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: M**easurement 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 Schiling; TMH
- Communication Systemsby Singh and Sapre ; TMH
- Communication Systems by A Bruce Carlson; TMH
- Communication Engineering by Sanjay Sharma byS.K.Kataria& Sons
- Communication Systems by Simon Haykin bypearson

Useful Video Links:

Unit No	Topics	Links
Unit-I	Convolution Theorem	https://www.youtube.com/watch?v=AILlSc73eqs
	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=g2UlDNamG84
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=X0kKIkycwiI

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 Architectureby 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 Systemsby CarlHamacher, McGraw Hill Higher Education.
- Computer Architecture and Organization by latest edition by John P. Hayes, WCB/McGraw-Hill
- Computer Organization and Architecture: Designing for Performanceby William Stallings, Pearson Education
- Computer System Design and Architectureby 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_lADfFI
Unit IV	Privileged & Non-Privileged Instructions	https://www.youtube.com/watch?v=z0URQryCbI0
	Memory organization	https://www.youtube.com/watch?v=lKVu02WjhoI
	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 inDVM - 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 DigitalRecorders 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 MeasurementTechniques by Albert D.Helfrick and William D. Cooper, Prentice Hall of India, latest edition
- A course in Electrical & Electronics Measurements & Instrumentation byA.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_MSClsnwm8QtyYpwmQpXjp1XnvuKcRk
	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. applications. • 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, sacrificiallayer 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.

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 & MicrosystemsMEMS 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=YgtJlUXdCjI 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-synthesistechnique. 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.729standards

Suggested Readings:

- Digital Speechby A.M.Kondoz
- Speech Coding Algorithms: Foundation and Evolution of Standardized Coders by W.C.Chu, WileyInter 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 Audio Coding: Basic Concepts	https://www.youtube.com/watch?v=MBxFVBAzdMc https://www.youtube.com/watch?v=aCvceLLrE0k
Unit-II	Linear Prediction of Signals Basics of Scalar Quantization Vector Quantization	https://www.youtube.com/watch?v=1k7FPs-6X88 https://www.youtube.com/watch?v=CmEV6HdexKc https://www.youtube.com/watch?v=CKNjEp_38GI
Unit-III	Scalar Quantization -The Quantization Problem Linear Prediction, Formants LPC for speech synthesis	https://www.youtube.com/watch?v=hL1untZ1wwE https://www.youtube.com/watch?v=NtTYdYffalY https://www.youtube.com/watch?v=Sayks3lFLXM
Unit-IV	Speech Coding III Code excited LPC and Residual Excited LPC	https://www.youtube.com/watch?v=y0iIZ8LZ1jc https://www.youtube.com/watch?v=7qbxqFlUAlI

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.

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_HGUOO9lSd4dTJ-37qCFtlBgh https://www.youtube.com/watch?v=JGrU9Bcf4wA&list=PLAHr0cis_HGUOO9lSd4dTJ-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 MACprotocols 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 TE10 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 TE10 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.

<table>
<tr><td>Course Code</td><td colspan="5">LC-ECE-327A</td></tr>
<tr><td>Category</td><td colspan="5">Project</td></tr>
<tr><td>Course Title</td><td colspan="5">Mini Project - 1</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">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.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5"></td></tr>
</table>

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/@mcwhorpj • 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 andW.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 Antenna**s, 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.

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, 4thEdition, 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=SV1qufFXTQU
Unit-IV	Designing Memory and Array	https://www.youtube.com/watch?v=EsGxt-XFLYY

<table>
<tr><td>Course Code</td><td colspan="5">PCC-ECE- 308A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">ADVANCE MOBILE COMMUNICATION TECHNOLOGIES</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">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.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

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=lcldzIXz3u8
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=TV8etzFxjQU

<table>
<tr><td>Course Code</td><td colspan="5">PEC-ECE- 310A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">FIBER OPTIC COMMUNICATION</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">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.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

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), Activemodels, 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=HtoAbUqg_hM&list=PLdFco-rRUDt1pMTtPkI2lYq1X1NNjbKwg
	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=KWl2lQkUCzE&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	I**ntroduction 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 BernandWidrow, Pearson Education, Asia.2009
- Adaptive filter by SimonHaykins , 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 TulayAdali, 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	Introduction To Adaptive Signal Processing - Course
Unit-II	Wiener filters (FIR and IIR)	https://youtu.be/9yNQBWKRSs4?si=lXPfUmXBHReWCNj4
Unit-III	FFT Filters	https://youtu.be/QmgJmh2I3Fw?si=vjwobjXqgHILNv0s
Unit-IV	Adaptive Filter	https://youtu.be/QPTnIMn63Vw?si=JGH6oc7BkDs1t1or

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 PathLoss 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 KaufmannPublishers an Imprint of Elsevier, USA 2009 (Indian reprint)
- Introduction to Wireless and Mobile Systems by D. P. Agrawal and Q.-A. Zeng, ThirdEdition, 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=UtIl6v-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 ofSwitching, Types of Telephone Switching Systems, Elements of Telecommunication,Telecommunication Standard. Telephone System: PSTN, Modern Telecom System,Telephone Network, Telephone Set, Telephone Network organization, Principles andexamples 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-Toke 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 = .8ym 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

<table>
<tr><td>Course Code</td><td colspan="5">PROJ-ECE-324A</td></tr>
<tr><td>Category</td><td colspan="5">Project</td></tr>
<tr><td>Course Title</td><td colspan="5">MINI PROJECT - II</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester- VI</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">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.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5"></td></tr>
</table>

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/@mcwhorpj • 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

<table>
<tr><td>Course Code</td><td colspan="5">SM-ECE-326A</td></tr>
<tr><td>Category</td><td colspan="5">Seminar</td></tr>
<tr><td>Course Title</td><td colspan="5">SEMINAR</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester- VI</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">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.</td></tr>
<tr><td>Assessment</td><td colspan="5">50 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">--</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">--</td></tr>
</table>

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.

Annexure AC/5.5

~~Annexure 4.4~~

Course Code	**OEC-01A**				
Category	Open Elective Course				
Course Title	**Engineering Ethics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	3	
Course Objectives	The objectives of this course are ● To understand ethical principles, moral reasoning, and professional responsibilities in engineering practice and decision-making. ● To gain knowledge of ethical awareness in professional and research practices. ● To learn the role of engineers in society, environmental & corporate responsibility, and global justice.				
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	RBT Levels
CO1	Identify risks and safety measures for ethically sound technical solutions.	L1 (Remembering)
CO2	Describe various ethical practices for promoting professionalism and environment sustainability.	L2 (Understanding)
CO3	Examine engineering dilemmas, moral reasoning and ethical issues in digital platforms.	L3 (Applying)
CO4	Analyze global situations and make responsible decisions to ensure research integrity and social well-being.	L4 (Analyzing)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units 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	**Ethics and Professionalism:** Ethics and Excellence in Engineering, Micro and Macro Issues, Dimensions of Engineering, Potential Moral Problems, What Is Engineering Ethics, Why Study Engineering Ethics? Responsible Professionals, Professions, and Corporations: Saving Citicorp Tower, Meanings of Responsibility, Engineering as a Profession, Ethical Corporations and Senses of Corporate Responsibility. Moral Reasoning and Codes Ethics, Moral Choices and Ethical Dilemmas, Rights Ethics, Duty Ethics, Utilitarianism, Virtue Ethics, Self-Realization Ethics, Ethical Egoism, Which Ethical Theory Is Best?

Unit-II	**Engineering as Social Experimentation:** Engineering as Experimentation, Engineers as Responsible Experimenter, Commitment to Safety: The Concept of Safety, Risks, Acceptability of Risk, Assessing and Reducing Risk: Uncertainties in Design, Risk-Benefit Analyses, Personal Risk versus Public Risk, Examples of Improved Safety, Three Mile Island, Safe Exits.
Unit-III	**Truth and Truthfulness**: Whistle-Blowing, Moral Guidelines, Protecting Whistle-Blowers, Common Sense Procedures, Beyond Whistle-Blowing, Honesty and Research Integrity: Truthfulness, Trustworthiness, Academic Integrity: Students, Research Integrity, Bias and Self-Deception, Protecting Research Subjects, Giving and Claiming Credit. Computer Ethics: The Internet and Free Speech, Power Relationships, Property, Privacy, Additional Issues.
Unit-IV	**Environmental Ethics**: Engineering, Ecology, and Economics, Environmental Moral Frameworks, Human-Centered Ethics, Sentient-Centered Ethics, Biocentric Ethics, Ecocentric Ethics, Religious Perspectives. Global Justice: Multinational Corporations, Technology Transfer and Appropriate Technology, Bhopal, "When in Rome", International Rights, Promoting Morally Just Measures, Weapons Development and Peace, Involvement in Weapons Work, Defense Industry Problems, Peace Engineering.

Suggested Readings:

- Introduction to Engineering Ethics by Mike W. Martin and Roland Schinzinger, McGraw Hill, New Delhi, latest edition
- Engineering Ethics by Govindarajan M, Natarajan S, Senthil Kumar V. S, Prentice Hallof India, New Delhi, latest edition
- Engineering Ethics by Charles B. Fleddermann, Senthil Kumar V. S, Prentice Hallof India, New Delhi, latest edition
- Ethics and the Conduct of Business by John R Boatright, Pearson Education, NewDelhi, latest edition
- Fundamentals of Ethics for Scientists and Engineers by Edmund G Seebauer and Robert L Barry, Oxford University Press, Oxford, latest edition
- Business Ethics: Decision Making for Personal Integrity and Social Responsibility by Laura P. Hartman and Joe Desjardins, Mc Graw Hill education, India Pvt. Ltd., New Delhi latest edition

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Ethics and Professionalism	https://www.youtube.com/watch?v=rI1urvmVfVI
Unit-II	Engineering as Social Experimentation	https://www.youtube.com/watch?v=-GJ7V6XV5H4
Unit-III	Whistle-Blowing, Moral guidelines, Protecting Whistle-Blowers,	https://www.youtube.com/watch?v=JGtrWVD5xmk https://www.youtube.com/watch?v=tbYegQf6ERg
	Truthfulness, Trustworthiness, Academic Integrity: Students, Research Integrity,	https://www.youtube.com/watch?v=r SMybaviUVY
Unit-IV	Environmental Ethics Responsibility to Environment. Ecology, and Economics	https://www.youtube.com/watch?v=urY5quh6Ym8 https://www.youtube.com/watch?v=IbJysNlSG7Y
	Global Justice: Multinational Corporations, Technology Transfer and Appropriate Technology	https://onlinecourses.nptel.ac.in/noc19_ge23/preview http://www.digimat.in/nptel/courses/video/110105081/L42.html

Course Code	**OEC-06A**				
Category	Open Elective Courses				
Course Title	**United Nations Sustainable Development Goals**				
Scheme and Credits	L	T	P	**Credits**	**Semester- VI**
	3	0	0	3	
Course Objectives	The objectives of this course are to: • Develop an understanding of sustainable development goals (SDGs) in global and Indian perspectives. • Familiarize students with sustainable resource management, circular economy, sustainable production and consumption and renewable energy. • Provide knowledge of climate change, sustainable energy, corporate social responsibility and life cycle assessment for sustainable development.				
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	RBT Levels
CO1	**Describe** the concepts, terminologies and importance of sustainable development.	L1 (Remembering)
CO2	**Explain** sustainability issues from environmental, social and economic perspectives.	L2 (Understanding)
CO3	**Apply** sustainability principles and practices to identify and address real-world challenges.	L3 (Applying)
CO4	**Analyze** sustainable development challenges and strategies for achieving long-term sustainability.	L4 (Analyzing)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 mark each from all units 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 Sustainable Development:** Need and Importance of Sustainable Development, Historical and Policy Perspectives of Sustainable Development, Sustainable Development: Global and Indian Perspectives. **Introduction to the 17 Sustainable Development Goals (SDGs):** Objectives of the Different SDGs, Challenges and Strategies for Achieving the Sustainable Development Goals.
Unit-II	**SDG 4: Quality Education and Lifelong Learning:** Focus of NEP-2020 on SDGs, Education for Sustainable Development (ESD), Berlin Declaration 2021 on ESD, Tools, Systems and Innovation for Sustainability,Sustainability Measurement: Indicators, Uses and Applications.

Unit-III	**Sustainable Resource Management in SDGs:**Current Economic Issues in the Context of Global Sustainable Development, Circular Economy: Principles of Reduce, Reuse, and Recycle (3Rs),Rural and Urban Sustainability Problems and Challenges. **Sustainable production and consumption**: Importance of Sustainable Production and Consumption, Renewable Energy Resources, Health and Hygiene, Water, Sanitation and Water Resource Management, Waste Management.
Unit-IV	**Climate Change, Energy and Sustainable Development:** The greenhouse effect: Causes and Consequences, Climate Change as a Threat to Sustainable Development; Adaptation to Current and Future Climate Regimes, Sustainable Energy and Climate Change Mitigation. **Sustainable Business Practices:** Corporate Social Responsibility, Sustainable Products and Services, Business and Environmental Sustainability, Corporations and Ecological Sustainability, Life Cycle Assessment (LCA): Overview and Applications.

Suggested Readings:

- Energy, Environment and Sustainable Development: Issues and Policies by S.Ramaswamy sathis, Regal Publication.
- The Economics of Sustainable Development: The Case of India by Surender Kumar and Shunsuke Managi , Springer Publication, Switzerland
- Corporate Social Responsibility in Developing and Emerging Markets by OnyekaOsuji, Cambridge Publication.
- Environmental Ecology, Biodiversity and Climate Change by H MSaxena, Rawat Publication.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Need and Importance of Sustainable Development	https://www.youtube.com/watch?v=rMh4LmwvMAg
Unit-II	Education for Sustainable Development (ESD)	https://www.youtube.com/watch?v=NFKYks8-xVg
Unit-III	Sustainable production and consumption	https://www.youtube.com/watch?v=PS1ffI6K6Fc
Unit-IV	Climate Change, Energy and Sustainable Development	https://www.youtube.com/watch?v=LEFhb51q3Sg

Annexure AC/5.6

~~Annexure 4.5~~

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

'A' GRADE ACCREDITED BY NAAC

Scheme of Studies and Examinations

(Under NEP-2020)

B-SCHEME

Bachelor of Technology (Electronics and Communication Engineering)

2nd Year

(Academic Session: 2026-27)

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

1. 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

2. RANGE OF CREDIT

As per AICTE guidelines, a student shall be eligible to receive an Undergraduate Degree with Honors/Minors/Specialization upon earning additional 18-20 credits beyond the prescribed about 160 major credits. The minor variation is allowed as per the need of the respective disciplines.

However the Board of Studies after deliberation and discussion framed the curriculum and scheme of Examination has finalized 170 credits for the award of Undergraduate Degree (B.Tech in Electronics & Communication Engineering.) and additional 20 credits for B.Tech Honors/Minors/Specialization. Furthermore as per the AICTE/UGC SWAYAM Credit Framework Regulations, credit transfer for SWAYAM/NPTEL courses is permitted subject to the approval of the Chairperson, Board of Studies (BOS). A classroom course may be considered equivalent to a SWAYAM/NPTEL course if a majority of the course contents and syllabus components are substantially similar.

3. 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	20
8	Value Added Courses	2
9	Mandatory Courses	Non-Credit
	Total Credits	**170**

4. 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) – 3rd Semester

W.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in Hours
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core courses	PCC-ECE-201B	Electronic Devices	3	0	0	3	3	30	45		75	3
2	Engineering Science Courses	PCC-CSE-203B	Data Structures	3	0	0	3	3	30	45		75	3
3	Professional Core courses	PCC-ECE-205B	Computer Organization & Architecture	3	0	0	3	3	30	45		75	3
4	Basic Science Courses	BSC-MECE-207B	Mathematics-III	3	1	0	4	4	40	60		100	3
5	Professional Core Courses	PCC-ECE-209B	Signal Systems and Network Analysis	3	1	0	4	4	40	60		100	3
6	Humanities and Social Sciences including Management Courses	HSMC-02B	Economics for Engineers	3	0	0	3	3	30	45		75	3
7	Professional Core Courses	LC-ECE-211B	Electronic Devices Lab	0	0	2	2	1	10	-	15	25	
8	Professional Core Courses	LC-ECE-213B	Signal Systems and Network Analysis Lab	0	0	2	2	1	10	-	15	25	
9	Professional Core Courses	LC-ECE-215B	Electronic Workshop & PCB Design Lab	0	0	2	2	1	10	-	15	25	
10	Mandatory Courses	*MC-201B	Environmental Science	2	0	0	2	-	20	30	-	-	3
Total Credits								**23**				**575**	
NOTE 1: *MC-201B: - It is a mandatory non –credit course in which the students will be required passing marks.													
Minor/Honors (Hons.)/Specialization in VLSI Design and Technology													
I	Classroom OR MOOCs	Refer to Annexure-I	Minor/Honors (Hons.)/Specialization (Table –II)	4	0	0	4	4	40	60		100	3

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

Scheme of Studies and Examination

B.Tech (Electronics & Communication Engineering) – 4th Semester

W.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in Hours
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-ECE-202B	Analog & Digital Communication	3	0	0	3	3	30	45	-	75	3
2	Professional Core Courses	PCC-ECE-204B	Analog Electronic Circuits	3	0	0	3	3	30	45	-	75	3
3	Professional Core Courses	PCC-ECE-206B	Digital Electronics	3	1	0	4	4	40	60	-	100	3
4	Professional Core Courses	PCC-ECE-208B	Microprocessor and Microcontroller	3	0	0	3	3	30	45	-	75	3
5	Professional Elective Courses	Refer to Annexure-I	Professional Elective (Table –I)	3	0	0	3	3	30	45	-	75	3
6.	Humanities and Social Sciences including Management Courses	HSMC-01B	Fundamental of Management and Organizational Behavior	3	0	0	3	3	30	45	-	75	3
7.	Professional Core Courses	LC-ECE-218B	Analog & Digital Communication lab	0	0	2	2	1	10	-	15	25	-
8.	Professional Core Courses	LC-ECE-220B	Analog Electronics Circuit Lab	0	0	2	2	1	10	-	15	25	-
9.	Professional Core Courses	LC-ECE-222B	Digital Electronics Lab	0	0	2	2	1	10	-	15	25	-
10.	Professional Core Courses	LC-ECE-224B	Microprocessor and Microcontroller Lab	0	0	2	2	1	10	-	15	25	-
11.	Project	*PROJ-226B	Project Based Learning/Micro Project	0	0	2	2	1	25	-	-	25	-
Total Credits								**24**				**600**	

NOTE 1: *PROJ-226B: - It is an innovative learning approach in which students actively participate in real-world projects, micro projects, and demonstrations to solve practical problems. This approach fosters critical thinking, creativity, teamwork and hands-on technical skills while encouraging experiential, application-oriented and self-directed learning. The evaluation will be carried out on the basis of specified rubrics.

NOTE 2: At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/Professional Organization/ Research Laboratory/ training centre etc. and submit a report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

NOTE 3: Students must choose one course from the Professional Elective–I category (Table I). 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.

Minor/Honors (Hons.)/Specialization in VLSI Design and Technology

I	Classroom	MLECEVLSI-203B	Digital Design with Verilog Lab	0	0	2	2	1	10	-	15	25	-
II	Classroom OR MOOCs	Refer to Annexure-I	Minor/Honors (Hons.)/Specialization (Table –II)	4	0	0	4	4	40	60	-	100	3

Annexure-I

Professional Elective Courses (Table-I)

S. No	Course Code	Course Name
1	PEC-ECE-210B	Scientific Computing
2	PEC-ECE-212B	Power Electronics
3	PEC-ECE-214B	Introduction to Artificial Intelligence
4	PEC-ECE-216B	Introduction to MEMS
5	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms

Minor/Honors (Hons.)/Specialization in VLSI Design and Technology (Table-II)

S. No	Course Code	Course Name
1	#MECEVLSI-201B	VLSI Technology
2	#MECEVLSI-202B	Digital Design with Verilog

#Note 1: The above course may be altered in even/odd semester as per availability of courses on NPTEL/Swayam platform with prior approval of the Chairperson of BOS.

 # Note 2: The laboratory course Digital Design with Verilog Lab (MLECEVLSI-204B) shall be offered along with the theory course Digital Design with Verilog (MECEVLSI-202B) in the same semester, subject to the availability of the theory course on the NPTEL/SWAYAM platform and with the prior approval of the Chairperson, Board of Studies (BoS).

Course Code	**PCC-ECE-201B**				
Category	Professional Core Courses				
Course Title	**Electronic Devices**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	3	
Course Objectives	The objectives of this course are ● To understand the fundamental concepts and operating principles of semiconductor devices. ● To study the characteristics and practical applications of various semiconductor devices. ● To design and analyze basic electronic circuits using semiconductor components. ● To explore biasing techniques and equivalent models for device operation in amplification and switching applications.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 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 and apply the fundamental concepts, working operations and characteristics of semiconductor devices to design electronic circuits and systems.
CO2	Apply diode principles to design and analyze its applications in rectifiers, Clippers, Clampers, filters, voltage doubler circuits.
CO3	Analyze biasing techniques used in amplifiers to determine their stability conditions for establishing a proper operating point.
CO4	Describe the working principles and applications of special purpose semiconductor devices used in electronics circuits.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 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 Semiconductor And PN-Junction Theory:** Introduction, Atomic Structure, Band Theory of Semiconductors, Effect of Temperature on Conduction, Drift Current, Donor & Accepter Impurities in Semiconductor, Law of Mass Action, Hall's Effect, Hall Coefficient & Mobility, continuity equation. **Characteristics Of Diode:** PN-Junction, Construction Types, Unbiased Junction, Biased Junction, Space Charge Region, Diode Characteristics & Parameters, Diode Capacitance, Diode Resistance, DC And AC Load Lines, Diode Testing, Zener And Avalanche Breakdown Diodes, Temperature Characteristics of Diode, Reverse Recovery Time, Switching Characteristics of Diode.

Unit-II	**Diode Applications:** Half Wave, Full Wave Center Tapped, Full Wave Bridge(Rectification), Series Clipping Circuit, Shunt Clipping Circuit, Clamping Circuit, Bridge Voltage Doubler, Filtering Circuit Using Capacitor & Inductor. **Special Semiconductor Devices:** Optoelectronic Devices, Photoconductors, Photo Diode, Photo Voltaic Sensor, Solar Cells, LED, LCD, Laser Diode, Schottky Diode, Tunnel Diode ,SCR, TRIAC, DIAC, UJT, IGBT, Opto Coupler.
Unit-III	**Junction Transistor:** Introduction, Construction Of Junction Transistor, Circuit Symbols, Transistor Operation, Unbiased Transistor, Operation Of Biased Transistor, Transistor Current Components, DC & AC Load Line, Operating Point, Transistor Configuration CB, CE, CC, Input/Output Characteristics, Early Effect(Base Width Modulation), Eber's-Moll-Model of Transistor, Maximum Rating of Transistor, Transistor Testing, Transistor as an amplifier. **BJT Biasing:** Bias Stability, Instability Due To β, Thermal Stability, Stability Factor, Fixed Biased Circuits, Effect of Emitter Resistor, Collector to Base Bias, Voltage Divider Biasing, Advantage & drawbacks of Biasing Techniques, Stability Factor calculation of Biasing Techniques, Bias Compensation by various device, Thermal Runway, Transistor Dissipation, Thermal Resistance, Condition of Thermal Stability.
Unit-IV	**Small Signal Circuit:** Two Port Network, Hybrid (H-Parameter) Model, Typical Values of H-Parameter Model, Conversion of CE, CB, CC Configuration to Equivalent Hybrid Model, CB Circuit Analysis, CE circuit with & without R_E analysis, CC circuit analysis, Analysis of CE, CB & CC Configuration with approximate Hybrid Model, Miller's Theorem, Dual of Miller Theorem. **FET:** Introduction, The Junction FET, Basic Construction, Operation, P- Channel FET, N-Channel FET, High Frequency Model of FET, Low Frequency FET Amplifiers, Transfer Characteristics of FET. JFET and MOSFET Structure, Operation and characteristics.

Suggested Readings:

- Electronics Device &Circuit by J.B. Gupta -S.K. Kataria and Sons.
- Electronics Device &Circuit by Sahdev, S.K 2nd Edition—DhanpatRai& sons.
- Integrated Electronics by Millman Halkias -- TMH.
- Electronics Device Circuit by David. A. Bell -- Oxford.
- Principal of Electronics Device & Circuit by Theraja , B.L, Sedha, RS, S Chand.
- Electronics Device &Circuit by Maini, A.K; Agarwal, Varsha—-Wiley India.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Basic Semiconductor Introduction	https://youtu.be/CXFtbpYaBXw?si=yAkLNOIiRFCCo7te
	Characteristics of Diode	https://youtu.be/OkyKCNvKJI4?si=zAN6-T2SNOou2hkI
Unit-II	Clipper Circuit	https://www.youtube.com/watch?v=1hfhih839oU
	Special Semiconductor Devices	https://www.youtube.com/watch?v=o_d9j67Zm7k
Unit-III	Introduction to BJT	https://youtu.be/qFaAk9YPURw?si=74PmQzvApKquQF1R
	Transistor Configuration	https://www.youtube.com/watch?v=x8WxZjKrvTc
	BJT Biasing	https://www.youtube.com/watch?v=1vRgDzJ2yOU
Unit-IV	H-parameter	https://youtu.be/N5YIsvY5uBM?si=AAdMvHVVN_mNKG00
	Small Signal Amplifier	https://www.youtube.com/watch?v=5MLVr9r6Vzk&list=PL-IC1WV1OE4kRdcpTfgtNjFpR8XEpDu7O

Course Code	**PCC-CSE-203B**				
Category	Engineering Science Courses				
Course Title	**Data Structures**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	3	
Course Objectives	The objectives of this course are to ● To introduce the basics of data structures and algorithms. ● To explain stacks, linked lists and trees with their implementation. ● To understand sorting, hashing and graph algorithms with complexity analysis. ● To evaluate algorithm efficiency in terms of time and space complexity.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 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 the key terminologies of data structures and algorithms including their classifications, operations, and performance characteristics.
CO2	Describe the design and implementation of various linear and non-linear data structures, and their real-world applications including hashing and binary trees.
CO3	Apply appropriate data structures such as arrays, stacks, queues, linked lists, trees, and graphs to solve computational problems effectively.
CO4	Analyze the efficiency of algorithms and operations in searching, sorting, and traversals using time and space complexity metrics.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 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:** Basic Terminologies: Concept of Data Structure, Choice of right Data Structure, Algorithms, how to design and develop algorithm, Complexity of algorithm. Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Searching: Linear Search and Binary Search Techniques and their complexity analysis. Arrays: Array Definition, Types, Operations on array and their complexity analysis.
Unit-II	**Stacks and Queues:** Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation -corresponding algorithms and complexity analysis. Tower of Hanoi problem. Queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis.

Unit-III	**Linked Lists:** Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis. **Trees:** Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Path length, Huffman's algorithm, Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.
Unit-IV	**Sorting and Hashing:** Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. **Graph:** Basic Terminologies, Sequential representation of graphs, Adjacency matrices. Graph search and traversal algorithms and complexity analysis.

Suggested Readings:

- Fundamentals of Data Structures by Ellis Horowitz, Tata McGraw-Hill
- Algorithms, Data Structures, and Problem Solving with C++, by Mark Allen Weiss, Addison-Wesley
- Data Structures and Algorithms by Narasimha Karumanchi.
- Data Structures Using C by Aaron M.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Data Structures and Algorithms	https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F
	Linear Search Algorithm	https://www.youtube.com/watch?v=C46QfTjVCNU
	Binary Search	https://www.youtube.com/watch?v=V_T5NuccwRA
Unit-II	Stacks	https://youtu.be/g1USSZVWDsY?list=PLBF3763AF2E1C572F
	Stack and its Applications	https://www.youtube.com/watch?v=aG0HjeXBUDU
	Queues and Linked Lists	https://youtu.be/PGWZUgzDMYI?list=PLBF3763AF2E1C572F
Unit-III	Linked Lists-I	https://www.youtube.com/watch?v=K7VIKlUdo20
	Trees	https://youtu.be/tORLeHHtazM?list=PLBF3763AF2E1C572F
	Search Trees-II	https://www.youtube.com/watch?v=5jQGqaAUzOI
	AVL Trees	https://youtu.be/mRGQylRWAsI?list=PLBF3763AF2E1C572F
Unit-IV	Sorting	https://youtu.be/4OxBvBXon5w?list=PLBF3763AF2E1C572F
	Hashing	https://www.youtube.com/watch?v=2-h9193Ztqg
	Graphs	https://youtu.be/9zpSs845wf8?list=PLBF3763AF2E1C572F

Course Code	**PCC-ECE-205B**				
Category	Professional Core Courses				
Course Title	**Computer Organization & Architecture**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	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	30 Marks				
End Semester Examination	45 Marks				
Total	75 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 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 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 CarlHamacher, 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_lADfFI
Unit IV	Privileged & Non-Privileged Instructions	https://www.youtube.com/watch?v=z0URQryCbI0
	Memory organization	https://www.youtube.com/watch?v=lKVu02WjhoI
	Memory Hierarchy	https://www.youtube.com/watch?v=zwovvWfkuSg

Course Code	**BSC-MECE-207B**					
Category	Basic Science Courses					
Course Title	**Mathematics-III**					
Scheme and Credits	L	T	P	**Credits**	**Semester-III**	
	3	1	0	4		
Course Objectives	The objectives of this course are • To understand and classify first and second-order linear partial differential equations, and apply appropriate solution techniques including complementary function and particular integral methods. • To solve and analyze physical models such as wave and diffusion equations using methods like separation of variables and D'Alembert's solution.					
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 partial differential equations and probability distributions, including their properties and physical relevance.
CO2	Solve second-order PDEs using complementary functions and particular integrals.
CO3	Apply probability concepts, including conditional probability and Bayes' Theorem, for real-world problems using discrete and continuous distributions.
CO4	Implement numerical methods (Bisection, Newton-Raphson, Euler, Runge-Kutta) for solving equations and ODEs with a focus on accuracy and efficiency.

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	**Partial Differential Equations**: Partial Differential Equations of higher order, Solution tohomogenous and non-homogenous linear partial differential equations of second order bycomplimentary function and particular integral method, Initial and boundary conditions, D'Alembert's solution of the wave equation, Separation of variables method to simple problems in Cartesian coordinates.
Unit-II	**Probability and Statistics:** Measure of central tendency, Basic concept of Probability, Conditional Probability, Baye's Theore m, Random Variables, Discrete and Continuous Distributions, Binomial, Poisson and Normal Distribution, Linear Regression and Correlation.
Unit-III	**Numerical Methods 1:** Solution of polynomial and transcendental equations – Bisection method, Regula-Falsi method and Newton-Raphson method, Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae, Numerical differentiation, Numerical integration, Trapezoidal rule and Simpson's 1/3rd and 3/8 rules

Unit-IV	**Numerical Methods 2:** Taylor's series, Euler and modified Euler's methods, Runge-Kutta method of fourth order for solving first and second order ordinary differential equations. Matrix inversion (Gauss Seidel, Gauss Elimination Method, LU Decomposition).

Suggested Readings:

- Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons
- Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers
- Higher Engineering Mathematics by B. V. Ramana, TMH
- A text book of Engineering Mathematics by N. P. Bali and Manish Goyal, Laxmi Publications
- A text book of Engineering Mathematics by Mathur, A.B., PHI Learning
- Numerical Methods by Balagurusamy, E, TMH
- Introductory Methods of Numerical Analysis by S. S. Sastry, PHI
- Business Statistics by T.R. Jain and S.C. Aggarwal, VK Global Publications Pvt. Ltd.

Useful Video Links:

Unit No.	Topics	Links
Unit I	Definition of Partial Differential Equations	https://www.youtube.com/watch?v=KlZqe4UC1jk
	Second-order linear partial differential equations	https://www.youtube.com/watch?v=PVUfuiuWaZQ
	Solution to homogenous and non-homogenous linear P.D.E	https://www.youtube.com/watch?v=5eZbgxmpK3Q&t=520s
	Separation of variables method	https://www.youtube.com/watch?v=DgvQzfLpaTY&t=92s
Unit II	Basic concept of Probability, Conditional probability, Bays' theorem	https://youtu.be/60vHy2lA4o4 https://www.youtube.com/watch?v=ZFMcWe_SNyI https://www.youtube.com/watch?v=-ELHOnLwE9U
	Discrete and Continuous Distributions	https://www.youtube.com/watch?v=ruWsWnik7YY
	Binomial, Poisson and Normal Distribution	https://www.youtube.com/watch?v=eH4bao6elis
	Measure of central tendency	https://www.youtube.com/watch?v=X48cZ6DGaSw
	Linear Regression and Correlation	https://www.youtube.com/watch?v=_WM8vzYSQhs
Unit III	Bisection method, Regula-Falsi method and Newton-Raphson method	https://www.youtube.com/watch?v=3j0c_FhOt5U&list=PLU6SqdYcYsfIk1VhXxIYNPFU67ym6gae8 https://www.youtube.com/watch?v=FliKUWUVrEI&list=PLU6SqdYcYsfIk1VhXxIYNPFU67ym6gae8&index=2 https://www.youtube.com/watch?v=7eHuQXMCOvA&list=PLU6SqdYcYsfIk1VhXxIYNPFU67ym6gae8&index=5
	Interpolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae	https://www.youtube.com/watch?v=Y-yMQvYpltUhttps://www.youtube.com/watch?v=zdyUwzOm1zw https://www.youtube.com/watch?v=2h0R0Uka1HI
	Numerical integration, Trapezoidal rule and Simpson's 1/3rd and 3/8 rules	https://www.youtube.com/watch?v=EA76ONWBgK4&list=PLhSp9OSVmeyJBkLSO51JFPSEIIoeRiaJy
Unit IV	Taylor's series	https://www.youtube.com/watch?v=0JxwRqIM5t8&t=879s
	Euler and modified Euler's methods	https://www.youtube.com/watch?v=zD-Mg4ZUGsE&t=776s https://www.youtube.com/watch?v=zD-Mg4ZUGsE
	Runge-Kutta method	https://www.youtube.com/watch?v=iSO9DFcMDog

Course Code	**PCC-ECE-209B**				
Category	Professional Core Courses				
Course Title	**Signal Systems & Network Analysis**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	1	0	4	
Course Objectives	The objectives of this course are • To provide knowledge of signals and systems in time and frequency domains. • To introduce Fourier and Laplace methods for signal analysis. • To explain electrical network analysis using standard techniques and parameters. • To study transient response, network functions, and topology 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	Explain and summarize various types of signals and systems by interpreting their properties and characteristics in time and frequency domains.
CO2	Apply Fourier Series and Fourier Transform techniques to determine signal spectra and evaluate system responses for different excitation signals.
CO3	Apply node, mesh and matrix analysis methods along with network theorems to determine responses of electrical networks.
CO4	Analyze electrical network behavior using network functions, pole–zero plots, two-port parameter relationships, state variable models and graph theory concepts.

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 Signal:** Signal definition and classification with examples; continuous/discrete-time, analog/digital, deterministic/random, even/odd, causal/non-causal, real/complex, periodic/a periodic, energy/power, and elementary discrete-time signals. . **Introduction to Systems:** Continuous –Time & Discrete Time System, classifications of Systems: Causal and Non-causal Systems, Time-variant and Time-invariant Systems, Stable and Unstable Systems, Linear and non-linear systems, Static and Dynamic System, Invertible and inverse Systems.

Unit-II	**Fourier Series (FS):** Definition, Frequency domain representation of a signal, Existence of Fourier Series, Types of Fourier Series, Fourier Spectrum, Dirichlet's Condition, Concept of Gibbs phenomenon, Properties of Fourier Series. **Fourier Transforms (FT):** Definition, conditions of existence of FT, properties, magnitude and phase spectra, Some important FT theorems, Parseval's theorem, Inverse FT. **State Space Analysis:** State Variable Model, Variable Model using Physical variables, Variable Model using Phase variables.
Unit-III	**Fundamentals of Network Analysis:** Node and Mesh Analysis, matrix approach of network containing voltage and current sources. source transformation and duality. Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer theorem. **Network Functions:** Terminal pairs or Ports, Network functions for one-port and two portnetworks, poles and zeros of Network functions, Time domain behavior from the pole-zero plot.
Unit-IV	**Two port network and interconnections:** Characteristics and parameters of two port networks**,** Network Configurations**,** short-circuit Admittance parameters, open-circuit impedance parameters, Transmission parameters, hybrid parameters, Inter-relationships between parameters of two-port network sets, Inter-connection of two port networks. **Network Topology:**Basic terminology of network topology, Principles of network topology, graph matrices, network analysis using graph Theory.

Suggested Readings:

- Network Analysis by M.E. Van, Valkenburg.,, Pearson Education,3rd Edition
- Circuits and Network by Sudhakar A. Shyammohan, S. P., TMH
- Network Analysis and Synthesis by Raja, P; Singh, K.K, Raja, Umesh Publications
- Network Theory by Soni K.M., S.K. Kataria and Sons
- Network Theory and Filter Design by Aatre, Vasudev K, New Age International
- Signals & Systems by A. V. Oppenheim, A. S. Willsky, with S. Nawab, Pearson Education , 2nd Edition
- Signals & Systems by Nagrath & R. Ranjan, TMH
- Digital Signal Processing, Principles, Algorithms, & Applications by J. G. Proakis, D. G. Manolakis, Pearson Education,4th Edition
- Signals & Systems by Dr. Sanjay Sharma, Katsons Books
- Digital Signal Processing By S. Salivahanan
- Signals & Systems by A. Anand Kumar, PHI , 3RD Edition

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Basics of S&S	https://www.youtube.com/watch?v=PkFS5HutDiM&list=PLgwJf8NK-2e64X9h-rshDvVI76uD0gDOf&index=2
	LTI System	https://www.youtube.com/watch?v=EIYYhwTP1jk&list=PLBlnK6fEyqRhWw8GLfNIaWj7onqai8VjV
Unit-II	Fourier Transform	https://www.youtube.com/watch?v=rCw-FVegWJA&list=PLBlnK6fEyqRhkN2yGQpH40Pk-paIJzzvv
	Laplace Transform	https://www.youtube.com/watch?v=c9NibpoQjDk&t=9s
	State Variable technique	https://www.youtube.com/watch?v=DSvBXXnZv34&list=PLW6YlvHa65xg5asFyEm6hx0wjHNcaVpTT

Unit-III	Fundamentals of Network Analysis	https://www.youtube.com/watch?v=YhJWrhW3vjE&list=PL9RcWoqXmzaLG1SpJk_istSmesK4mZBiZ
Unit-IV	Two port network and interconnections	https://www.youtube.com/watch?v=pn777Ya0OHk&list=PLBlnK6fEyqRjQZj_QXvH8sp1lOWtjQCtT
	Transient Response of RC, RL, and RLC Circuits to various excitation signals	https://www.youtube.com/watch?v=Vb_OFPpynpg&list=PLgwJf8NK-2e58RyKZzw9t3mfXUqpJL6nV

Course Code	**HSMC-02B**				
Category	Humanities and Social Science including Management Courses				
Course Title	**Economics for Engineers**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	3	
Course Objectives	The objectives of this course are • To introduce the basic concepts of economics and their relevance to science, engineering, and national development. • To develop a foundational understanding of microeconomic principles such as demand, supply, production, cost, and market structures. • To equip students with tools to apply economic reasoning to real-world pricing, output, and market decisions. • To familiarize students with macroeconomic elements like the Indian economy, banking system, privatization, and globalization.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 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 economic concepts, the connection between economics with engineering and technological development, along with economic laws relevant to resource based decision making in society.
CO2	Explain economic growth theories and illustrate the role of engineering and technology in supporting economic development.
CO3	Apply theories of consumption and production to the design and development of engineering products.
CO4	Analyze market conditions; evaluate cost structures and financial aspects to assess the feasibility of engineering projects.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 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	**Definition of Economics:** Various Definitions, Types of Economics, Micro and Macro Economics, Nature of Economic Problem, Production Possibility Curve, Economic Laws and their Nature, Relationship between Science, Engineering, Technology and Economic Development**.** **Demand:** Meaning of Demand, Law of Demand, Elasticity of Demand, Meaning, Factors affecting the Elasticity of Demand, Practical Application and Importance.
Unit-II	**Production:** Meaning of Production and Factors of production, Law of Variable Proportions, Returns to Scale, Internal and External Economies and Diseconomies of Scale, Various concepts of Cost of Production- Fixed Cost, Variable Cost, Money Cost, Real Cost, Accounting Cost, Marginal Cost, Opportunity Cost, Shape of Average Cost, Marginal Cost, Total Cost etc. in short run and long run.

Unit-III	**Market:** Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features). **Supply:** Supply and Law of Supply, Role of Demand and Supply in Price Determination and Effect of Changes in Demand and Supply on Prices.
Unit-IV	**Indian Economy:** Nature and Characteristics of Indian Economy as underdeveloped, developing and mixed economy (brief and elementary introduction). **Privatization:** Meaning, Merits and Demerits. **Globalization of the Indian Economy:** Merits and Demerits **Banking:** Concept of a Bank, Commercial Bank, Central Bank, Functions of a Bank, Difference between Commercial and Central Bank.

Suggested Readings:

- Modern Microeconomics: Theory and Applications by H.L. Ahuja, S. Chand & Company Pvt. Ltd.
- Indian Economy by S.K. Misra & V.K. Puri, Himalaya Publishing House
- Indian Economy : Principles and Policies by Srirangam, SriRam, ; Rohit Deo, Pearson Education
- Managerial Economics by R. Cauvery et al., S. Chand & Company Pvt. Ltd.
- Microeconomic Theory by Andreu; Whinston, Michael D ; Green, Jerry R, Oxford University Press.
- Principles of Economics by Case, Karl E; Fair, Ray C ; Oster, Sharon E, Pearson Education

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Fundamental concepts of microeconomics, including definitions, types, and the nature of economic problems.	https://www.youtube.com/watch?v=IFtOcNbej0o&list=PLFNFJbo2hfBGRTCMuroZGykNzacwmAH2L
Unit-II	Production and Cost of production	https://www.youtube.com/watch?v=VU1zySe-8NA
Unit-III	Theory of Markets	https://www.youtube.com/watch?v=HylqSa58lqQ
Unit-IV	Nature and characteristics of the Indian economy, highlighting aspects of underdevelopment and development.	https://www.youtube.com/watch?v=ME-0GOhhZcs&list=PLFW6lRTa1g83winAoIK92HL4xTytJaW7S

Course Code	**LC-ECE-211B**					
Category	Professional Core Courses					
Course Title	**Electronic Devices Lab**					
Scheme and Credits	L	T	P	**Credits**	**Semester-III**	
	0	0	2	1		
Course Objectives	The objectives of this course are • To study the characteristics and applications of various electronic devices. • To analyze different transistor configurations and their behavior. • To explore the operation of field-effect transistors and their amplifier circuits. • To understand and test special semiconductor devices used in practical applications.					
Assessment	10 Marks					
End Semester Examination	15 Marks					
Total	25 Marks					
Duration of Exam						

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

COs	Skills Demonstrated
CO1	Examine the behavior of PN junction diodes under different biasing conditions and their applications in electronic circuits and filters.
CO2	Demonstrate the characteristics of special purpose semiconductor devices of thyristor family used in triggering and switching circuits.
CO3	Design and analyze transistor configurations in amplifiers and switches to optimize the performance of electronic circuits.
CO4	Demonstrate and analyze the characteristics of field-effect transistors under different configurations for electronic circuit applications.

List of Experiments

Sr.No.	Contents
1	To study and Analyze the characteristics of diode.
2	To study and Analyze zener diode as a voltage regulator.
3	To study and Analyze half wave and full wave rectifiers.
4	To study and Analyze power supply filters.
5	To study and Analyze diodes as a clipper and clamper.
6	To study and design of a DC voltage doubler.
7	To study and Analyze transistor as a constant current source in CE configuration
8	To study and Analyze CB & CC transistor configuration.
9	To study and Analyze CE amplifier for voltage, current and power gains input, output impedances.
10	To study characteristics of FET.
11	To study and Analyze FET common source amplifier.
12	To study characteristics of SCR.
13	To study characteristics of DIAC.
14	To study UJT as a relaxation oscillator.

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	Characteristics of diode.	https://www.youtube.com/shorts/wVVDrphYtLI
2	Clipper and Clamper Circuits	https://www.youtube.com/watch?v=JAWswYG-jDA
3	DC voltage doubler	https://www.youtube.com/watch?v=779NQxJZeFc
4	UJT as a relaxation oscillator	https://www.youtube.com/watch?v=8AK0rxgsN9o
5	CE amplifier	https://www.youtube.com/watch?v=0iRs1XMNChI
6	Transistor configuration.	https://www.youtube.com/watch?v=DJHmaOb6Z7s

Course Code	**LC-ECE-213B**				
Category	Professional Core Courses				
Course Title	**Signal Systems and Network Analysis Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are • To introduce circuit simulation tools for network analysis. • To analyze RLC circuits in time and frequency domains. • To design and study low-pass, high-pass, and band-pass filters. • To calculate and analyze two-port network parameters.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

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

COs	**Skills Demonstrated**
CO1	Demonstrate standard signals and visualize time-domain behaviors using circuit simulation tools.
CO2	Analyze RC, RL, and RLC circuits for transient and steady-state responses.
CO3	Design and examine the filter circuits by determining their frequency response characteristics.
CO4	Determine and verify two-port parameters and assess their effect on connected networks.

List of Experiments

Sr. No.	**Contents**
1	Introduction of circuit creation & simulation by relevant software.
2	To study various commands for creating two and three dimensional plots using simulation software.
3	Write a program to plot the continuous time and discrete time Step Function using simulation software.
4	Write a program to plot the continuous time and discrete time Impulse Function using simulation software.
5	Write a program to perform amplitude-scaling, time-scaling and time shifting on a given signal using simulation software.
6	Write a program to plot the continuous time and discrete Ramp Function using simulation software.
7	To plot the transient response of RC, RL circuit.
8	To find the resonance frequency, bandwidth of RLC series circuit.
9	To plot the frequency response of a low pass filter and determine half-power frequency.
10	To plot the frequency response of high pass filters and determines the half-power frequency.
11	To plot the frequency response of band-pass filters and determines the band-width.
12	To calculate and verify "Z" & "Y" parameters of a two port network.
13	To determine the equivalent parameter of parallel connections of two port networks and study loading effect.
14	To calculate and verify "ABCD" parameters of a two port network.

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

Useful Video Links:

Sr. No.	Topics	Links
1	Introduction of circuit creation & simulation software like TINAPRO	https://www.youtube.com/watch?v=REQ9K3qqp-0&list=PLsMtCcso-QfbYqJOsWwcg97gtN0GxungD
2	Analyze the transient response of RC, RL, and RLC circuits using simulation tools to evaluate circuit behavior and performance.	https://www.youtube.com/watch?v=86OpfpZchOY
3	To calculate and verify "Z" & "Y" parameters of a two port network.	https://www.youtube.com/watch?v=Op l8_kMes
4	To plot the frequency responses of a high pass filter and determine the half-power frequency.	https://www.youtube.com/watch?v=lagfhNjMuQM
5	To calculate and verify "ABCD" parameters of a two port network.	https://www.youtube.com/watch?v=5Q1coA-0-Tg
6	To plot the frequency response of a band-pass filter and determine the band-width.	https://www.youtube.com/watch?v=MG_OvKdhqiQ
7	Introduction to MATLAB	https://www.youtube.com/watch?v=0x4JhS1YpzI&list=PLjVLYmrlmjGcNZrPa9bRg0JVlcxLX4Mu9
8	Amplitude-scaling, Time-scaling and Time shifting on a given signal.	https://www.youtube.com/watch?v=IO3K7UpKcgY

Course Code	**LC-ECE-215B**				
Category	Professional Core Courses				
Course Title	**Electronic Workshop & PCB Design Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To understand and simulate electronic circuits using software tools. ● To learn the operation of PCB fabrication machines. ● To practice PCB fabrication processes and techniques. ● To design, assemble, and test printed circuit boards				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

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

COs	Skills Demonstrated
CO1	Understand and apply simulation and PCB design tools for the design and development of electronic circuits.
CO2	Implement the process of etching, UV exposure, drilling and coating for PCB fabrication using standard tools and techniques.
CO3	Analyze circuit parameters and component behavior to design compact and efficient PCBs for optimized system performance.
CO4	Evaluate the functionality and performance of fabricated electronic circuits through testing and validation procedures.

List of Experiments

Sr. No.	Contents
1	Introduction & Hands on experience to use circuit creation & simulation software like TINAPRO, Edwin XP etc.
2	Identification of various active and passive devices used for circuit designing. such as R, C, L, transformers, relays, switches, bread board, universal printed circuit board, diode, Zener diode, light emitting diode, transistors etc.
3	To study the process of PCB fabrication and assembly, including etching, post-etching treatments and various component mounting techniques.
4	Design and verify half wave rectifier with software like TINAPRO/EdwinXP.
5	Design and verify full wave rectifier with software like TINAPRO/EdwinXP.
6	Design and verify half adder with software like TINAPRO/EdwinXP.
7	Design and verify full adder with software like TINAPRO/EdwinXP.
8	Convert the power supply circuit into PCB & simulates its 2D & 3D view.
9	To test the functionality and performance of the electronic circuit.
10	Design and simulate a regulated power supply circuit using LM317/7805 IC and convert it into a PCB layout.
11	Fabricate a simple electronic project on a PCB and test its functionality.

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

Useful Video Links:

Exp No.	Topics	Links
1	TINA- Introduction and DC Simulation	https://youtu.be/51ztp8zgEG8
2	Etching of PCB	https://youtu.be/QbAuq00BalI
3	Exposing to UV Light & Developing	https://youtu.be/ILRdnfEM7YI
4	Power supply circuit using LM317/7805 IC and convert it into a PCB layout.	https://www.youtube.com/watch?v=d-j0onzzuNQ

<table>
<tr><td>Course Code</td><td colspan="5">*MC-201B</td></tr>
<tr><td>Category</td><td colspan="5">Mandatory Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Environmental Science</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-III</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>-</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
• Create awareness of the multidisciplinary nature and importance of environmental studies, including the sustainable management and conservation of natural resources.
• Develop an understanding of ecosystem dynamics, biodiversity, pollution types, and their impacts on environmental and human health.
• Foster critical thinking on social, ethical, and legislative aspects of environmental protection, emphasizing the role of individuals and society.
• Engage students in practical learning through fieldwork and case studies to apply environmental concepts for sustainable development and responsible citizenship.</td></tr>
<tr><td>Assessment</td><td colspan="5">20 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">30 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
<tr><td>Remarks</td><td colspan="5">The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded. The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations.
The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.</td></tr>
</table>

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

COs	Skills Demonstrated
CO1	Describe key concepts of environmental studies, types of natural resources, ecosystem structures, pollution types, major environmental laws and human-environment interactions.
CO2	Explain the interrelationships among ecosystems, biodiversity, pollution, social issues, environmental ethics and related legislation for sustainable development.
CO3	Apply principles of environmental management, pollution control, disaster preparedness and sustainable practices in real-world and field-based environmental contexts.
CO4	Analyze environmental problems, population growth impacts, climate change, welfare programs and the role of information technology in promoting public health and environmental sustainability.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 4 parts (covering all units) of 1.5 marks each and remaining eight questions of 6 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	The Multidisciplinary nature of environmental studies. Definition scope and importance. **Natural Resources:** Renewable and non-renewable resources, Natural resources and associated problems. **a) Forest resources:** Use and over-exploitation: deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people. **b) Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems. **c) Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies. **d) Food resources:** World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer pesticide problems, Water logging, salinity, case studies. **e)** Energy resources: Growing energy needs; renewable and non- renewable energy sources, use of alternate energy sources, case studies. f) **Land resources:** Land as are source, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources, equitable use of resources for sustainable life styles
Unit-II	**Ecosystems**: Producers, Consumers and Decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, Food web sand ecological pyramids**,** Introduction, types, characteristic features, structure and function of Forest ecosystem, Grass land ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). **Biodiversity and its conservation:** Introduction, Definition, Genetic, Species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-spots of biodiversity. Threats to biodiversity, habitat loss, poaching of wild life, man-wild life conflicts, Endangered and endemic species of India, In-situ and ex-situ conservation of biodiversity.
Unit-III	**Environmental Pollution:** Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards. **Solids Waste Management:** Causes, Effects and Control Measures of Urban and Industrial Wastes, Role of an Individual in Prevention of Pollution, Pollution Case Studies. **Disaster Management:** Floods, Earthquake, Cyclone and Landslides. **Social issues and the Environment:** From unsustainable to sustainable development, Urban problems related to energy, Water conservation, Rain Water Harvesting, Watershed Management, Resettlement and Rehabilitation of People, its problems and concerns case studies. **Environmental Ethics:** Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Waste land reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of pollution) Act, Water (Prevention and Control of pollution) Act, Wild life Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

Unit-IV	**Human population and the Environment:** Population growth, Variation among Nations, Population explosion-Family Welfare Programme, Environment and human health, Human Rights. Value Education, HIV/AIDS, Woman and Child Welfare Role of Information Technology in Environment and human health. Case Studies. **Field Work (Field work equal to 10 lecture hours)-**Visit to a local area to document environmental assets- river/forest/grassland/hill/mountain, Visit to a local polluted site-urban/Rural/Industrial/ Agricultural, Study of common plants, insects, birds, Study of simple ecosystems-pond, river, hills, slopes, etc.

Suggested Readings:

- Environmental Biology by K.C. Agarwal, Nidi Pub. Ltd., Bikaner
- The Biodiversity of India by Bharucha, MA Pin Publishing Pvt. Ltd., Ahmedabad.
- Hazardous Waste Incineration by R.C. Brunner, McGraw Hill Inc., 1989
- Environmental Chemistry by A.K. De, Wiley Eastern Ltd.
- Global Biodiversity Assessment by V.H. Heywood & R.T. Watson, Cambridge University Press, 1995, 1140p.
- Environmental Protection and Laws by H. Jadhav & V.M. Bhosale, Himalaya Pub. House, Delhi, 1995, 284p.
- Matter Hazardous by A.K. Mhaskar, Techno-Science Publications.
- Waste Water Treatment by M.N. Rao & A.K. Datta, Oxford & IBH Publ. Co. Pvt. Ltd., 1987, 345p.
- Environmental Chemistry by B.K. Sharma, Goel Publ. House, Meerut, 2001.
- Survey of the Environment, The Hindu.
- Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II by R.K. Trivedi, Enviro Media.
- Introduction to Air Pollution by R.K. Trivedi & P.K. Goel, Techno-Science Publications.
- Environmental Management by K.D. Wagner, W.B. Saunders Co., Philadelphia, USA, 1998, 499p.
- A Textbook of Environmental Education by Dr. J.P. Yadav, G.V.S. Publishers.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Environment Science: Introduction	https://www.youtube.com/watch?v=5QxxaVfgQ3k
	Natural Resources	https://www.youtube.com/watch?v=CXCT2R1K6Ts
	Ecosystem	https://www.youtube.com/watch?v=1dBU6HB8G6s
Unit-II	Biodiversity and its conservation	https://archive.nptel.ac.in/courses/102/104/102104068/
Unit-III	Sustainable Water Management In Urban Areas	http://digimat.in/nptel/courses/video/127106004/L29.ht
	Environmental Pollution	https://archive.nptel.ac.in/courses/123/105/123105001/
Unit-IV	Population and population growth	https://archive.nptel.ac.in/courses/102/104/102104068/
	National Family Welfare Programme	https://www.youtube.com/watch?v=X5F99L8ZEtc

Course Code	**PCC-ECE-202B**				
Category	Professional Core Courses				
Course Title	**Analog and Digital Communication**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand the basic concepts of communication systems and the impact of noise on signals. • To study various techniques used for signal transmission and reception. • To learn methods for converting signals between analog and digital forms. • To understand the working principles of radio transmitters and receivers.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 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 basic terminologies, signal types, communication modes and media used in analog and digital systems.
CO2	Understand and apply analog & pulse modulation and demodulation techniques used in communication systems for effective signal transmission.
CO3	Describe the structure and function of various radio transmitters and receivers used in communication systems.
CO4	Classify various modulation techniques and examine the impact of noise on signal quality and system performance

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 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 :** Modulation, Demodulation, Radio Frequency Spectrum, Signals & their classification, Limitations & Advantages of a Communication System, Comparison of Analog & Digital Communication Systems, Historical Perspective, Modes & Medias of Communication. **Noise:** Sources of Noise, External & Internal Noise, Noise Ratio, Noise Figure, Noise Temperature, Noise in Communication Systems, Pre-Emphasis & De-Emphasis.
Unit-II	**Amplitude Modulation:** Basic definition & derivation for Modulation & Modulation Index, Modulation & Demodulation of AM, Suppressed Carrier Modulation: - SSB-SC, DSB-SC, VSB Modulation & Demodulation, Comparison of various AM Systems, Generation and Detection (Demodulation) of AM Waves. Quadrature Amplitude Modulation. **Angle Modulation:** Basic definition & derivation for Modulation & Modulation Index, Generation of FM & PM waves, Bandwidth & Frequency Spectrum of FM, Types of FM, Demodulation of FM & PM waves, Comparison between AM, FM & PM.

Unit-III	**Pulse Analog Modulation:** Sampling theory, Multiplexing & Demultiplexing (TDM, FDM), Sampling Techniques, PAM, PWM, PPM, Modulation & Demodulation techniques. **Pulse Digital Modulation:** Quantization, Elements of Pulse Code Modulation, Noise, Bandwidth & Channel Capacity of PCM System. Delta Modulation (DM), Adaptive Delta Modulation (ADM), Differential Pulse Code Modulation (DPCM). Comparison of PCM/DM/ADM/DPCM.
Unit-IV	**Digital Carrier Modulation and Demodulation Techniques:** coherent and non-coherent modulation and demodulation techniques including ASK, FSK, PSK, QPSK, MSK, and DPSK; M-ary modulation schemes including M-PSK, M-FSK, and M-QAM. Performance comparison of digital modulation techniques (ASK, FSK, PSK). **Transmitters & Receivers**: Basic Block Diagram of Radio Transmitte r, Classification of Radio Transmitters, Basic Block Diagram of Radio Receiver, Classification of Radio Receivers.

Suggested Readings:

- Electronic Communication Systems, By Kennedy – TMH
- Communication Systems, By Singh & Sapre – TMH
- Communication System (Analog & Digital), Sanjay Sharma, Kataria & sons.
- Digital and Analog Communication Systems by Couch, Leon W, Pearson Education
- Communication System, By Manoj Duhan – I. K. International
- Analog Communication Systems by Chakraborty P, Dhanpat Rai & Company
- Communication System by Haykin, Simon, Wiley India

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Communication System	https://www.youtube.com/watch?v=INn5EQ9l5PE
	Noise in communication system	https://www.youtube.com/watch?v=u9nuKs2RAe0
Unit-II	Analog Modulation & Demodulation	https://www.youtube.com/watch?v=kAs8OerKRmc&list=PLgwJf8NK-2e7uyUYrpgUUQowmRuKxRdwp
Unit-III	Pulse Analog & Digital Modulation	https://youtu.be/TM47sEXeaj8?list=PLDp9Jik5WjRvjqQ6ruRFC6hZcxnOsp3BE
Unit-IV	Digital Carrier Modulation and Demodulation Techniques	https://www.youtube.com/watch?v=01zv0thaAUw
	Radio Transmitters & Receivers	https://www.youtube.com/watch?v=iUBC-S_zLk4

Course Code	**PCC-ECE-204B**				
Category	Professional Core Courses				
Course Title	**Analog Electronic Circuits**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • To study working operation and behavior of transistors and amplifiers. • To understand different types of feedback which affects the overall performance of the circuit? • To learn working operation of oscillator circuits. • To study power amplifiers, voltage regulators, and the basics of operational amplifiers with practical circuit applications.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

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

COs	**Skills Demonstrated**
CO1	Analyze the frequency response of BJTs and multistage amplifiers to determine gain, bandwidth, and high-frequency performance.
CO2	Design and implement feedback mechanism in amplifiers and oscillators used for improving the performance of analog circuits.
CO3	Classify power amplifiers and voltage regulators to ensure efficient power management in analog and mixed-signal circuits.
CO4	Understand and apply the process, principles and characteristics of operational amplifiers and IC fabrication for designing the electronic circuits.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 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	**Multistage Amplifier:** Classifications of amplifiers, Multistage amplifier voltage gain,RC Coupled Transistor Amplifier, Frequency response of RC Coupled Transistor Amplifier, Lower & Upper Cut off Frequency response, Transformer Coupled Amplifier, Direct Coupled Amplifier, Cascode Amplifier, Darlington Pair Amplifier, Distortion In Amplifiers. **Feedback Amplifiers:** Feedback concept, Transfer Gain with Feedback, General Characteristics of Negative Feedback, Effects of Negative Feedback on gain, Transfer gain, Input and Output Resistance calculation of feedback amplifiers/topologies: Voltage Series Feedback topology, Voltage Shunt, Current Series & Current Shunt topology.

Unit-II	**Oscillators:** Barkhausen Criterion, Condition for Sustained Oscillations & Frequency of Oscillations, Oscillator with RC Feedback circuit (RC Phase Shift, Wien Bridge), Tuned Collector Oscillator, LC Feedback circuits (Hartley, Colpitts) oscillators, Crystal Oscillator. **Power Amplifier:** Definition, Application & Types of Power Amplifiers, Class - A, B, AB, C, D power amplifier, Push Pull Amplifiers, Distortion in Simple & Push Pull Amplifier, Complementary Push Pull Amplifier and Integrated Circuit Power Amplifier.
Unit-III	**Voltage Regulators:** Voltage Regulation, Basic Series Regulators, Basic Shunt Regulators, Power Supply Parameters, Basic Switching Regulators, Step up Configuration, Step down Configuration, IC Voltage Regulator, SMPS. **Integrated Circuit Fabrication Process**: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapour deposition, sputtering, twin-tub CMOS process.
Unit-IV	**Operational Amplifier Fundamentals:** Block Diagram Representation, Ideal Op-Amp, OP-AMP Equivalent Circuit, Ideal Voltage Transfer Curve, Input Offset Voltage, Input Bias Current, Input Offset Current, Output Offset Voltage, Thermal Drift, Common Mode Configuration and CMRR,Slew Rate, Frequency Response of Op-Amp, Open loop and closed loop Configurations of an Op-Amp, Op-Amp as summing, scaling and averaging amplifier, Integrator, Differentiator. **Operational Amplifier Applications**: Linear and non-linear applications-ADC and DAC, Multivibrators, Astable Multivibrator, Monostable Multivibrator, Bistable Multivibrator, 555 Timer, Monostable & Astable Operation with 555 Timer.

Suggested Readings:

- Integrated Electronics By Millman Halkias -- TMH.
- Electronics Device & Circuit By Robert Boylestad ,Louis Nashelsky, 11th Edition, Pearson Education.
- Electronics Device & Circuit Theory By Nagrath, I.J., PHI Learning
- Electronics Device & Integrated Circuit By Singh, A K, PHI Learning
- A Textbook of Electronic Devices and Circuits by Gupta, J.B., S.K. Kataria and Sons
- Integrated Electronics : Analog and Digital Circuits and Systems by Millman, Jacob, TMH
- Applications and Design with analog Integrated Circuits by Jacob, Michael, Pearson Education

Useful Video Links:

Unit No.	Topics	Links
Unit-I	RC Coupled Amplifiers	https://youtu.be/BSR26SU3R2U
Unit-II	Power Amplifiers	https://youtu.be/huDZjQcEBMg
Unit-III	Voltage regulators	https://youtu.be/R_QnIAEk7Go
Unit-IV	Operational Amplifier	https://youtu.be/clTA0pONnMs

Course Code	**PCC-ECE-206B**				
Category	Professional Core Courses				
Course Title	**Digital Electronics**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	3	1	0	4	
Course Objectives	The objectives of this course are ● To learn fundamentals of digital logic and Boolean algebra. ● To design combinational and sequential logic circuits. ● To understand ADC/DAC and memory devices. ● To study programmable logic devices like FPGA and CPLD.				
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 knowledge of Boolean algebra, K-MAP and other digital design methods for simplification and optimization of digital circuits.
CO2	Design and implement combinational logic circuits using logic gates for arithmetic operations, code conversion, and control applications.
CO3	Understand and apply the concepts of latches, flip-flops, and counters in designing synchronous and asynchronous circuits for memory and storage applications.
CO4	Analyze memory types and programmable logic device architectures to interpret the functional organization.

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	**Logic Simplification**: Review of Boolean Algebra and De Morgan's Theorem, Digital codes, Logic gates and their operations, Realization of logic gates using universal gates, Number system, Representation of Boolean functions in sum of products (SOP) form and product of sums (POS), Addition and subtractions of a complements numbers, Minimization of Boolean functions using Karnaugh map and Quine McCuskeymethods, Error detection and correction techniques using Parity Check method and Hamming Code
Unit-II	**Combinational Logic Design**: Half and Full Adders, Half and Full Subtractors, Multiplexers, Demultiplexers, Encoder, Decoder, Magnitude Comparators, Priority encoder, Parallel Adders, Adder with Look Ahead Carry, BCD Adder.

Unit-III	**Sequential Logic Design**: Latches, Concept of edge triggered and level triggered clock, S-R, JK and Master-Slave JK FF, D FF, T FF,Conversions of FF, Ripple and Synchronous counters, Ring and Johnson counter, UP & DOWN counter, Sequence Generator, Shift registers.
Unit-IV	**A/D and D/A Converter**: Sample and hold circuit, weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters: Quantization, parallel - comparator, successive approximation, counting type, dual-slope ADC, specifications of ADCs. P**rogrammable Logic Devices**: ROM, PLA, PAL, SRAM, DRAM. FPGA and CPLDs

Suggested Readings:

- Modern digital Electronics by R.P. Jain, Tata McGraw Hill, 4th edition.
- Switching Theory & Logic Design by A.Anand Kumar, PHI.
- Digital Electronics Circuit and System by V K Puri, TMH.
- Digital Circuits and Systems by D.V. Hall, Tata McGraw Hill.
- Principle of Digital Electronics by K Meena, PHI
- Logic & Computer Fundamentals by Morris Mano, Pearson Education, 4th Edition.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Boolean Algebra	https://www.youtube.com/shorts/xtAYbY_Pz7I
Unit-II	Multiplexer	https://www.youtube.com/watch?v=p6yPvw88BJk
	Combinational Circuits	https://www.youtube.com/watch?v=fXrbYMDevDU
Unit-III	Sequential Circuits	https://www.youtube.com/watch?v=S0mKCNLmCh4&list=PLgwJf8NK-2e4mEQv0ttgW-am4wiqrpdcX
	Counter	https://www.youtube.com/watch?v=NTCrCYPoA5A&list=PLgwJf8NK-2e6lcDg0NxW-_yO6Bl5dPBp8
Unit-IV	Finite state machines	https://www.youtube.com/watch?v=LOZxYBOKRLg
	PLD's	https://www.youtube.com/watch?v=m6975d-U6j8

Course Code	**PCC-ECE-208B**				
Category	Professional Core Courses				
Course Title	**Microprocessor and Microcontroller**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	3	0	0	3	
Course Objectives	The objectives of this course are ● To understand the architecture and instruction set of microprocessors (8086, x86) and microcontrollers (8051, ARM). ● To develop low-level programming skills using assembly language. ● To learn peripheral interfacing concepts such as timers, I/O ports, ADC/DAC, and communication protocols. ● To explore advanced processors and embedded system using ARM Architecture.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 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 features and architecture of Intel processors and microcontrollers for signal descriptions and system design.
CO2	Use addressing modes and instructions of microprocessors and microcontrollers to write simple and efficient assembly programs.
CO3	Classify the interrupts and modes of operation in microprocessors and microcontrollers and analyze their impact on system performance and functionality.
CO4	Apply appropriate data transfer schemes and hardware for transfer data between the of peripheral devices for interfacing I/O devices.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 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 of Microprocessors and Programming:** Introduction to Microprocessors: Evolution, 8-bit/16-bit (8085/8086), Architecture, Pin configuration, Addressing modes and register organization of 8085. **8086 Architecture**: Pin configuration, Register organization, Addressing Modes, Memory Segmentation, Instruction Set of 8086, Minimum/Maximum Mode, Assembly language programming of 8086.

Unit-II	**Microprocessor Interfacing** Overview of Intel Pentium family processor, Overview of Multi-core Processors and Mobile Processor, Memory Interfacing, Peripheral Interfacing (8255 PPI, 8254 Timer, 8237 DMA, 8259 PIC), Concepts of Interrupts and DMA. **Memory Concepts**: Cache Memory, Virtual Memory – Mapping and Access Mechanisms.
Unit-III	**8051 Microcontroller and Interfacing:8051 Architecture**: RAM/ROM layout, machine cycle, I/O structure, Instruction Set: Addressing Modes, Data Transfer, Arithmetic, Logical, Branching, Assembly Language Programming. Peripherals and Interfacing: Timers/Counters, Serial Communication, Interrupts, ADC, DAC, LCD, LED, Keypad.
Unit-IV	**ARM Processor Architecture and Instruction set :**RISC vs. CISC, ARM Design Philosophy, ARM Architecture: States (ARM, Thumb, Jazelle), Register, Sets, Modes, Pipelining ARM Instruction Set: Data Processing, Load/Store, Branch, Conditional Execution, SWI, Vector Tables, Exception Handling.

Suggested Readings:

- Microprocessors and interfacing by D. V. Hall,, TMH, 2nd Edition.
- Microprocessor 8086: Architecture, Programming and Interfacing by Sunil Mathur, PHI Publisher
- Microprocessors and Microcontrollers by Sunil Mathur, Jeebananda Panda, PHI Publisher
- Advanced Microprocessors and Peripherals Architectures, Programming and Interfacing by Ray A. K. and Burchandi, TMH.
- The Intel Microprocessors 8086- Pentium Processor by Brey, 8th Edition, Pearson Education.
- The X86 PC: Assembly Language, Design and interfacing by M. A. Mazidi, J. P. Maizidi and Danny Causey, 5th Edition, Pearson Education.
- Microcontrollers: Architectures, Programming, Interfacing and System Design by Raj Kamal, Pearson Education

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Microprocessors and Interfacing – NPTEL Focuses on the interfacing aspects of microprocessors, covering essential concepts and practical applications	https://www.youtube.com/playlist?list=PLdlPA9pGVVtaUwRP-2Eaux10vo_USuDy1
	Microprocessors & Microcontrollers by Prof. Sunil Mathur	https://www.youtube.com/@profsunilmathur8809
Unit-II	Advanced Microprocessors and Memory Systems	https://www.youtube.com/playlist?list=PLuv3GM6-gsE01L9yDO0e5UhQapkCPGnY3
Unit-III	8051 Microcontroller and Interfacing ,The 8051 Microcontroller and Embedded Systems by Prof. Santanu Chattopadhyay (IIT Kharagpur)	https://www.youtube.com/playlist?list=PLEPI1RnS5drMCNu1VPDwdrRO_U0awwTxJ
Unit-IV	ARM Processor Architecture and Embedded Design, Embedded System Design with ARM by Prof. Dhananjay V. Gadre (IIT Delhi). Focuses on ARM architecture and its application in embedded system design, offering practical insights and examples.	https://www.youtube.com/playlist?list=PLbRMhDVUMngcJu5oUhgpgYqtOn7DmSfuU

Course Code	**PEC-ECE-210B**				
Category	Professional Elective Courses				
Course Title	**Scientific Computing**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand different types of errors in numerical computation. • To understand advanced computational techniques. • To solve linear and nonlinear systems, and perform data fitting.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 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 errors, stability, conditioning and other key terminologies related to computer arithmetic and numerical methods.
CO2	Describe the purpose, strengths, and application areas of numerical methods used in solving engineering and scientific problems.
CO3	Apply methods to solve linear and nonlinear systems, data fitting, interpolation, differentiation, integration, and differential equations.
CO4	Analyze the performance, accuracy, and limitations of numerical algorithms and their applications in simulation, optimization, and signal processing.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 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:** Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation.
Unit-II	**System of linear equations:** Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting **Eigen values and singular values:** Eigen values and Eigenvectors, Methods for Computing All Eigen values, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD

Unit-III	**Nonlinear equations:** Fixed Point Iteration, Newton's Method, Inverse Interpolation Method Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation Numerical Integration And Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation
Unit-IV	Initial Value Problems for ODES, Euler's Method, Taylor Series Method, RungaKutta Method, Extrapolation Methods, Boundary Value Problems For ODES, Finite Difference Methods, Finite Element Method, Eigen value Problems Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences

Suggested Readings:

- Scientific Computing: An Introductory Survey by Heath Michael T., McGrawHill, latest edition.
- Numerical Recipes: The Art of Scientific Computing by Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, Cambridge University Press, latest edition
- Introduction To Computational Mathematics by Xin-she Yang (Ed.).,World Scientific Publishing Co.
- Computational Science by Kiryanov D. and Kiryanova E., Infinity Science Press, latest edition
- Scientific Computing With MATLAB And Octave by Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, Springer, latest edition.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Data Error and Computational, Truncation Error and Rounding Error	https://www.youtube.com/watch?v=nPZmfpFrgPo
Unit-II	Positive Definite Systems and Indefinite System	https://www.youtube.com/watch?v=ttMZB5Gm_fM
Unit-III	One-Dimensional Optimization, Multidimensional Unconstrained Optimization	https://www.youtube.com/?bp=wgUCEAE%3D
Unit-IV	Solution for Sparse Linear Systems	https://www.youtube.com/watch?v=gwqbNtFuvWU

Course Code	**PEC-ECE-212B**				
Category	Professional Elective Courses				
Course Title	**Power Electronics**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand the construction and working of power electronic devices. • To design and analyze rectifiers, inverters, choppers, and converters. • To study different control techniques for AC and DC electric drives. • To explore real-world applications of power electronics in systems like UPS and electric vehicles.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 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 construction, working principles, and characteristics of power electronic devices.
CO2	Analyze single-phase and three-phase controlled rectifier circuits and inverter configurations for various load conditions.
CO3	Apply the concepts of choppers, dual converters, and cyclo- for efficient power control and conversion in electrical systems.
CO4	Implement thyristor-based control strategies for DC and AC electric drives and identify real- world applications of power.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 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	Role of power electronics, SCR- Construction, working principles of SCR, V-I characteristics of SCR, Two transistor analogy of SCR, Protection of SCR, Different methods of SCR triggering, Different commutation circuits for SCR, Construction, working principle & V-I characteristics of DIAC, TRIAC, IGBT, GTO, MOSFET, UJT. Basic idea about the selection of Heat sink for thyristors.
Unit-II	**Controlled Rectifiers:** Single phase half wave-controlled rectifier with R, R-L Load & concept of freewheeling diode, Single phase half controlled full wave rectifier with R, R-L Load), Single phase fully controlled full wave rectifier (centre tapped and bridge), Three phase full wave half-controlled and fully controlled bridge rectifier (R Load)
Unit-III	**Inverters:** Principle of operation of basic inverter circuits, concepts of duty cycle, series & parallel, inverters & their applications. **Choppers:** Introduction, types of choppers (Class A, Class B, Class C, Class D and Class E). Step up and step-down choppers. Comparison of various choppers.

Unit-IV	**Dual Converters and cyclo-converters:** Introduction, types & basic working principle of dual converters and cyclo- converters & their applications. **Thyristorised Control of Electric Drives:** DC drive control (half-wave, full-wave, and chopper-fed drives), AC drive control (phase control, V/f control, inverter/cycloconverter drives, and slip control) applications of power electronic devices. UJT as relaxation oscillator.

Suggested Readings:

- Power electronics by Muhammad H. Rashid, Prentice Hall of India.
- Power electronics by PC Sen,2nd edition, TMH.
- Power Electronics: Devices, Circuits, and Matlab Simulation by Alok Jain, Pernam international Publication.
- Power Electronics by M H Rashid, 3rd Edition,Pearson Education.
- Power Electronics and drive by Sachin Sharma, Vayu Education.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Two transistor analogy of SCR	https://www.youtube.com/watch?v=uN42NhZCU_M
Unit-II	Single phase half controlled full wave rectifier	https://www.youtube.com/watch?v=lFrbdl9AsQE
Unit-III	Step up and step-down choppers	https://www.youtube.com/watch?v=8UbLt2U1Ydw
Unit-IV	Thyristorised Control of Electric drives DC drive control	https://www.youtube.com/watch?v=q4YEChr8R5I

Course Code	**PEC-ECE-214B**				
Category	Professional Elective Courses				
Course Title	**Introduction to Artificial Intelligence**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	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	30 Marks				
End Semester Examination	45 Marks				
Total	75 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 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 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, Logic Propositional 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.

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_HGUOO9lSd4dTJ-37qCFtlBgh https://www.youtube.com/watch?v=JGrU9Bcf4wA&list=PLAHr0cis_HGUOO9lSd4dTJ-37qCFtlBgh&index=7

Course Code	**PEC-ECE-216B**				
Category	Professional Elective Courses				
Course Title	**Introduction To MEMS**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • 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. Applications. • To Develop understanding of mechanical behaviour in MEMS structure. • To Familiarize with modeling and analysis of MEMS devices.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 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 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 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, Hooke's 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.

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	**HSMC-01B**				
Category	Humanities and Social Sciences including Management Courses				
Course Title	**Fundamental of Management and Organizational Behavior**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • To introduce students to foundational management theories, functions, and organizational concepts to build a strong conceptual framework. • To develop understanding of individual and group behavior, motivation, communication, and leadership in organizational settings. • To equip students with practical skills to manage interpersonal processes, conflicts, and team dynamics effectively. • To foster critical analysis of organizational structures, cultures, and change mechanisms to enhance adaptability and effectiveness in organizations.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 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 fundamental management concepts, functions, organizational processes, and organizational behavior elements.
CO2	Explain the roles, skills, and interrelationships in management, individual behaviors, group dynamics, and communication processes within organizations.
CO3	Apply principles of management, motivation techniques, leadership styles, and conflict management strategies to solve organizational behavior challenges.
CO4	Analyze organizational structure, culture, change processes, and behavioral dynamics to support effective decision-making and organizational development.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 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 Management:** Meaning, Definitions, Nature of Management; Managerial Levels, Skills and Roles in an Organization. **Functions of Management:** Planning, Organizing, Staffing, Directing & Controlling, Interrelationship of Managerial Functions, Scope of Management, Importance of Management, Difference between Management and Administration.

Unit-II	**Introduction of Organization:** Meaning and Process of Organization, Management v/s Organization. **Fundamentals of Organizational Behavior:** Concepts, Evolution, Importance and Relationship with other Fields, Contemporary Challenges and Opportunities of OB **Individual Processes and Behavior:** Personality, Concept, Determinants and Applications. **Perception:** Concept, Process and Applications. **Learning:** Brief Introduction. **Motivation:** Concept, Techniques and Importance.
Unit-III	**Interpersonal Processes:** Teams and Groups, Definition of Group, Stages of Group Development, Types of Groups, Meaning of Team, Merits and Demerits of Team, Difference between Team and Group, Conflict- Concept, Sources, Types, Management of Conflict. **Leadership:** Concept, Function, Styles, Qualities of Leadership. **Communication:** Meaning, Process, Channels of Communication, Importance and Barriers of Communication.
Unit-IV	**Organizational Processes:** Organizational Structure, Meaning and Types of Organizational Structure and their effect on Human Behavior. **Organizational Culture:** Elements, Types and Factors affecting Organizational Culture. **Organizational Change:** Concept, Types and Factors affecting Organizational Change, Resistance to Change.

Suggested Readings:

- Fundamentals of Management by Robbins, S.P. and Decenzo, Pearson Education, New Delhi.
- Organisational Behaviour by Robbins, S.P. & Judge, T.A., Prentice Hall of India, New Delhi.
- Management concept practice and cases by Ghuman Karminder, AswathappaK.,TM, New Delhi.
- Fundamental of Management by Chhabra T. N., Sun India Publications, New Delhi.
- Organizational Behaviour by Stephen P Robin, Pearson Education.
- Organizational Behaviour by McShane, Steven L, Tata McGraw Hill, New Delhi.
- Organizational Behaviour by FC Sharma, Shree mahavir publications.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Nature and Scope of Management	https://nptel.ac.in/courses/110105146
Unit-II	Perception and Personality	https://nptel.ac.in/courses/110103433
Unit-III	Group Dynamics	https://archive.nptel.ac.in/courses/110/106/110106145/
Unit-IV	Organizational Change, Resistance to Change.	https://nptel.ac.in/courses/110105146

Course Code	**LC-ECE-218B**				
Category	Professional Core Courses				
Course Title	**Analog & Digital Communication Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	0	0	2	1	
Course Objectives	The objectives of this course are • To understand the basic principles of analog modulation and demodulation techniques like AM, FM, and PM. • To learn and observe the waveform analysis of pulse modulation and demodulation methods. • To study digital modulation techniques such as ASK, FSK, and PSK with waveform analysis.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

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

COs	Skills Demonstrated
CO1	Apply various analog modulation schemes for representation of AM, FM, PM signals.
CO2	Implement various analog detection methods for optimized & effective signal reception.
CO3	Examine the performance and applications of various pulse modulation & demodulation techniques used in communication systems.
CO4	Categorize different digital modulation & demodulation schemes used in modern communication systems.

List of Experiments

Sr. No.	Contents
1	To study and waveform analysis of amplitude modulation and determine the modulation index of amplitude modulation.
2	To study and waveform analysis of amplitude demodulation by any method.
3	To study and waveform analysis of frequency modulation and determine the modulation index of frequency modulation.
4	To study and waveform analysis of frequency demodulation by any method.
5	To study and waveform analysis of phase modulation.
6	To study Phase demodulation.
7	To study Pulse amplitude modulation and demodulation.
8	To study Pulse width modulation and demodulation.
9	To study Pulse position modulation and demodulation.
10	To study Pulse code modulation.
11	To study delta modulation.
12	To study Amplitude Shift Keying (ASK) modulation.
13	To study Frequency Shift Keying (FSK) modulation.
14	To study Phase Shift Keying (PSK) modulation.

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	Analog Modulation & Demodulation	https://www.youtube.com/watch?v=kAs8OerKRmc&list=PLgwJf8NK-2e7uyUYrpgUUQowmRuKxRdwp
2	Pulse Analog & Digital Modulation	https://www.youtube.com/watch?v=TM47sEXeaj8&list=PLDp9Jik5WjRvjqQ6ruRFC6hZcxnOsp3BE
3	Digital Carrier Modulation And Demodulation Techniques	https://www.youtube.com/watch?v=01zv0thaAUw

Course Code	**LC-ECE-220B**				
Category	Professional Core Courses				
Course Title	**Analog Electronics Circuit Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To understand the characteristics and AC analysis of RC coupled amplifiers. ● To understand the operation and characteristics of different oscillators, regulators and timers. ● To understand the operation of the power supply.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

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

COs	Skills Demonstrated
CO1	Analyze the characteristics and frequency response of different transistor amplifier configurations.
CO2	Examine the effects of negative feedback topologies on the performance of amplifiers.
CO3	Apply oscillator and op-amp principles to design and analyze circuits for signal generation and processing.
CO4	Demonstrate and apply the principles and working operations of IC regulators, SMPS, and 555 timers in analog circuits.

List of Experiments

Sr. No.	Contents
1	To analyze and study frequency response of RC coupled amplifier.
2	To analyze and study different types of feedback topologies.
3	To analyze and study RC phase shift oscillator.
4	To analyze and study the wein bridge oscillator.
5	To analyze and study three terminal IC voltage regulator.
6	To draw characteristics of a transistor.
7	To analyze and study inverting and non-inverting op-amp amplifiers.
8	To analyze and study the 555 timer as a square wave generator.
9	To analyze and study SMPS power supply.
10	To analyze and study working of Push-Pull amplifiers.
11	To analyze and study op-amp amplifiers as a differentiator.
12	To analyze and study op-amp amplifiers as an integrator.

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	Frequency response of RC coupled amplifier.	https://www.youtube.com/watch?v=ru72wlF6epU
2	Characteristics of a transistor.	https://www.youtube.com/shorts/8dN_4qNJALE
3	555 timer as a square wave generator	https://www.youtube.com/shorts/wjN-7eiuIgY
4	Wein bridge oscillator	https://www.youtube.com/watch?v=_TD0xG5FbCs
5	SMPS	https://www.youtube.com/shorts/5DQP-41mlQk
6	Working of Push-Pull amplifier	https://www.youtube.com/watch?v=NuW2ztF27R8
7	Inverting and non-inverting op-amp amplifiers	https://www.youtube.com/watch?v=EOZyofNXWXc

Course Code	**LC-ECE-222B**				
Category	Professional Core Courses				
Course Title	**Digital Electronics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To learn the basics of digital electronics and use logic gates and ICs. ● To design and check different combinational and sequential logic circuits. ● To understand the working operation of adders, subtractors, multiplexers, flip-flops, and counters in digital systems. ● To learn to build and test ADC, DAC, and practical counters for various applications.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

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

COs	Skills Demonstrated
CO1	Understand and apply operational principles of logic gates used in digital systems.
CO2	Analyze and verify the operation of sequential circuits used in digital systems
CO3	Verify the truth tables and behavior of combinational circuits with different states and inputs.
CO4	Perform and verify the operation of ADC and DAC circuits for digital system applications.

List of Experiments

Sr.No.	Contents
1	To study the operation of logic gates and verify their truth tables.
2	To verify the operation of universal gates.
3	To design and verify the operation of Binary-to-Gray and Gray-to-Binary code converters.
4	To design Half Adder and Full Adder circuits using gates.
5	To design and verify the operation of Half Subtractor and Full Subtractor circuits.
6	To study and verify the operation of Multiplexer and De-Multiplexer circuits.
7	To study the operation of Encoder and Decoder circuits.
8	To design and verify the operation of BCD-to-Seven Segment Decoder circuits.
9	To analyze and verify the operation and characteristic behavior of S-R, J-K, T, and D flip-flops under different input conditions.
10	To design and verify the operation of Decade counter using JK flip flops.
11	To design and verify the operation of 4-bit SISO and SIPO shift registers.
12	To analyze and verify the operation and performance characteristics of ADC and DAC circuits for digital system applications.

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	To study & design basic gates.	https://de-iitr.vlabs.ac.in/exp/truth-table-gates/
2	To study and realize logic functions with the help of universal gates.	https://de-iitr.vlabs.ac.in/exp/half-full-adder/
3	To verify the operation of Multiplexer & De-multiplexer.	https://de-iitr.vlabs.ac.in/exp/multiplexer-demultiplexer/
4	To perform half adder and full adder	https://de-iitr.vlabs.ac.in/exp/half-full-adder/
5	To perform half subtractor and full subtractor.	https://de-iitr.vlabs.ac.in/exp/half-full-subtractor/index.html
6	To verify the truth table of S-R, J-K, T & D Type flip flop.	https://de-iitr.vlabs.ac.in/exp/truth-tables-flip-flops/
7	To design & verify the operation of 3 bit synchronous counter.	https://de-iitr.vlabs.ac.in/exp/4bit-synchronous-asynchronous-counter/
8	To design & verify operation of Asynchronous counter.	https://de-iitr.vlabs.ac.in/exp/4bit-synchronous-asynchronous-counter/

Course Code	**LC-ECE-224B**				
Category	Professional Core Courses				
Course Title	**Microprocessor and Microcontroller Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	0	0	2	1	
Course Objectives	The objectives of this course are • To understand architecture and working of Microprocessor and Microcontroller. • To learn assembly programming for arithmetic and data operations. • To provide hands-on experience in interfacing various peripherals with processor based systems.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

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

COs	Skills Demonstrated
CO1	Explain the architecture and functioning of microprocessors and microcontroller using model kits and instruction sets.
CO2	Develop and debug assembly language programs for arithmetic, logical and data manipulation tasks using instruction sets.
CO3	Apply interfacing techniques to connect peripherals with computing devices for practical applications.
CO4	Analyze embedded control algorithms for hardware interfacing and timing operations using microcontroller kit.

List of Experiments

Sr.No.	Contents
1	To study the architecture and functional blocks of the 8085 and 8086 microprocessors using trainer kit.
2	Write and execute program to perform arithmetic operations such as addition, subtraction, multiplication and division using 8085 instruction set.
3	Write a program to add the content of the memory location to the content of other memory location and store the result in 3rd memory location using 8086 instruction set.
4	Write a program to add 16 bit number using 8086 instruction set.
5	Write a program for multiplication of two 16 bit numbers using 8086 instruction set.
6	Write a program for division of two 16 bit numbers using 8086 instruction set.
7	Write a program to calculate the factorial of a given number using the 8086 instruction set.
8	Write a program to find the average of two given numbers using the 8086 instruction set.
9	Write a program to find the largest number in a data array using 8086 Instruction set.
10	Write and execute an 8086 assembly language program to interface and control a stepper motor using the 8255 (PPI).
11	To study the architecture and functioning of the 8051 microcontroller using trainer kit.
12	Write and execute a program to generate a square wave using the 8051 microcontroller.
13	Write and execute a program to interface an LED with the 8051 microcontroller and generate a blinking effect using software delay.

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	Introduction of Microprocessor 8085 Trainer Kit. Introduction of Microprocessor 8086 Trainer Kit	https://www.youtube.com/watch?v=GsPxk6GYf2Y&list=PLbEc0iDORYCp1yLvEfNxbZOZ4lTPUv_4f https://www.youtube.com/watch?v=GZibA34SU0c
2	Write a program to find the average of two given numbers using the 8086 instruction set.	https://www.youtube.com/watch?v=nOt9Wa-ClRo&list=PLNdrDld4dxeVrRU4OmzVCR6UUgyRYMquI&index=10
3	Write a program to find the largest number in a data array using 8086 Instruction set.	https://www.youtube.com/watch?v=vNRGKG8ujVc&list=PLNdrDld4dxeVrRU4OmzVCR6UUgyRYMquI&index=12
4	Write a program to calculate the factorial of a given number using the 8086 instruction set..	https://www.youtube.com/watch?v=riliLJP0Q_0&list=PLNdrDld4dxeVrRU4OmzVCR6UUgyRYMquI&index=13
5	To write and execute an 8086 assembly language program to interface a stepper motor using 8255 PPI and control its rotation.	https://www.youtube.com/watch?v=lj5L1nGZAwg
6	To write and execute a program to interface an LED with the 8051 microcontroller and generate a blinking effect using software delay.	https://www.youtube.com/watch?v=aGVn4xGrAfY

Course Code	**PROJ-226B**				
Category	PROJECT				
Course Title	**Project Based Learning/Micro Project**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	0	0	2	1	
Course Objectives	The objectives of this course are • To expose students to domains related real-world engineering problem. • 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	-				
Total	25 Marks				
Duration of Exam					

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

COs	Skills Demonstrated
CO1	Identify domain specific real world or engineering problems and applications suitable for project development.
CO2	Explain the principles, methodology and systematic process for project execution, reporting and technical presentation.
CO3	Apply appropriate engineering knowledge, tools and techniques to develop solutions for identified problem.
CO4	Analyze ethical practices, economics associated with different technologies suitable for project development.
CO5	Justify design choices, performance parameters, and technical constraints of the developed solution.
CO6	Design and develop a cost effective, environmental friendly, functional prototype addressing a defined engineering problem.

Guidelines:

- The Project Based Learning (PBL)/Micro Project course is intended to promote experiential learning, innovation, creativity, critical thinking and problem-solving abilities through the development of a small-scale engineering project, case study, technical model, simulation, design activity or technical presentation.
- Students shall undertake the project individually or in groups consisting of a maximum of four members under the guidance and supervision of an assigned faculty mentor.
- The project shall focus on identifying and addressing a real-world problem, engineering challenge, societal need, industry requirement, sustainability issue, or emerging technological application relevant to Electronics and Communication Engineering or allied disciplines.
- Students shall perform a preliminary study involving literature survey, technology review, need analysis,

problem investigation, market survey, or application analysis to identify a suitable project topic.

- The selected work shall contribute to the attainment of Course Outcomes (COs), Programme Outcomes (POs), Programme Specific Outcomes (PSOs), UNSDGs and Washington Accord Knowledge Profiles (WK1-WK8).
- In consultation with the faculty mentor, students shall define the problem statement, objectives, scope of work, methodology, resource requirements, implementation plan and expected outcomes.
- The project shall incorporate considerations related to technical feasibility, functionality, safety, reliability, cost effectiveness, environmental impact, sustainability and ethical engineering practices wherever applicable.
- Faculty mentors shall conduct periodic reviews to monitor progress and provide guidance related to technical development, project management, documentation, presentation skills, innovations and professional practices.
- Students shall demonstrate teamwork, communication skills, leadership qualities, professional ethics, accountability and effective time management throughout the project duration.
- Continuous assessment shall be carried out through periodic reviews, demonstrations, project documentation and viva-voce examinations based on predefined rubrics.
- The final report shall include the problem statement, objectives, literature review, methodology, design approach, implementation details, results, analysis, conclusions, limitations and future scope of work.

Course Code	**MECEVLSI-201B**				
Course Title	**VLSI Technology**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III/IV**
	4	0	0	**4**	
Course Objectives	The objectives of this course are • To introduce the basics of MOS fundamentals, fabrication technology and CMOS process steps. • To explain layout design rules, stick diagrams, and lambda-based design methodology. • To understand the complete VLSI design flow from RTL to GDSII using CAD tools. • To develop the ability to apply CAD tools for chip-level design and verification through case studies.				
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 VLSI evolution, Moore's Law and complete IC fabrication process flow stages.
CO2	Explain MOS capacitor and MOSFET operation, scaling concepts and short-channel effects in modern devices.
CO3	Apply CMOS fabrication processes, lithography, etching, metallization and integration techniques.
CO4	Analyze advanced VLSI technologies, reliability issues and TCAD-based process and device simulations.

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-I

Introduction to VLSI Technology: Evolution of IC technology: SSI, MSI, LSI, VLSI, ULSI and Moore's Law and scaling challenges. Overview of fabrication process flow (wafer preparation, oxidation, lithography, etching, doping), Comparison of VLSI Design vs VLSI Technology focus, metallization, planarization (CMP), detailed process integration

Unit-II

MOSFET Fundamentals & Scaling: - MOS capacitor and MOSFET structure, Threshold voltage, channel formation, short-channel effects, Scaling theories, constant field scaling, constant voltage scaling, High-k dielectrics, metal gates, Fin FETs. MOSFET I–V characteristics, velocity saturation, sub threshold conduction, DIBL, mobility degradation.

Unit-III

Fabrication Technology: -Wafer fabrication steps: oxidation, diffusion, ion implantation, Photolithography and mask design, Etching techniques (wet, dry, plasma), Metallization and interconnect technology, Process integration for CMOS, CMP, isolation techniques, advanced lithography.

Unit-IV

Advanced VLSI Technology: -Low-power and high-speed technology trends, SOI (Silicon-on-Insulator), Emerging technologies, Reliability issues: hot carrier effects, NBTI, electro migration, TCAD basics, process and RTL device/Process/device simulation basics. Reliability testing methodologies, Packaging and yield issues.

Suggested Readings

- VLSI Technology by Simon M. Sze (McGraw Hill)
- CMOS VLSI Design: A Circuits and Systems Perspective by Neil H.E. Weste & David Harris
- Introduction to VLSI Design Flow by Sneh Saurabh
- VLSI Fabrication Principles: Silicon and Gallium Arsenide by Sorab K. Ghandhi
- Modern VLSI Design: System-on-Chip Design by Wayne Wolf

Useful Video Links

Unit No.	Topic	Link
Unit-I	Evolution of IC technology	https://www.youtube.com/watch?v=g6CCJAbdkK8&list=PLHO2NKv71TvsSqYwVvUCZwNkY-jUyUHdS
	Overview of fabrication process flow	https://www.youtube.com/watch?v=Uj0QJliffcI
Unit-II	MOS capacitor and MOSFET structure	https://www.youtube.com/watch?v=faiEVOOCe-s
	short-channel effects, High-k dielectrics	https://www.youtube.com/watch?v=ftdNBEwNDm0
Unit-III	Wafer fabrication steps Photolithography Etching techniques.	https://www.youtube.com/watch?v=Tacv0fA9n_s
	Metallization and interconnect technology.	https://www.youtube.com/watch?v=HSn3G3r69QE&list=PLLy_2iUCG87AMeXL_nGl5_6-L-hD8IK6i
Unit-IV	Low-power and high-speed technology trends.	https://www.youtube.com/watch?v=KvN3JXICzdM
	Emerging technologies: CNTFETs, TFETs, Quantum devices.	https://www.youtube.com/watch?v=U9I9yFTxa6c&list=PLwdnzlV3ogoVGGv52O5biztwOcUewLEf5

NPTEL Link

nptel.ac.in/courses/117106093

<table>
<tr><td>Course Code</td><td colspan="5">MECEVLSI-202B</td></tr>
<tr><td>Course Title</td><td colspan="5">Digital Design with Verilog</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-III/IV</td></tr>
<tr><td>4</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To introduce the fundamentals of Boolean algebra, logic gates, and HDL programming.
To explain the design and implementation of combinational and sequential circuits using HDL and CMOS concepts.
To understand finite state machines (FSMs), test benches, and simulation for digital systems.
To develop the ability to prototype digital designs on FPGA platforms and analyze performance.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

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

COs	Skills Demonstrated
CO1	Define Boolean algebra concepts, truth tables, logic gates, and canonical representations of digital logic.
CO2	Explain CMOS logic principles and structural behavior of digital circuits.
CO3	Simplify Boolean expressions and design combinational, sequential, and finite state machine circuits.
CO4	Analyze FPGA architecture, timing constraints and resource utilization for digital circuit implementation.

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-I

Logic Fundamentals & Boolean Algebra: Boolean laws, truth tables, canonical forms (SOP, POS), Number Systems, Logic gates, Base conversions and signed number representation (1's & 2's only),Binary codes, Code converters, Prime Implicants, Minimization techniques: K-map, Quine-McCluskey(Tabulation method).

Unit-II

Combinational Circuit Design: CMOS Combinational Circuit: Design Half Adder, Full Adder, Multiplexer and Demultiplexer using CMOS. CMOS Sequential logic circuits: Design SR latch, SR flip flop, JK flip flop, D flip flop using CMOS. Comparator design, parity checker, decoders, multipliers. Ripple carry adder, Carry look-ahead adder.BCD adders, code converters.

Unit-III

Sequential Circuit Design: Flip-flops (SR, JK, D, T) – CMOS latch and flip-flop design Registers (SISO, SIPO, PISO, PIPO) – CMOS register structures, Counters (asynchronous, synchronous, modulo N) – CMOS counter design, FSMs (Mealy & Moore) withVerilog.FSM minimization techniques, Implementation of flip-flops, counters, and registers in Verilog, ASM charts.RTL sequential multiplier.

Unit-IV

HDL Modeling & FPGA Prototyping: VHDL/Verilog syntax, modeling styles (behavioral, dataflow, structural) Test benches and simulation (Model Sim, Viv ado) FPGA synthesis, mapping, implementation, FSM testing, ASM methodology, Timing constraints and clock distribution in FPGA and optimization strategies.

Suggested Readings

- Digital Logic Circuits: With VHDL and Verilog Programs – A. Nagoor Kani
- Fundamentals of Digital Logic with VHDL Design – Stephen D. Brown & Zvonko Vranesic
- Digital Design: With an Introduction to Verilog HDL – M. Morris Mano & Michael Ciletti
- Digital Design Using Verilog- Charles H. Roth Jr., Lizy Kurian John
- Digital Systems Design Using Verilog-Charles H. Roth Jr., Lizy Kurian John
- Verilog Digital System Design-Zainalabedin Navabi

Useful Video Links

Unit No.	Topic	Link
Unit-I	Boolean laws	https://www.youtube.com/watch?v=yqDDwJalxUk
	Minimization using k- map	https://www.youtube.com/watch?v=BPBiyzc0OBw
Unit-II	Design Half Adder	https://www.youtube.com/watch?v=85XxQZqBNlg
	CMOS Sequential logic circuit: Design SR latch	https://www.youtube.com/watch?v=jm0PGDSSBkI
Unit-III	Logic Gate design using pass transistor:	https://www.youtube.com/watch?v=eqnMAaYU4OY
	Basic principle, non-ideal effects, domino CMOS logic, high performance dynamic CMOS circuits, clocking issues, clock distribution	https://www.youtube.com/watch?v=q8adOpQx7tc
Unit-IV	VLSI design methodology, design Hierarchy	https://www.youtube.com/watch?v=9QgdNsl9qwk&list=PLyqSpQzTE6M8iOrfy70ELk9W72JG5a98V
	Lambda-based design rules.	https://www.youtube.com/watch?v=OAxIm8up7QY

NPTEL Link

nptel.ac.in/courses/106103358

Course Code	**MLECEVLSI-203B**				
Course Title	**Digital Design with Verilog Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III/IV**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To introduce HDL programming for combinational and sequential circuits. • To explain FSM modeling and simulation using CAD tools • To understand FPGA synthesis and mapping of digital designs. • To develop the ability to analyze timing and functionality of FPGA prototypes.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

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

COs	**Skills Demonstrated**
CO1	Design combinational digital circuits using HDL and demonstrate their functional behavior through simulation results.
CO2	Design sequential digital circuits using HDL and their functional operation through simulation.
CO3	Realize finite state machine–based digital systems using HDL and implement them on FPGA platforms.
CO4	Evaluate HDL-based digital designs by judging logical correctness and timing performance using simulation waveforms.

List of Experiments

Sr. No.	**Contents**
1	Design of half-adder and full adder using Verilog/VHDL.
2	Design and verify multiplexer and de-multiplexer circuits using HDL.
3	Implement and simulate encoder and decoder circuits using HDL.
4	Develop HDL models for basic logic gates and verify their logical operation.
5	Design and simulate SR, JK, D, and T flip-flops using HDL.
6	Implement up, down, and modulo-N counters using HDL.
7	Design and simulate SISO, SIPO, PISO, and PIPO registers using HDL.
8	Implement CMOS-based latches and flip-flops and study their sequential behavior.
9	Design and simulate a traffic light controller using finite state machine modeling in HDL.
10	Model and verify Mealy and Moore finite state machines using HDL.

Useful Video Links

Sr. No.	Topic	Link
1	Design of half-adder and full adder using Verilog/VHDL.	https://youtu.be/lDbQq_t3N8I
2	Multiplexer and Demultiplexer design with HDL.	https://www.youtube.com/watch?v=BbhJnd0A9dI
3	Encoder and decoder implementation	https://www.youtube.com/watch?v=uiQuoUxPJZY
4	HDL coding for basic gates (AND, OR, NOT, NAND, NOR, XOR).	https://www.youtube.com/playlist?list=PLgwJf8NK-2e5JBJcNCZ7tqc2XjbezGjS8
5	Traffic light controller using FSM in Verilog.	https://www.youtube.com/watch?v=hJhBhEcCc-c
6	HDL modeling of Mealy and Moore FSMs	https://www.youtube.com/watch?v=EzMWYmRkHFQ&list=PLBlnK6fEyqRhduNC2PI4FPJqAhwoNTe1d

Annexure AC/5.7

~~Annexure – 4.6~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute
'A' GRADE ACCREDITED BY NAAC

Evaluation Scheme & Syllabus

For

Minor/ Honors (Hons.)/ Specialization

in

VLSI Design and Technology

Department of Electronics & Communication Engineering

(Effective from the Session: 2026-27)

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

Minor Degree/Honors (Hons.)/Specialization

in

VLSI Design and Technology

Offered by Department of Electronics & Communication Engineering

VLSI (Very Large Scale Integration) Design and Technology is a specialized and rapidly evolving branch of Electronics & Communication Engineering concerned with the design, development, verification, and fabrication of integrated circuits (ICs) containing millions to billions of transistors on a single silicon chip. It forms the technological backbone of the modern semiconductor and electronics industry, powering consumer electronics, telecommunications, automotive systems, artificial intelligence hardware, and IoT devices. With the Government of India's continued thrust on the semiconductor mission and self-reliance in chip design and manufacturing, the demand for skilled VLSI professionals is growing rapidly. Institutions and Universities must incorporate them into education, training and research.

Keeping the above in view, the Department of Electronics & Communication Engineering has started a Minor Degree/Honors (Hons.)/Specialization in "VLSI Design and Technology" from the academic session 2025–26, with the aim of enhancing students' employability skills and imparting in-depth knowledge in emerging areas that are usually not covered in the undergraduate degree framework. These emerging areas will help students tap into the wide range of employment opportunities available in these domains.

This Minor Degree/Honors (Hons.)/Specialization will require earning 20 credits. It will be an addition to the regular undergraduate program, implying that passing or failing it will not affect the results of the regular undergraduate program being pursued by the student. Upon successful completion of the course, a Minor Degree/Honors (Hons.)/Specialization shall be awarded to the candidate. Students of Electronics & Communication Engineering and other engineering programs shall be eligible for the Minor Degree/Honors (Hons.)/Specialization as outlined below:

Name of the Minor Degree/Honors (Hons.)/Specialization	**B. Tech Program whose students are eligible to opt for Minor Degree**	**B. Tech Program whose students are eligible to opt for Honors (Hons.)/Specialization**
VLSI Design and Technology	All Branches except Electronics & Communication Engineering and Electrical Engineering	Electronics & Communication Engineering and Electrical Engineering

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

Scheme of Studies and Examination

Minor/ Honors (Hons.) / Specialization in VLSI Design and Technology

w.e.f. 2026-27

Sr. No.	Semester	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration inHrs
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	III	MECEVLSI-201B	VLSI Technology	4	0	0	4	4	40	60		100	3
2	IV	MECEVLSI-202B	Digital Design with Verilog	4	0	0	4	4	40	60		100	3
3	IV	MLECEVLSI-203B	Digital Design with Verilog Lab	0	0	2	2	1	10		15	25	-
4	V	MECEVLSI-301B	Low Power VLSI Circuits & Systems	4	0	0	4	4	40	60		100	3
5	VI	MECEVLSI-302B	Analog VLSI Design	4	0	0	4	4	40	60		100	3
6	VI	MLECEVLSI-303B	Analog VLSI Design Lab	0	0	2	2	1	10		15	25	-
7	VII	MLECEVLSI-402B	Project Work	0	0	4	4	2	20		30	50	-
Total Credits								**20**				**500**	

Note: To earn the required credits for the award of B.Tech Minor/Honors (Hons.)/Specialization Degree, students may choose either:

(i) To enroll in courses offered through NPTEL/MOOCs that must be equivalent to the prescribed courses in the approved scheme, subject to availability in any semester.

OR

(ii) To complete the prescribed courses in the same semester as offered by the department under the approved scheme and curriculum structure.

Course Code	**MECEVLSI-201B**				
Course Title	**VLSI Technology**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III/IV**
	4	0	0	**4**	
Course Objectives	The objectives of this course are • To introduce the basics of MOS fundamentals, fabrication technology and CMOS process steps. • To explain layout design rules, stick diagrams, and lambda-based design methodology. • To understand the complete VLSI design flow from RTL to GDSII using CAD tools. • To develop the ability to apply CAD tools for chip-level design and verification through case studies.				
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 VLSI evolution, Moore's Law and complete IC fabrication process flow stages.
CO2	Explain MOS capacitor and MOSFET operation, scaling concepts and short-channel effects in modern devices.
CO3	Apply CMOS fabrication processes, lithography, etching, metallization and integration techniques.
CO4	Analyze advanced VLSI technologies, reliability issues and TCAD-based process and device simulations.

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-I

Introduction to VLSI Technology: Evolution of IC technology: SSI, MSI, LSI, VLSI, ULSI and Moore's Law and scaling challenges. Overview of fabrication process flow (wafer preparation, oxidation, lithography, etching, doping), Comparison of VLSI Design vs VLSI Technology focus, metallization, planarization (CMP), detailed process integration

Unit-II

MOSFET Fundamentals & Scaling: - MOS capacitor and MOSFET structure, Threshold voltage, channel formation, short-channel effects, Scaling theories, constant field scaling, constant voltage

scaling, High-k dielectrics, metal gates, Fin FETs. MOSFET I–V characteristics, velocity saturation, sub threshold conduction, DIBL, mobility degradation.

Unit-III

Fabrication Technology: -Wafer fabrication steps: oxidation, diffusion, ion implantation, Photolithography and mask design, Etching techniques (wet, dry, plasma), Metallization and interconnect technology, Process integration for CMOS, CMP, isolation techniques, advanced lithography.

Unit-IV

Advanced VLSI Technology: -Low-power and high-speed technology trends, SOI (Silicon-on-Insulator), Emerging technologies, Reliability issues: hot carrier effects, NBTI, electro migration, TCAD basics, process and RTL device/Process/device simulation basics. Reliability testing methodologies, Packaging and yield issues.

Suggested Readings

- VLSI Technology by Simon M. Sze (McGraw Hill)
- CMOS VLSI Design: A Circuits and Systems Perspective by Neil H.E. Weste & David Harris
- Introduction to VLSI Design Flow by Sneh Saurabh
- VLSI Fabrication Principles: Silicon and Gallium Arsenide by Sorab K. Ghandhi
- Modern VLSI Design: System-on-Chip Design by Wayne Wolf

Useful Video Links

Unit No.	Topic	Link
Unit-I	Evolution of IC technology	https://www.youtube.com/watch?v=g6CCJAbdkK8&list=PLHO2NKv71TvsSqYwVvUCZwNkY-jUyUHdS
	Overview of fabrication process flow	https://www.youtube.com/watch?v=Uj0QJliffcI
Unit-II	MOS capacitor and MOSFET structure	https://www.youtube.com/watch?v=faiEVOOCe-s
	short-channel effects, High-k dielectrics	https://www.youtube.com/watch?v=ftdNBEwNDm0
Unit-III	Wafer fabrication steps Photolithography Etching techniques.	https://www.youtube.com/watch?v=Tacv0fA9n_s
	Metallization and interconnect technology.	https://www.youtube.com/watch?v=HSn3G3r69QE&list=PLLy_2iUCG87AMeXL_nGl5_6-L-hD8IK6i
Unit-IV	Low-power and high-speed technology trends.	https://www.youtube.com/watch?v=KvN3JXICzdM
	Emerging technologies: CNTFETs, TFETs, Quantum devices.	https://www.youtube.com/watch?v=U9I9yFTxa6c&list=PLwdnzlV3ogoVGGv52O5biztwOcUewLEf5

NPTEL Link

nptel.ac.in/courses/117106093

Course Code	**MECEVLSI-202B**				
Course Title	**Digital Design with Verilog**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III/IV**
	4	0	0	**4**	
Course Objectives	The objectives of this course are • To introduce the fundamentals of Boolean algebra, logic gates, and HDL programming. • To explain the design and implementation of combinational and sequential circuits using HDL and CMOS concepts. • To understand finite state machines (FSMs), test benches, and simulation for digital systems. • To develop the ability to prototype digital designs on FPGA platforms and analyze performance.				
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 Boolean algebra concepts, truth tables, logic gates, and canonical representations of digital logic.**
CO2	**Explain CMOS logic principles and structural behavior of digital circuits.**
CO3	**Simplify Boolean expressions and design combinational, sequential, and finite state machine circuits.**
CO4	**Analyze FPGA architecture, timing constraints and resource utilization for digital circuit implementation.**

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-I

Logic Fundamentals & Boolean Algebra: Boolean laws, truth tables, canonical forms (SOP, POS), Number Systems, Logic gates, Base conversions and signed number representation (1's & 2's only),Binary codes, Code converters, Prime Implicants, Minimization techniques: K-map, Quine-McCluskey(Tabulation method).

Unit-II

Combinational Circuit Design: CMOS Combinational Circuit: Design Half Adder, Full Adder, Multiplexer and Demultiplexer using CMOS. CMOS Sequential logic circuits: Design SR latch, SR flip flop, JK flip flop, D flip flop using CMOS. Comparator design, parity checker, decoders, multipliers. Ripple carry adder, Carry look-ahead adder.BCD adders, code converters.

Unit-III

Sequential Circuit Design: Flip-flops (SR, JK, D, T) – CMOS latch and flip-flop design Registers (SISO, SIPO, PISO, PIPO) – CMOS register structures, Counters (asynchronous, synchronous, modulo N) – CMOS counter design, FSMs (Mealy & Moore) withVerilog.FSM minimization techniques, Implementation of flip-flops, counters, and registers in Verilog, ASM charts.RTL sequential multiplier.

Unit-IV

HDL Modeling & FPGA Prototyping: VHDL/Verilog syntax, modeling styles (behavioral, dataflow, structural) Test benches and simulation (Model Sim, Viv ado) FPGA synthesis, mapping, implementation, FSM testing, ASM methodology, Timing constraints and clock distribution in FPGA and optimization strategies.

Suggested Readings

- Digital Logic Circuits: With VHDL and Verilog Programs – A. Nagoor Kani
- Fundamentals of Digital Logic with VHDL Design – Stephen D. Brown & Zvonko Vranesic
- Digital Design: With an Introduction to Verilog HDL – M. Morris Mano & Michael Ciletti
- Digital Design Using Verilog- Charles H. Roth Jr., Lizy Kurian John
- Digital Systems Design Using Verilog-Charles H. Roth Jr., Lizy Kurian John
- Verilog Digital System Design-Zainalabedin Navabi

Useful Video Links

Unit No.	Topic	Link
Unit-I	Boolean laws	https://www.youtube.com/watch?v=yqDDwJalxUk
	Minimization using k- map	https://www.youtube.com/watch?v=BPBiyzc0OBw
Unit-II	Design Half Adder	https://www.youtube.com/watch?v=85XxQZqBNlg
	CMOS Sequential logic circuit: Design SR latch	https://www.youtube.com/watch?v=jm0PGDSSBkI
Unit-III	Logic Gate design using pass transistor:	https://www.youtube.com/watch?v=eqnMAaYU4OY
	Basic principle, non-ideal effects, domino CMOS logic, high performance dynamic CMOS circuits, clocking issues, clock distribution	https://www.youtube.com/watch?v=q8adOpQx7tc
Unit-IV	VLSI design methodology, design Hierarchy	https://www.youtube.com/watch?v=9QgdNsl9qwk&list=PLyqSpQzTE6M8iOrfy70ELk9W72JG5a98V
	Lambda-based design rules.	https://www.youtube.com/watch?v=OAxIm8up7QY

NPTEL Link

nptel.ac.in/courses/106103358

Course Code	**MLECEVLSI-203B**				
Course Title	**Digital Design with Verilog Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III/IV**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To introduce HDL programming for combinational and sequential circuits. • To explain FSM modeling and simulation using CAD tools • To understand FPGA synthesis and mapping of digital designs. • To develop the ability to analyze timing and functionality of FPGA prototypes.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

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

COs	**Skills Demonstrated**
CO1	Design combinational digital circuits using HDL and demonstrate their functional behavior through simulation results.
CO2	Design sequential digital circuits using HDL and their functional operation through simulation.
CO3	Realize finite state machine–based digital systems using HDL and implement them on FPGA platforms.
CO4	Evaluate HDL-based digital designs by judging logical correctness and timing performance using simulation waveforms.

List of Experiments

Sr. No.	**Contents**
1	Design of half-adder and full adder using Verilog/VHDL.
2	Design and verify multiplexer and de-multiplexer circuits using HDL.
3	Implement and simulate encoder and decoder circuits using HDL.
4	Develop HDL models for basic logic gates and verify their logical operation.
5	Design and simulate SR, JK, D, and T flip-flops using HDL.
6	Implement up, down, and modulo-N counters using HDL.
7	Design and simulate SISO, SIPO, PISO, and PIPO registers using HDL.
8	Implement CMOS-based latches and flip-flops and study their sequential behavior.
9	Design and simulate a traffic light controller using finite state machine modeling in HDL.
10	Model and verify Mealy and Moore finite state machines using HDL.

Useful Video Links

Sr. No.	Topic	Link
1	Design of half-adder and full adder using Verilog/VHDL.	https://youtu.be/lDbQq_t3N8I
2	Multiplexer and Demultiplexer design with HDL.	https://www.youtube.com/watch?v=BbhJnd0A9dI
3	Encoder and decoder implementation	https://www.youtube.com/watch?v=uiQuoUxPJZY
4	HDL coding for basic gates (AND, OR, NOT, NAND, NOR, XOR).	https://www.youtube.com/playlist?list=PLgwJf8NK-2e5JBJcNCZ7tqc2XjbezGjS8
5	Traffic light controller using FSM in Verilog.	https://www.youtube.com/watch?v=hJhBhEcCc-c
6	HDL modeling of Mealy and Moore FSMs	https://www.youtube.com/watch?v=EzMWYmRkHFQ&list=PLBlnK6fEyqRhduNC2PI4FPJqAhwoNTe1d