.com/watch?v=AgyCSmDVk5s https://www.youtube.com/watch?v=udOfKqeLVSg
Unit-III	First order/Predicate logic Artificial Intelligence Negation of Quantifiers Predicate Logic	https://www.youtube.com/watch?v=Aw3EOSr64j0 https://www.youtube.com/watch?v=XYfTz5gziBk
Unit-IV	Planning Introduction - Artificial Intelligence Planning Graph in Artificial Intelligence	https://www.youtube.com/watch?v=TK7ORfbT5UI&list=PLAHr0cis_HGUOO9ISd4dTJ-37qCFtLBgh https://www.youtube.com/watch?v=JGrU9Bcf4wA&list=PLAHr0cis_HGUOO9ISd4dTJ-37qCFtLBgh&index=7

Course Code	PEC-ECE-319A					
Category	Professional Elective Courses					
Course Title	WIRELESS SENSOR NETWORKS					
Scheme and Credits	L	T	P	Credits	Semester-V	
	3	0	0	3		
Course Objectives	The objectives of this course are • To introduce WSN fundamentals, challenges, and applications. • To explain MAC protocols and standards (IEEE 802.15.4, ZigBee). • To develop skills in data dissemination and Internet integration. • To analyze node architecture, hardware design and Tiny OS.					
Assessment	40 Marks					
End Semester Examination	60 Marks					
Total	100 Marks					
Duration of Exam	03 Hours					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define basics constraints, challenges, and applications of WSNs; differentiate from MANETs.
CO2	Explain routing/MAC protocols (S-MAC, B-MAC) and standards (IEEE 802.15.4, ZigBee).
CO3	Apply data dissemination, gathering, fusion, QoS, security, and gateway concepts for WSN–Internet integration.
CO4	Analyze node architecture, hardware constraints, power/security issues, and collaborative processing using Tiny OS.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Fundamentals: Introduction to Sensor Network unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks, Mobile Ad hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks.
Unit-II	Protocol Layer: Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B MAC protocol, IEEE 802.15.4 standard and ZigBee
Unit-III	Data & Gateway Concepts: Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols. Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.
Unit-IV	Node & System Architecture: data collection and processing, collaborative information processing and group connectivity Target tracking, localization and identity management. Power management, Security and privacy, Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to Tiny OS and nesC.

Suggested Readings:

- Fundamentals of Wireless Sensor Networks Theory and Practice by John Wiley & Sons Publications, 2011
- Sensors Handbook by Sabrie Soloman, McGraw Hill 2009
- Wireless Sensor Networks by Feng Zhao, Leonidas Guibas, Elsevier Publications 2004
- Wireless Sensor Networks Technology by Kazem Sohrabi, Wiley-Interscience

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Sensor Network	https://www.youtube.com/watch?v=PrnNKZJj-Oc
Unit-II	MAC protocols	https://www.youtube.com/watch?v=YAjfUc7Tt24&list=PLTmU03EUNiEeHQq1chuiRBb94OspHJtsV_g
Unit-III	Design Principles for WSNs	https://www.youtube.com/watch?v=P16atBN6knc
Unit-IV	Node & System Architecture	https://www.youtube.com/watch?v=VavRifvVwIo

Course Code	LC-ECE-321A				
Category	Professional Core Courses				
Course Title	MEASUREMENT, INSTRUMENTATION & SENSORS LAB				
Scheme and Credits	L	T	P	Credits	Semester-V
	0	0	2	1	
Course Objectives	The objectives of this course are • To provide hands-on exposure to electronic components, instruments, and measurement techniques. • To demonstrate working principles and troubleshooting methods of common electronic instruments. • To train students in the use of test equipment and transducers for measuring physical parameters. • To develop skills for analyzing faults and evaluating the performance of electronic systems.				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain the principles and functioning of electronic components, instruments, and basic measurement systems used in electronic applications.
CO2	Apply electronic instruments and tools to perform measurements and testing of electronic circuits and systems effectively.
CO3	Analyze experimental data to determine performance characteristics of electronic systems and measurement devices.
CO4	Evaluate faults in electronic systems and select appropriate troubleshooting techniques based on observations and measured data.

List of Experiments

Sr.No.	Contents
1	To study and demonstrate the working functions and various faults of the cathode ray oscilloscope.
2	To study and demonstrate the working functions and various faults of the function generator.
3	To study and demonstrate the working functions and various faults of the multimeter.
4	To understand the operating principles of a logic pulser.
5	To study and demonstrate the working functions and various faults of LED TV Trainer.

6	To study the working of strain gauge trainer and measure its parameters.
7	To study the characteristics of LVDT for measuring linear displacement.
8	To study the characteristics of temperature transducers like thermometer, thermocouple etc.
9	To measure the Quality factor of L, R, and C using LCRQ meter.
10	To measure the water level using a capacitive transducer.
11	To measure the differential pressure using a pressure transducer.
12	To study distortion factor meter and determination of the percentage distortion of the given oscillator.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topics beyond the syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	Function Generator debug and repair	https://www.youtube.com/watch?v=x3z2QSVtjSA
2	Understanding of LCR Meters	https://www.youtube.com/watch?v=vi9t5gdog7Q
3	Capacitive Water Level Measurement	https://www.youtube.com/watch?v=0du-QU1Q0T4
4	Pressure Transducer	https://www.youtube.com/watch?v=DVq10SGKHMU
5	Strain Gauge Trainer	https://www.youtube.com/watch?v=nFUo_txmw5M
6	Logic Pulser Working	https://www.youtube.com/watch?v=LIVUUyPI--4
7	LVDT Experiment	https://www.youtube.com/watch?v=00lk2jG_s_E
8	Temperature Transducers (Thermocouple / RTD)	https://www.youtube.com/watch?v=MPu-0xHPOGc

Course Code	LC-ECE-323A				
Category	Professional Core Courses				
Course Title	ELECTROMAGNETIC & MICROWAVE ENGINEERING LAB				
Scheme and Credits	L	T	P	Credits	Semester- V
	0	0	2	1	
Course Objectives	The objectives of this course are to • To study microwave components, waveguides and radiation patterns. • To measure impedance, frequency, wavelength, and VSWR. • To study characteristics and tuning of Reflex Klystron and Gunn diode sources. • To study coupling, insertion loss, directivity, and isolation in microwave devices				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Demonstrate microwave test bench to measure and analyze waveguide parameters and applications.
CO2	Use microwave test bench setup with frequency meter to determine modes and operations.
CO3	Implement techniques of antenna for obtaining radiation pattern and its parameters.
CO4	Analyze waveguide concepts and model wave propagation in rectangular waveguides to understand their behavior and applications.

List of Experiments

Sr. No.	Contents
1	To study various waveguide components and their functions in microwave system.
2	To study an antenna and analyze its radiation pattern for determining beam width.
3	To measure the impedance of an unknown load using microwave measurement techniques.
4	To study isolation and coupling coefficient of a magic Tee.
5	To determine frequency and wavelength in a rectangular waveguide on TE ₁₀ mode.
6	To measure the attenuation of an attenuator.
7	To measure the SWR in a microwave transmission line.
8	To study the characteristics of Reflex Klystron tube to determine its electronic tuning range.
9	To study measurement of relationship among guide dimensions, free space wavelength and guide wavelength
10	To study the characteristics of Gunn oscillator & Gunn diode as a modulated source.
11	To measure coupling coefficient, Insertion loss & Directivity of a Directional coupler.
12	To study the characteristics of radar and determine its radiation range .

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	To determine frequency and wavelength in a rectangular waveguide on TE ₁₀ mode	https://www.youtube.com/watch?v=oh_5D5Jw98E
2	Measurement of SWR in a Microwave transmission line.	https://www.youtube.com/watch?v=tm3oU0SAHA4
3	To measure the impedance of unknown load.	https://www.youtube.com/watch?v=kxPhsyjleA0

Course Code	PT-ECE-325A				
Category	Training				
Course Title	PRACTICAL TRAINING-I				
Scheme and Credits	L	T	P	Credits	Semester-V
	0	0	2	1	
Course Objectives	The objectives of this course are to ● To introduce circuit simulation using industry-standard software tools for electronic analysis. ● To study technical documentation, engineering processes and industry standards in real-world projects. ● To demonstrate professional communication, time management and ethical practices in industrial settings. ● To analyze engineering problems and develop solutions using industry-standard tools and methodologies.				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Interpret industry standards, technical documentation and engineering processes used in real-world projects.
CO2	Interpret industry standards, technical documentation and engineering processes used in real-world projects.
CO3	Demonstrate effective communication, time management skills and professional ethics in an industrial setting.
CO4	Analyze practical engineering problems and develop solutions through teamwork and professional collaboration.
CO5	Evaluate the mechanism for integrating theoretical concepts into innovative practical scenarios to enhance problem-solving skills in industrial applications.
CO6	Integrate engineering tasks using industry-standard tools, software and methodologies under professional supervision.

Guidelines:

- The Practical Training shall be carried out individually or under a faculty/industry mentor, focusing on real-world electronics and communication engineering tasks.
- The training may involve hands-on circuit simulation, hardware testing, or use of industry-standard software tools, with documentation forming an essential part of the work.
- After consultation with the training supervisor, students shall finalize the training title, aim, and objectives based on the assigned industrial problem or domain.

- Students are required to prepare a training plan in the early phase of the semester, including scope of work, tools and software to be used, methodology, and expected outcomes.
- The training work shall involve observation, analysis, and implementation of engineering tasks as per the scheduled timeline under professional supervision.
- Circuit simulation, analysis, and testing should be carried out using industry-standard EDA or simulation software tools such as Multisim, LTspice, or Proteus.
- Students must maintain a training logbook recording daily/weekly activities, observations, and outcomes throughout the semester.
- The completed training, along with documentation in the form of a training report, must be submitted at the end of the semester.
- Students shall strictly follow the professional ethics, discipline, and code of conduct applicable in the industrial or laboratory environment during the training period.
- Effective communication skills, punctuality, and time management must be demonstrated by students throughout the duration of the practical training.
- Students are expected to study and interpret relevant technical documentation, datasheets, and industry standards related to their assigned training domain.
- Teamwork and collaborative problem-solving skills shall be encouraged wherever group-based training activities or industry interactions are involved.
- Available sessions may be utilized for discussions on industry standards, technical documentation practices, professional communication skills, and report writing guidelines.
- At the end of the training, students shall deliver a presentation summarizing their training experience, tasks performed, outcomes achieved, and lessons learned.
- The training report must include an introduction, objectives, tools and technologies used, work performed, results, conclusions, and references following a standard technical documentation format.

Course Code	LC-ECE-327A				
Category	Project				
Course Title	Mini Project - 1				
Scheme and Credits	L	T	P	Credits	Semester-V
	0	0	2	1	
Course Objectives	The objectives of this course are to • The objectives of this course are to • To expose students to domains related to real-world engineering problems. • To introduce structured approaches for project planning, execution, documentation and technical presentation. • To enable the use of engineering concepts, tools and technologies for developing practical project solutions. • To create awareness of ethical, economic, environmental, and sustainability considerations in engineering projects.				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Identify and summarize the problem statement, hardware & software tools and relevant domain for project work planning.
CO2	Develop skills to write technical reports and deliver effective presentations.
CO3	Apply engineering principles and ethics to address real-world problems and foster lifelong learning.
CO4	Implement skills to manage the problem encountered by individuals and as a team for better resource utilization.
CO5	Analyze and assess methods and parameters for optimized resource utilization to ensure an efficient technical solution.
CO6	Design and develop innovative, sustainable, cost-effective and environment friendly solutions to real world problems for societal benefits.

Guidelines:

1. The Mini/Micro Project shall be carried out as a team activity comprising 2 to 4 students, focusing on real-life problems using electronic devices and systems.
2. The project may involve complete hardware or a combination of hardware and software, with the software component limited to less than 50% of the total work.
3. After consultation with the project guide and based on literature survey and need analysis, students shall finalize the project title, aim, and objectives.
4. Students are required to prepare a project proposal in the early phase of the semester, including specifications,

methodology, required resources, and critical design/implementation issues.

5. The project work shall involve design, development, and testing as per the planned schedule.
6. Circuit design, artwork, and layout should be carried out using CAD-based PCB design and simulation software.
7. The completed project, along with documentation in the form of a project report, must be submitted at the end of the semester.
8. Available sessions may be utilized for discussions on standard design practices, PCB design techniques, product development approach, and report writing guidelines.

Useful Video Links:

Details of Links
• https://www.youtube.com/@EEVblog • https://www.youtube.com/@greatscottlab • https://www.youtube.com/@allaboutelectronics • https://www.youtube.com/@mewhorpi • https://www.youtube.com/@Dronebotworkshop • https://www.youtube.com/@AndreasSpiess • https://www.youtube.com/@StuffMadeHere • https://www.youtube.com/@hacksmith • https://www.youtube.com/@allenpan • https://www.youtube.com/@ElectroBOOM • https://www.youtube.com/@adafruit • https://www.youtube.com/@sciguy14 • https://www.youtube.com/watch?v=jtpqsVKtu9Y • https://aislyn.in/project-ideas/electronics-communication-engineering-ideas • https://www.electronicsforu.com/electronics-projects/hardware-diy/ece-projects • https://www.youtube.com/watch?v=5ArmM80YMSM

Course Code	PCC-ECE-302A				
Category	Professional Core Courses				
Course Title	DIGITAL SIGNAL PROCESSING				
Scheme and Credits	L	T	P	Credits	Semester- VI
	3	1	0	4	
Course Objectives	The objectives of this course are • To understand the fundamental concepts and design techniques of digital signal processing. • To get the knowledge of various methods to design FIR and IIR digital filters. • To learn the multirate signal processing techniques in digital signal processing.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain the properties of signals & systems to design and develop digital systems.
CO2	Apply various transforms to process signals in real-time applications.
CO3	Implement various techniques used for designing the digital filters.
CO4	Analyze multirate digital signal processing (MDSP) techniques to solve signal processing problems and improve data efficiency in communication systems.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Discrete-Time Signals and System: DSP: Advantages, Disadvantages, Applications, Classification of signals, representation of discrete systems, Sampling and reconstruction of signals, aliasing, Sampling theorem and Nyquist rate. Z-Transform: Z-Transform, Region of Convergence(ROC), Properties of z-transform, Inverse z-transforms: Long division method, Partial fraction expansion method, Residue method.
Unit-II	Frequency Representation of Signal and Systems: Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Circular convolution, Linear Filtering using DFT, Fast Fourier Transform Algorithm, Decimation in time and Decimation in frequency algorithms for Radix-2 & composite numbers.

Unit-III	Design of Digital Filter :General Specifications and Design Steps, Comparison of FIR & IIR Filters, Design of FIR Filters using Window technique, Frequency sampling Method, Park-McClellan's method, Design of IIR Filters using Impulse Invariance technique, Bilinear Transformation, Design of IIR Filters using Butterworth, Chebyshev and Elliptic filter, Digital frequency transformation.
Unit-IV	Implementation of Discrete Time Systems: Block diagrams and signal flow graphs for FIR and IIR systems, Direct form, Cascade form and Lattice structures for FIR systems, Direct form, Cascade form, Parallel form, and Lattice and Lattice-Ladder Structures for IIR systems, Representation of fixed point and floating point numbers, Finite word length effects. Multirate Digital Signal Processing: Introduction to multirate digital signal processing, Multirate structures for sampling rate conversion, Multistage decimator and interpolators, Polyphase decomposition, Digital Filter Banks

Suggested Readings:

- Digital Signal Processing: Principles, Algorithms And Applications by John G. Proakis and D.G. Manolakis, Prentice Hall, latest edition
- Discrete Time Signal Processing by A.V. Oppenheim and Schafer, Prentice Hall, latest edition
- Digital Signal Processing by Salivahanan, Vallavaraj and Gnanapriya; TMH
- Theory and Application of Digital Signal Processing by L.R. Rabiner and B. Gold, Prentice Hall, latest edition
- Introduction to Digital Signal Processing by J.R. Johnson, Prentice Hall, latest edition
- Digital Signal Processing by D.J. DeFatta, J. G. Lucas and W.S. Hodgkiss, John Wiley & Sons, latest edition

Useful Video Links:

Unit No.	Topics	Links
Unit-I	DSP Introduction	https://www.youtube.com/watch?v=6dFnpz_AEyA
	Sampling and reconstruction of signals	Week 1 Solved Examples: Sampling and Reconstruction NPTEL DSP & Applications
	Z-Transform	https://www.youtube.com/watch?v=0XIYet-VRtA
	Inverse Z-Transform	https://www.youtube.com/watch?v=eqde-Erhk3s
Unit-II	DFT	https://www.youtube.com/watch?v=5HOaW3XA2nQ
	DITFFT	8-Point DFT Solved using Radix-2 DIT FFT Algorithm Digital Signal Processing Problem Tutorial
Unit-III	Design of FIR Filters using Window technique	FIR Filter Design: Different Window Functions Explained (Rectangular, Hamming, Hanning, Blackman)
	Design of IIR Filters using Impulse Invariance technique	What is Impulse Invariance Method in Digital IIR Filter Discrete Time Signal Processing
Unit-IV	Direct form, Cascade form and Lattice structures for FIR systems	Digital Filters: Cascade Form Structure & Realization EC Academy Direct Form I and II Structures of Digital Filters in DSP Transfer Function Representation LATTICE Form Representation of Digital Filters Third-Order and Second-Order Examples EC Academy
	MDSP	What is meant by Multirate Signal Processing or Multirate Sampling Discrete Time Signal Processing
	Polyphase decomposition	How to design Polyphase Filter Multi Rate Signal Processing Discrete Time Signal Processing

Course Code	PCC-ECE-304A				
Category	Professional Core Courses				
Course Title	ANTENNA & WAVE PROPAGATION				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	1	0	4	
Course Objectives	The objectives of this course are • To learn antenna fundamentals and radiation characteristics. • To gain knowledge of various antennas. • To implement antenna arrays and smart antenna concepts.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define and explain key fundamental concepts, characteristics, types and properties of antennas.
CO2	Design and analyze antenna systems by selecting appropriate parameters to meet specified frequency ranges and application requirements.
CO3	Illustrate wave propagation mechanism and their impact on antenna performance.
CO4	Apply synthesis techniques and analyze antenna arrays for desired radiation patterns.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Fundamental Concepts- Physical concept of radiation, Radiation pattern, near and far-field regions, reciprocity, directivity, gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions. Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.
Unit-II	Aperture and Reflector Antennas, Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.
Unit-III	Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas. Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

Unit-IV	Antenna Arrays- Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method. Concept and benefits of smart antennas.
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Suggested Readings:

- Antennas by J.D. Kraus, McGraw Hill, 1988.
- Antenna Theory - Analysis and Design by C.A. Balanis, John Wiley, 1982.
- Antennas and Radio Wave Propagation by R.E. Collin, McGraw Hill, 1985.
- Antenna Engineering Handbook by R.C. Johnson and H. Jasik, McGraw Hill, 1984.
- Micro Strip Antennas by I.J. Bahl and P. Bhartia, Artech House, 1980.
- Electromagnetic Waves by R.K. Shevgaonkar, Tata McGraw Hill, 2005

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Friis transmission equation	https://www.youtube.com/watch?v=Op7bBz6qbwY
Unit-II	Huygens' principle	https://www.youtube.com/watch?v=22YHJDoC7Uw
	Parabolic reflector and Cassegrain antennas.	https://www.youtube.com/watch?v=Ia6OnrqBeP8
Unit-III	Design of rectangular and circular patch antennas.	https://www.youtube.com/watch?v=MihOachw-MM
	Broadcast antenna	https://www.youtube.com/watch?v=cJkkicgfVQ8
Unit-IV	synthesis of antenna arrays using Schelkunoff polynomial method	https://www.youtube.com/watch?v=L9OyJJ_NxMY
	Woodward-Lawson method.	https://www.youtube.com/watch?v=UfCRaw-pmcc

Course Code	PCC-ECE-306A				
Category	Professional Core Courses				
Course Title	CMOS DESIGN				
Scheme and Credits	L	T	P	Credits	Semester- VI
	3	0	0	3	
Course Objectives	The objectives of this course are to • To provide the CMOS circuit’s behavior and its characteristics. • To explain combinational & sequential digital circuits. • To cover different Architectures and performance tradeoffs involved in designing and realizing the circuits in CMOS technology..				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define and explain MOS transistor characteristics, CMOS logic and layout design principles for VLSI circuit implementation.
CO2	Illustrate combinational circuit design techniques considering power consumption, delay and interconnect effects in digital systems.
CO3	Implement sequential circuits with appropriate timing, synchronization and pipelining techniques for reliable system performance.
CO4	Design and optimize CMOS arithmetic units and memory architectures by analyzing and balancing trade-offs in speed, power and area using appropriate techniques to meet performance requirements.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction of MOS Transistor MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V characteristics, C-V characteristics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling..

Unit-II	Combinational Circuit Design Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DPL Power: Dynamic Power, Static Power, Low Power Architecture. Interconnect: Interconnect Modelling and Impact
Unit-III	Sequential Circuit Design Static latches and Registers Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits. Timing Issues: Timing Classification of Digital System, Synchronous Design
Unit-IV	Design of Arithmetic Building Blocks and Subsystem Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff. Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry

Suggested Readings:

- N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4th Edition, Pearson Education India, latest edition
- J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, latest edition
- C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, latest edition
- P. Douglas, VHDL: programming by example, McGraw Hill, latest edition
- L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, latest edition

Useful Video Links:

Unit No	Topics	Links
Unit-I	CMOS logic	https://www.youtube.com/watch?v=Ado4CD7jd68
Unit-II	Cascode Voltage Switch Logic	https://www.youtube.com/watch?v=eXi6P-A6LQ4
Unit-III	Registers Dynamic latches and Registers	https://www.youtube.com/watch?v=SV1qufXTQU
Unit-IV	Designing Memory and Array	https://www.youtube.com/watch?v=EsGxt-XFLYY

Course Code	PCC-ECE- 308A				
Category	Professional Core Courses				
Course Title	ADVANCE MOBILE COMMUNICATION TECHNOLOGIES				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand the fundamentals of cellular and wireless communication systems. • To study wireless propagation models and fading characteristics in mobile channels. • To learn multiple access and digital modulation techniques used in wireless networks. • To explore mobility management and modern cellular technologies including GSM, UMTS, and LTE.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain cellular concepts, communication standards and mobility parameters to enhance efficiency of mobile networks.
CO2	Illustrate large-scale and small-scale fading effects in wireless networks using empirical propagation models.
CO3	Apply modulation techniques and multiple access schemes to efficiently utilize resources and reliable communication in wireless networks.
CO4	Analyze the impact of mobility, handoff mechanisms, power control and protocols in UMTS, LTE and advanced mobile systems to optimize network performance.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Cellular concepts- Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards.

Unit-II	Large scale signal propagation. Fading channels-Multipath and small scale fading- Doppler shift, doppler spread, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate. Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, Indoor Propagation Models-Partition losses (Same Floor), Partition losses between Floors, Log-distance path loss model.
Unit-III	Multiple access schemes -FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM and OFDMA.
Unit-IV	Mobility in Cellular Systems: The Gateway Concept, Measurement Reports, Mobility Procedures - Mobile IP: Basic Components, Tunneling GSM: Architecture, – UMTS: Architecture, Basics of CDMA, - Introduction to LTE: History, Architecture - OFDM – Uplink and Downlink Communication in LTE

Suggested Readings:

- Mobile Cellular Telecommunications Systems by WCY Lee, McGraw Hill, 1990.
- Mobile Communications Design Fundamentals by WCY Lee, Prentice Hall, 1993.
- Mobile Radio Communications by Raymond Steele, IEEE Press, New York, 1992.
- CDMA: Principles of Spread Spectrum Communications by AJ Viterbi, Addison Wesley, 1995.
- Wireless & Personal Communication Systems by VK Garg & JE Wilkes, Prentice Hall, 1996.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Handoff	https://www.youtube.com/watch?v=mNZSQ5dfXOA
	Overview of 2G and 3G cellular standards.	https://www.youtube.com/results?search_query=Overview+of+2G+and+3G+cellular+standards.+
Unit-II	Okumura Model	https://www.youtube.com/watch?v=uzLI85SazM4
	Log-distance path loss model.	https://www.youtube.com/watch?v=lclldIXz3u8
Unit-III	multicarrier modulation	https://www.youtube.com/watch?v=L80aRAUcKyw
	OFDM and OFDMA.	https://www.youtube.com/watch?v=t7ks2llwILY
Unit-IV	Introduction to LTE	https://www.youtube.com/watch?v=DcmnJN3Qgx8&list=PLIjcuHcIw1q56zRPztlDxImMVsbhzwR8Z
	Basics of CDMA	https://www.youtube.com/watch?v=TV8etzFxiQU

Course Code	PEC-ECE- 310A				
Category	Professional Elective Courses				
Course Title	FIBER OPTIC COMMUNICATION				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are • To provide the fundamentals of optical fiber communication and its applications. • To introduce optical fibers, light propagation, and fiber characteristics. • To provide knowledge of optical sources, detectors, and communication system components. • To explain optical fiber links, networks, and recent communication technologies.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Describe the fundamental concepts, characteristics, losses, fabrication methods and applications of optical fiber communication.
CO2	Analyze the structure, efficiency and noise effects of optical sources and detectors in fiber optics.
CO3	Analyze link budget parameters and system effects to enhance the performance of optical communication systems.
CO4	Understand and apply optical amplifiers, modulation & multiplexing techniques and soliton based system for efficient data transmission in optical communication

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction: Elements of Optical communication system. Principle of working, Ray Theory and electromagnetic mode theory for optical propagation. Type of optical fibers, step index and graded index and their characteristics. Optical losses: Attenuation, Absorption, Scattering, dispersion, polarization, and fiber bend losses. Fabrication techniques of fiber.

Unit-II	Optical Sources: Basic concepts of light source: LED and Lasers. Working principle, Shape geometry, efficiency, Fabry Perot laser, quantum well lasers, and MQM and Quantum dot lasers. Characteristics of both LED and Lasers. Optical Detectors: Working principle, PN, PIN diodes, APD. Efficiency and effect of noise.
Unit-III	Link Budget: Link design, path loss calculations, safety margin and budgeting. Optical termination and distribution system. Optical Amplifiers and Modulation: EDFA, SOA and Raman amplifiers. Intensity modulation, concept of WDM and DWDM systems and networks.
Unit-IV	System Effects: Nonlinear effects in fiber optic links. Concept of self-phase modulation, four wave mixing, Kerr effect. Soliton based communication system

Suggested Readings:

- Optical Fiber Communications: John M Senior; Pearson.
- Optical Communication Systems: John Gowar; PHI.
- Optical Fiber Communications: Gerd Keiser; TMH
- Optical Fiber Communication System: Dr. M.K. Raina, Satya Prakashan

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Optical Communication System	https://www.youtube.com/watch?v=pavBq7HIoIE
	Optical Fiber: Structure, Step Index & Graded Index Fiber	https://www.youtube.com/watch?v=8GTPFcCxTA8
Unit-II	Optical Sources (LED & LASER)	https://www.youtube.com/watch?v=5cPDRNsMfnY
	Optical Detectors (PIN & APD)	https://www.youtube.com/watch?v=7gP4SNKvOtE&list=PLgwJf8NK-2e5paHjQ3IZl-Gh3OuaaUmqz
Unit-III	Optical Link Budget	https://www.youtube.com/watch?v=NctDb6pWpoA&list=PLgwJf8NK-2e6CGL-xtwXgcLwNA8TSxWZb
	Optical Amplifiers (EDFA, SOA, Raman) & WDM/DWDM	https://www.youtube.com/watch?v=WGItOWzHGos&list=PLgwJf8NK-2e70FZO1BgFttIqZLuyKX4EP
Unit-IV	Nonlinear Effects in Optical Fiber	https://www.youtube.com/watch?v=EiIDScj124Q&list=PLbRMhDVUMngfBwyonVP8VIsabtnsV3GVv
	Soliton Communication System	https://www.youtube.com/watch?v=C2niGcIjbxE

Course Code	PEC-ECE-312A				
Category	Professional Elective Courses				
Course Title	HIGH SPEED ELECTRONICS				
Scheme and Credits	L	T	P	Credits	Semester- VI
	3	0	0	3	
Course Objectives	The objectives of this course are ● To introduce basics of transmission lines, signal integrity and noise. ● To explain device models, oscillators, PLLs, and transceivers. ● To apply methods for PCB layouts and fabrication to reduce crosstalk and emissions. ● To analyze stability and efficiency of high frequency circuits.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define basics of transmission lines, signal integrity, and noise sources.
CO2	Explain device models, RF amplifiers, mixers, oscillators, PLLs, and transceiver architectures.
CO3	Apply methods for high-speed buses, PCB layouts, CAD tools, and fabrication to minimize crosstalk and emissions.
CO4	Analyze amplifier stability, noise figure, distortion, efficiency, and overall high frequency system performance.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Transmission line theory (basics) crosstalk and nonideal effects; signal integrity: impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency power delivery, methodologies for design of high speed buses; radiated emissions and minimizing system noise.
Unit-II	Noise Analysis: Sources, Noise Figure, Gain compression, Harmonic distortion, Intermodulation, Cross-modulation, Dynamic range. Devices: Passive and active, Lumped passive devices (models), Active models, low vs High frequency)
Unit-III	RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-over distortion Efficiency RF power output stages. Mixers –Up conversion Down conversion, Conversion gain and spurious response. Oscillators Principles. PLL Transceiver architectures.
Unit-IV	Printed Circuit Board Anatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.

Suggested Readings:

- High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices by Stephen H. Hall ,Wiley-IEEE Press ,1st Edition, 2000
- The Design of CMOS Radio-Frequency Integrated Circuits by Thomas H. Lee , Cambridge University Press ,2nd Edition, 2004
- RF Microelectronics by Behzad Razavi ,Prentice Hall ,1st Edition, 1998
- Electronic Product Design by R.G. Kaduskar, Wiley India ,1st Edition, 2011

Useful Video Links:

Unit No	Topics	Links
Unit-I	Transmission line theory	https://www.youtube.com/watch?v=HtoAbUgg_hM&list=PLdFco-rRUDtIpMTtPkI2IYq1X1NNjbKwg
	Radiated emissions	https://www.youtube.com/watch?v=bhHJrdtft6E
Unit-II	Noise Figure	https://www.youtube.com/watch?v=ksoxRtfyx5Q
	Devices: Passive and active.	https://www.youtube.com/watch?v=X-qd5afdCMo
Unit-III	RF Amplifier Design	https://www.youtube.com/watch?v=KWl2IQkUCzE&list=PL9OnCetH8TYpFk-gC0SRB9izEiblJmjBm
	PLL Transceiver architectures	https://www.youtube.com/watch?v=yx5g99CNtmo
Unit-IV	CAD tools for PCB design	https://www.youtube.com/watch?v=NhC4MYKmCek&list=PLp6ek2hDcoNAUpqc3DUj4U5hcipc2idZ5

Course Code	PEC-ECE-314A				
Category	Professional Elective Courses				
Course Title	ADAPTIVE SIGNAL PROCESSING				
Scheme and Credits	L	T	P	Credits	Semester- VI
	3	0	0	3	
Course Objectives	The objectives of this course are to • To Introduce fundamentals of Adaptive filtering random process and correlation. • Provide knowledge of Wiener and LMS adaptive filtering techniques. • Develop understanding of advanced adaptive algorithms and signal space concepts • Familiarize with lattice filters and adaptive signal estimation methods.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define adaptive signal processing concepts, characteristics and its application.
CO2	Explain the various mathematical models to adaptive signal processing..
CO3	Apply simulation tools for adaptive signal processing in communication systems.
CO4	Analyze nonlinear control and the need for real-time parameter adaptation. .

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction to Adaptive Systems: Definitions, characteristics, and applications (adaptive noise cancellation, channel equalization, echo cancellation), . Open and closed loop adaptation, and its applications, The adaptive Linear combiner: Description, weight vector, Desire response, performancefunction, Gradient and mean square error.

Unit-II	Introduction to Filtering: Smoothing and Prediction-Linear Optimum Filtering, Problem Statement, Principle of Orthogonality, Minimum– Mean-Squared Error, Wiener –Hopf Equations, Error Performance, Normal Equation. Transversal filters, lattice filters, and their adaptive implementations. FFT based adaptive kalman filter, Kalman Filtering Problem.
Unit-III	ADAPTIVE MODELING AND SYSTEM IDENTIFICATION: General description, adaptive modeling of multipath communication channel, adaptive modeling in geophysical exploration, adaptive modeling in FIR digital filter synthesis, general description of inverse modeling.
Unit-IV	Adaptive Algorithms : LMS algorithm (real and complex signals) ,Recursive least squares algorithm (RLS),Comparison of LMS and RLS ,Adaptive equalization in communication systems, Stability and Performance Analysis of LMS Algorithms, LMS Gradient and Stochastic Algorithms, Convergence of LMS Algorithms,

Suggested Readings:

- Adaptive Signal Processing by Bernard Widrow, Pearson Education, Asia.2009
- Adaptive filter by Simon Haykins , PHI.2003.
- Adaptive Signal Processing by Aurelio Uncini,
- Adaptive Signal Processing: by Tulay Adali & Simon Haykin (2010,
- Adaptive Signal Processing by S. Thomas Alexander, SpringerVerlag.
- Adaptive Signal Processing by Tulay Adali, Simon Haykin , Wiley Publications, 2012.
- Basic Adaptive Signal Processing and its MATLAB Simulation by Alexander D. Poularikas ,1st Edition,

Useful Video Links:

Unit No	Topics	Links
Unit-I	Definition and characteristics of Adaptive signal processing	<u>Introduction To Adaptive Signal Processing - Course</u>
Unit-II	Wiener filters (FIR and IIR)	<u>https://youtu.be/9yNOBWKRss4?si=IXPfUmXBHReWCNj4</u>
Unit-III	FFT Filters	<u>https://youtu.be/QmgJmh2I3Fw?si=vjwobjXqgHILNv0s</u>
Unit-IV	Adaptive Filter	<u>https://youtu.be/QPTnIMn63Vw?si=JGH6oc7BkDs1t1or</u>

Course Code	PEC-ECE-316A				
Category	Professional Elective Courses				
Course Title	WIRELESS COMMUNICATION				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are to • To understand wireless communication principles and propagation models. • To study wireless networking and multiplexing techniques. • To learn multiple access methods and cellular technologies. • To explore diversity, OFDM, and MIMO communication techniques.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain the principles of wireless communication systems, propagation models and channel characteristics for analyzing wireless transmission performance.
CO2	Understand and Apply multiplexing methods and wireless networking protocols in wireless communication systems.
CO3	Apply multiple access and cellular communication techniques in wireless systems.
CO4	Analyze diversity techniques and MIMO-based signal processing methods for improving wireless system performance.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Review of Digital Communications - Components of a Wireless Transmitter and Receiver – Bandwidth, Duplexing, Licensed and Unlicensed Bands - Power, Rate and SNR - Shannon's Capacity, Bandwidth and Power Limited Regimes - Radio Propagation and Propagation Path Loss Model: Free-Space Attenuation, Multipath Channel Characteristics, Introduction to wireless communication systems: Evaluation of mobile radio communications, examples of wireless communication systems, paging systems, cordless telephone systems, compression of various wireless systems.

Unit-II	Types of Multiplexing: Fixed Assignment vs. Statistical Multiplexing - Aloha, Slotted Aloha - CSMA with Collision Avoidance and Collision Detection - WIFI: History and Motivation, Architecture, Wireless Personal Area Networks (PANS): Bluetooth 802.15.1, Zigbee 802.15.4.
Unit-III	Multiple access techniques in wireless communication: contention-free multiple access schemes (FDMA TDMA, CDMA, SDMA and Hybrid) Mobile wireless communication systems: second generation cellular networks, third generation wireless networks, fourth generation wireless networks. Recent wireless technologies: multicarrier modulation, OFDM, MIMO system.
Unit-IV	Diversity Techniques- Polarization Diversity, Frequency Diversity, Time Diversity, Practical Space Diversity Consideration-Selection Diversity, Feedback or Scanning Diversity, Maximal Ratio Combining, Equal Gain Combining, spatial multiplexing, MIMO and space time signal processing. Text Books/Reference Books 1. Vijay K Garg, “Wireless Communications and Networks”, Morgan K

Suggested Readings:

- Wireless Communications and Networks by Vijay K Garg,, Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2009 (Indian reprint)
- Introduction to Wireless and Mobile Systems by D. P. Agrawal and Q.-A. Zeng, Third Edition, Cengage Learning, 2010
- Wireless Communications & Networks by W. Stallings, Second Edition, Prentice Hall, 2004.
- Wireless Communications by T. S. Rappaport, Second Edition, Prentice Hall, 2002
- Mobile Communications by J. Schiller, Second Edition, Addison Wesley, 2003

Useful Video Links:

Unit No	Topics	Links
Unit-I	Components of a Wireless Transmitter and Receiver	https://www.youtube.com/watch?v=iY6RHALuOzE
	Shannon's Capacity	https://www.youtube.com/watch?v=lQHjREaGJvc
Unit-II	Wireless Personal Area Networks (PANS)	https://www.youtube.com/watch?v=XB479LeOvRw
	Fixed Assignment vs. Statistical Multiplexing	https://www.youtube.com/watch?v=7i-72hsmWTQ
Unit-III	Fourth generation wireless networks	https://www.youtube.com/watch?v=UtlI6v-CBCI
	Multicarrier modulation	https://www.youtube.com/watch?v=6mjaAc1P59A
Unit-IV	Space time signal processing	https://www.youtube.com/watch?v=cIH5o7wYNzs&t=82s
	Practical Space Diversity	https://www.youtube.com/watch?v=MFaxyD-p80M

Course Code	PEC-ECE-318A				
Category	Professional Elective Courses				
Course Title	TELECOMMUNICATION AND SWITCHING NETWORKS				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are to • To understand the fundamentals of telecommunication systems used in modern communication systems. • To Study telecommunication traffic and multiplexing methods used in network communication. • To study electronic and stored program controlled telephone exchanges with digital switching systems. • To understand signaling systems and network protocols of modern communication networks.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain the evolution of telecommunication systems, telephone networks, switching techniques, and subscriber loop design.
CO2	Interpret telecommunication traffic models and operation of circuit, space, time and hybrid switching systems.
CO3	Describe the working of electronic exchanges and digital switching systems used in modern telecommunication networks.
CO4	Analyze signaling systems, network protocols, LAN architectures, and the evolution of communication networks towards ISDN.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction: Evolution of Telecommunication, Switching System, Classification of Switching, Types of Telephone Switching Systems, Elements of Telecommunication, Telecommunication Standard. Telephone System: PSTN, Modern Telecom System, Telephone Network, Telephone Set, Telephone Network organization, Principles and examples of step by step, Cross bar and reed relay systems, Central Battery System, Transmission impairments, Two-four-wire transmission, Subscriber Loop Design.

Unit-II	Telecommunication traffic: Telecommunication traffic, Traffic considerations, Erlang, Grade of Service, Traffic Measurement, Switching System: Resource sharing and need for switching, Need for Networks, Switching, Types of Switching, Circuit Switching, Message Packet Switching, Function of Switching System, Electronic Switching System, Multiplexing- TDM,FDM, Implementation of Switching System, Blocking and Non-blocking Switches, Single & Multi stage Switches, Space Switching, Time Switching, Hybrid Switching, Path finding, Complexity, Blocking Probability of Switch.
Unit-III	Telephone Exchange: Stored Program Controlled Exchange, Electronic Exchange, Electronic Switching & Stored Program Control Systems, Digital Switching Time, Space & Hybrid Switches, Example of Digital Exchanges, Example of Modern Exchanges (C-DOI exchange), Availability of Parallel Exchange.
Unit-IV	Signaling Systems: Signaling, Types of Signaling information, Forms of Signaling, Channel Associated Signaling (CAS), Common Channel Signaling, CCITT No-7 System, SS7 Signaling, Architecture Computer & Data Networks, ARPANET, ALOHA-Token Protocols Network Topology, Multiple Access Schemes, Layered Architectures, Networks Protocols, Local Area Network, Evolution towards ISDN.

Suggested Readings:

- J. E. Flood,, Telecommunication and Switching Traffic & Networks, Pearson Education , 2001
- Thiagarajan Viswanathan, Telecommunication Switching Systems & Networks, PHI , 2006
- P. Gnanasivam,Telecommunication Switching Systems & Networks, Pearson Education

Useful Video Links:

Unit No	Topics	Links
Unit-I	Evolution of Telecommunication	https://www.youtube.com/watch?v=IVOg-TdBx-M
Unit-II	Telecommunication traffic	https://www.youtube.com/watch?v=bU3jr-CrE9g
Unit-III	Electronic Switching & Stored Program Control Systems	https://www.youtube.com/watch?v=XIJviYQebZY
Unit-IV	Types of Signaling information	https://www.youtube.com/watch?v=zmdfJ-wcKzI

Course Code	LC-ECE-320A					
Category	Professional Core Courses					
Course Title	DIGITAL SIGNAL PROCESSING LAB					
Scheme and Credits	L	T	P	Credits	Semester- VI	
	0	0	2	1		
Course Objectives	The objectives of this course are to ● Get the knowledge of MATLAB for developing signal processing applications. ● To learn various signal processing techniques through practical applications.					
Assessment	25 Marks					
End Semester Examination	25 Marks					
Total	50 Marks					
Duration of Exam						

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Describe the functionality of MATLAB for representing signals in various signal processing applications for practical problem-solving.
CO2	Implement Z-Transform, DFT and FFT techniques for discrete-time signals to analyze their frequency-domain characteristics.
CO3	Develop algorithms for designing and implementation of FIR and IIR filters using standard techniques.
CO4	Analyze the effect of noise on the performance of the signals.

List of Experiments

Sr. No.	Contents
1	Represent basic signals (unit step, unit impulse, ramp, exponential, sine and cosine)
2	To develop program for Z-Transform.
3	To develop program for Convolution of sequences.
4	To develop program for Correlation of sequences.
5	To develop program for DFT & IDFT of two sequences.
6	To develop program for FFT of two Sequences.
7	To develop program for Circular Convolution.
8	To design analog filter (low-pass, high pass, band-pass, band-stop).
9	To design digital IIR filters (low-pass, high pass, band-pass, band-stop).
10	To develop program for Interpolation and Decimation of sequences.
11	To design FIR filters using windows technique.
12	Detection of Signals buried in Noise.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	Represent basic signals (unit step, unit impulse, ramp, exponential, sine and cosine)	Generating Basic sequences (step, impulse, ramp, exponential) using MATLAB Part-2 let'sdECodE 8. MATLAB Tutorial Basic Signals: Step, Impulse, Sine, and Square
2	To develop program for Z-Transform	z transform in MATLAB MATLAB code for z transform z transform using MATLAB ztrans command
3	To develop program for Convolution of sequences	convolution of two sequences in Matlab...
4	To develop program for Correlation of sequences	Cross Correlation in MATLAB Cross Correlation Function MATLAB Tutorial for Beginners in Hindi
5	To develop program for DFT & IDFT of two sequences	EE 407: DSP Computing DFT and IDFT using Matlab
6	To develop program for FFT of two Sequences	How to Do FFT in MATLAB
7	To develop program for Circular Convolution	MATLAB Program Circular Convolution using DFT
8	To design analog filter (low-pass, high pass, band-pass, band-stop).	Bandpass filter from High pass and low pass filter MATLAB
9	To design digital IIR filters (low-pass, high pass, band-pass, band-stop).	https://www.youtube.com/watch?v=VFt3UVw7VrE

Course Code	LC-ECE-322A				
Category	Professional Core Courses				
Course Title	CMOS DESIGN LAB				
Scheme and Credits	L	T	P	Credits	Semester- VI
	0	0	2	1	
Course Objectives	The objectives of this course are to ● To provide knowledge of CMOS devices, PMOS and NMOS layout design ● To introduce CMOS schematic design, layout generation, and simulation of basic digital circuits ● To explain the design and verification of combinational circuits including adder and subtractor ● To provide understanding of analog CMOS circuit design and simulation of differential amplifiers				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain PMOS and NMOS circuit and its characteristics with performance parameters
CO2	Examine and simulate CMOS schematic and layout of basic logic gates such as inverter, NAND and NOR circuits.
CO3	Demonstrate CMOS-based combinational circuits including adder and multiplexer using truth tables and transient analysis.
CO4	Analyze analog CMOS circuits such as differential amplifiers to achieve specified gain and performance requirements.

List of Experiments

Sr. No.	Contents
1	Write a spice programme for CMOS inverter with following details. pmos L = .8um W=12.0um, nmos = 8um W=2.4um, nmos (kp=60u Vto=0.6v) pmos(kp=20u Vto=-0.8v)
2	Write a spice programme for CMOS nand gate with following details: Vdd=5volt, pmos L=.8umW=20um,nmos L=8umW=um, nmos (kp=45u V to = 1.0v) pmos (kp=25u Vto=-1.2v)
3	Write a spice programme for CMOS nor gate with following details: Vdd=5volt, pmos L=.8umW=20um,nmos L=8umW=um, nmos (kp=45u V to = 1.0v) pmos (kp=25u Vto=-1.2v)
4	Design a full adder using half adder circuit.
5	Design the layout for PMOS in layout editor
6	Design the Layout for NMOS in layout editor
7	Design the layout for CMOS inverter with equal rise and fall time in layout editor
8	Draw the CMOS schematic and Layout of the inverter circuit, simulate both schematic and layout to determine propagation delay, rise time fall time and Q point and comment on the results

9	Draw the CMOS schematic of the 2 input NAND and NOR gate, also draw the layout of the same, and simulate for transient result
10	Draw the CMOS schematic of the Half Adder circuit and verify its truth table and also draw the layout and simulate for transient results.
11	Draw the CMOS circuit of the 2:1 Multiplexer circuit and verify its truth table and also draw the layout and simulate for transient results.
12	Design the Differential amplifier schematic for a gain of 50dB

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	Design a full adder using half adder circuit	https://www.youtube.com/watch?v=CiJcMP6V-ro
2	Design the layout for PMOS in layout editor	https://www.youtube.com/watch?v=1JGBk5R3WSo
3	Design the Layout for NMOS in layout editor	https://www.youtube.com/watch?v=1JGBk5R3WSo
4	Design the layout for CMOS inverter with equal rise and fall time in layout editor	https://www.youtube.com/watch?v=nQ3zudQGyow

Course Code	PROJ-ECE-324A				
Category	Project				
Course Title	MINI PROJECT - II				
Scheme and Credits	L	T	P	Credits	Semester- VI
	0	0	2	1	
Course Objectives	The objectives of this course are to ● To expose students to domains related to real-world engineering problems. ● To introduce structured approaches for project planning, execution, documentation and technical presentation. ● To enable the use of engineering concepts, tools and technologies for developing practical project solutions. ● To create awareness of ethical, economic, environmental, and sustainability considerations in engineering projects.				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Identify and summarize the problem statement, hardware & software tools and relevant domain for project work planning.
CO2	Develop skills to write technical reports and deliver effective presentations.
CO3	Apply engineering principles and ethics to address real-world problems and foster lifelong learning.
CO4	Implement skills to manage the problem encountered by individuals and as a team for better resource utilization.
CO5	Analyze and assess methods and parameters for optimized resource utilization to ensure an efficient technical solution.
CO6	Design and develop innovative, sustainable, cost-effective and environment friendly solutions to real world problems for societal benefits.

Guidelines:

1. The Mini/Micro Project shall be carried out as a team activity comprising 2 to 4 students, focusing on real-life problems using electronic devices and systems.
2. The project may involve complete hardware or a combination of hardware and software, with the software component limited to less than 50% of the total work.

3. After consultation with the project guide and based on literature survey and need analysis, students shall finalize the project title, aim, and objectives.
4. Students are required to prepare a project proposal in the early phase of the semester, including specifications, methodology, required resources, and critical design/implementation issues.
5. The project work shall involve design, development, and testing as per the planned schedule.
6. Circuit design, artwork, and layout should be carried out using CAD-based PCB design and simulation software.
7. The completed project, along with documentation in the form of a project report, must be submitted at the end of the semester.
8. Available sessions may be utilized for discussions on standard design practices, PCB design techniques, product development approach, and report writing guidelines.

Useful Video Links:

Details of Links
• https://www.youtube.com/@EEVblog • https://www.youtube.com/@greatscottlab • https://www.youtube.com/@allaboutelectronics • https://www.youtube.com/@mcwhorpi • https://www.youtube.com/@Dronebotworkshop • https://www.youtube.com/@AndreasSpiess • https://www.youtube.com/@StuffMadeHere • https://www.youtube.com/@hacksmith • https://www.youtube.com/@allenpan • https://www.youtube.com/@ElectroBOOM • https://www.youtube.com/@adafruit • https://www.youtube.com/@sciguy14 • https://www.youtube.com/watch?v=jtpqsVKtu9Y • https://aislyn.in/project-ideas/electronics-communication-engineering-ideas • https://www.electronicsforu.com/electronics-projects/hardware-diy/ece-projects • https://www.youtube.com/watch?v=5ArmM80YMSM

- <https://www.youtube.com/@EEVblog>
- <https://www.youtube.com/@greatscottlab>
- <https://www.youtube.com/@allaboutelectronics>
- <https://www.youtube.com/@mcwhorpi>
- <https://www.youtube.com/@Dronebotworkshop>
- <https://www.youtube.com/@AndreasSpiess>
- <https://www.youtube.com/@StuffMadeHere>
- <https://www.youtube.com/@hacksmith>
- <https://www.youtube.com/@allenpan>
- <https://www.youtube.com/@ElectroBOOM>
- <https://www.youtube.com/@adafruit>
- <https://www.youtube.com/@sciguy14>
- <https://www.youtube.com/watch?v=jtpqsVKtu9Y>
- <https://aislyn.in/project-ideas/electronics-communication-engineering-ideas>
- <https://www.electronicsforu.com/electronics-projects/hardware-diy/ece-projects>
- <https://www.youtube.com/watch?v=5ArmM80YMSM>

Course Code	SM-ECE-326A				
Category	Seminar				
Course Title	SEMINAR				
Scheme and Credits	L	T	P	Credits	Semester- VI
	0	0	2	1	
Course Objectives	The objectives of this course are to • To develop technical presentation and professional communication skills. • To enhance the ability to review and interpret technical literature from research and industry sources. • To promote awareness of emerging technologies and contemporary engineering developments. • To strengthen technical report writing, documentation, and discussion skills.				
Assessment	50 Marks				
End Semester Examination	--				
Total	50 Marks				
Duration of Exam	--				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Identify emerging technologies, recent developments, and contemporary issues in engineering.
CO2	Interpret and summarize technical information from research papers, journals, and industry reports.
CO3	Prepare technical reports and deliver effective seminar presentations using appropriate communication tools.
CO4	Show technical knowledge and professional communication skills during seminar discussions and viva-voce.

Guidelines:

- Each student shall select a seminar topic related to Electronics & Communication Engineering or allied emerging technologies in consultation with the faculty mentor.
- The seminar topic should preferably be based on recent research papers, industrial developments, innovative products or emerging technologies.
- Students shall conduct a comprehensive literature survey using journals, conference proceedings, patents, technical magazines and authentic online resources.
- A seminar report shall be prepared in the prescribed format and submitted before the presentation.
- Each student shall deliver an oral presentation followed by a question-and-answer session.
- Evaluation shall be based Technical Knowledge & Conceptual Clarity, Presentation & Communication Skills Technical Discussion & Viva-Voce, Seminar Report Innovation & Future Scope
- Proper citation of references and adherence to academic integrity standards shall be mandatory.
- Students are encouraged to use presentation aids such as slides, demonstrations, simulations, videos, or prototypes etc. wherever applicable.
- The seminar shall aim to enhance technical knowledge, communication skills, critical thinking and lifelong learning abilities.