Learning Outcomes based Curriculum Framework (LOCF)

For

B. Tech. (Electronics and Communication Engineering)

3rd and 4th semester

Faculty of Engineering and Technology

Chaudhary Devi Lal University Sirsa-125055

Program outcomes (POs) and Program Specific Outcomes (PSOs)

Program outcomes (POs) of Bachelor Programs in Engineering and Technology have been specified in First year common curriculum of B.Tech. Program. Program Specific Outcomes (PSOs) are given as:

PSO1	To prepare the students to understand electronic and communication systems, components and processes to address technical and engineering challenges
PSO2	To empower the students to build up career in industry or pursue higher studies in ECE or interdisciplinary courses
PSO3	To enhance the skills of the students with the ability to implement the scientific concepts for betterment of the society considering ethical, environment and social values.

Course Code	**Definition/ Category**
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management Courses
MC	Mandatory Courses
PC	Program Core
PE	Program Elective Courses
OE	Open Elective Courses
EEC	Employability Enhancement Courses (Project work/ Summer Training/ Industrial Training/ Practical Training/ Internship/Seminar, etc.)

Course Code	Course Title	Workload/Credit			
	Semester III	Theory	Tutorial	Practical	Total
BSC/7-T	Mathematics-III	3/3	-	-	3/3
PC/ECE/1-T	Digital Electronics	3/3	-	-	3/3
PC/ECE/2-T	Analog Electronics-I	3/3	-	-	3/3
PC/ECE/3-T	Network Analysis and Synthesis	3/3	-	-	3/3
PC/ECE/4-T	Analog Communication	3/3	-	-	3/3
PC/ECE/1-P	Digital Electronics Lab	-	-	2/1	2/1
PC/ECE/2-P	Analog Electronics-I Lab	-	-	4/2	4/2
PC/ECE/3-P	Network Analysis and Synthesis Lab	-	-	2/1	2/1
*MC/3-T	Indian Constitution	3/0	-	-	3/0
	Total	18/15	-	8/4	26/19

Course Code	Course Title	Workload/Credit			
1. ***EEC/ECE/1	Industrial Training/Internship	-	-	-/4	-/4
	Semester IV	Theory	Tutorial	Practical	Total
PC/ECE/5-T	Sensors and measuring Instruments	3/3	-	-	3/3
PC/ECE/6-T	Digital Communication and Information theory	3/3	-	-	3/3
PC/ECE/7-T	Analog Electronics -II	3/3	-	-	3/3
PC/ECE/8-T	Electromagnetic Theory	3/3	-	-	3/3
PC/ECE/9-T	Signals and Systems	3/3	-	-	3/3
PC/ECE/5-P	Sensors and measuring Instruments Lab	-	-	2/1	2/1
PC/ECE/6-P	Analog and Digital Communication Lab	-	-	2/1	2/1
PC/ECE/7-P	Analog Electronics-II Lab	-	-	4/2	4/2
PC/ECE/10-P	Problem Solving using MATLAB	-	-	2/1	2/1
*MC/4-T	Essence of Indian Traditional Knowledge	3/0	-	-	3/0
**HSMC/2-T	Human Values and Personality Development	3/0	-	-	3/0
Total		21/15	-	10/5	31/20

* Non-credit qualifying mandatory course.

**Non-credit qualifying mandatory course. The assessment will be completely internal.

***The students will have to undergo Industrial/Practical Training/ Internship for 4-6 weeks during summer vacations after the examination of 4th semester which will be evaluated in 5th semester.

Note: Students will be allowed to use non-programmable scientific calculators only, however, sharing of calculator should not be permitted.

Detailed Syllabus of B.Tech.(ECE)

3rd Semester

Theory Courses

Mathematics-III

BSC/7-T

General Course Information

Course Credits: 3 Mode: Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration: 03 Hours	Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70) Two minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end- semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Mathematics I and Mathematics II

About the Course

This is an advanced mathematics course that offers the knowledge of Fourier Series, Fourier Transforms, Functions of Complex Variables. These concepts are essential for students to solve problems in image processing, digital signal processing and other related engineering fields.

Course Outcomes: By the end of the course students will be able to:

CO1. **Define** concepts and terminology of Fourier Series and Fourier transforms, Functions of complex variables and Power Series etc. (LOTS: Level 1: Remember)
CO2. **Solve** problems using Fourier transforms in domains like digital electronics and image processing. (LOTS: Level 3: Apply)
CO3. **Apply** principles of functions of complex variables to solve computational problems. (LOTS: Level 3: Apply)
CO4. **Compare** various concepts related to Fourier transforms and functions of complex variables. (HOTS: Level 4: Analyse)
CO5. **Select** suitablemethod for given computational engineering problems and related domain. (HOTS: Level 4: Evaluate)
CO6. **Integrate** the knowledge of Fourier Series and Fourier transforms, Functions of complex variables, and Power Series for solving real world problems. (HOTS: Level 6: Create)

Course Content

Unit I

Fourier Series and Fourier Transforms: Euler's formulae, conditions for a Fourier expansion, change of interval, Fourier expansion of odd and even functions, Fourier expansion of square wave, rectangular wave, saw-toothed wave, half and full rectified wave, half range sine and cosine series.

Unit II

Fourier integrals, Fourier transforms, Shifting theorem (both on time and frequency axes), Fourier transforms of derivatives, Fourier transforms of integrals, Convolution theorem, Fourier transform of Dirac delta function.

Linear Programming Problem (LPP): Introduction; Formulation of linear programming problem (LPP); Graphical method for its solution; Standard form of LPP; Basic feasible solutions; Simplex Method and Dual Simplex Method for solving LPP.

Unit III

Functions of Complex Variable: Definition, Exponential function, Trigonometric and Hyperbolic functions, Logarithmic functions. Limit and Continuity of a function, Differentiability and Analyticity. Cauchy-Riemann

equations, necessary and sufficient conditions for a function to be analytic, polar form of the Cauchy-Riemann equations. Harmonic functions.

Unit IV

Complex integral, Cauchy Gaursat theorem (without proof), Cauchy integral formula (without proof), Power series, radius and circle of convergence, Taylor's Maclaurin's and Laurent's series. Zeroes and singularities of complex functions, Residues. Evaluation of real integrals using residues (around unit and semi-circle only).

Text and Reference Books:

1. F. Kreyszig, *Advanced Engineering Mathematics*, 10th edition, Wiley, 2015.
2. B. S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 44th edition, 1965.
3. R. K. Jain, S.R.K. Iyenger. *Advance Engineering. Mathematics*, 4th edition, Narosa Publishing House, 2012.
4. Michael D. Greenberg, *Advanced Engineering Mathematics*, 2nd edition, Pearson Education, 2002.
5. Johnson and Miller *Probability and statistics for Engineers*, 8th edition, Pearson Education India, 2015.

CO-PO Articulation matrix: Mathematics-III(BSC/7-T)															
List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1:Define concepts and terminology of Fourier Series and Fourier transforms, Functions of complex variables and Power Series etc. (LOTS: Level 1: Remember)	1	-		-	-	-	-	-	-	-	-	0	2	2	2
CO2: **Solve** problems using Fourier transforms in domains like digital electronics and image processing. (LOTS: Level 3: Apply)	2	2	2	2	-	-	-	-	-	-	-	-	3	2	2
CO3:**Apply** principles of functions of complex variables to solve computational problems. (LOTS: Level 3: Apply)	2	2	2	2	-	-	-	-	-	-	-	-	3	2	2
CO4:**Compare** various concepts related to Fourier transforms and functions of complex variables. (HOTS: Level 4: Analyse)	3	3	2	3	-	-	-	-	-	-	-	-	3	2	3
CO5:**Select** suitable method for given computational engineering problems and related domain. (HOTS: Level 4: Evaluate)	3	3	2	3	-	-	-	-	-	-	-	-	3	2	3
CO6: **Integrate** the knowledge of Fourier Series and Fourier transforms, Functions of complex variables, and Power Series for solving real world problems. (HOTS: Level 6: Create)	3	3	2	3	-	-	-	-	-	-	-	-	2	2	3
Level of attainment															

Correlation level: 1- slight /Low **2-** Moderate/ Medium **3**- Substantial/High

DIGITAL ELECTRONICS
PC/ECE/1-T

General Course Information

Course Credits: 3 Mode: Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration: 03 Hours	Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70) Two minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end- semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basics of Electronics

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT Level
CO1	Outline the general concepts and terminology related to logic gates, number systems, logic families, combinatorial and sequential logic circuits.	LOTS: Ll (Remember)
CO2	Discuss the basic analog/digital components and their interconnections in logic families, combinatorial and sequential circuits.	LOTS: L2 (Understand)
CO3	Apply different methods/techniques to design various digital circuits.	LOTS: L3 A I
CO4	Analyse day to day problems and industrial problems for their solutions using digital circuits.	HOTS: L4 (Analyse)
CO5	Contrast different types of digital circuits and their designing methods.	HOTS L5 Evaluate
CO6	Design digital circuit for various Practical problems.	HOTS: L6 Create

Course Content

UNIT-I

Digital signals & logic gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR, Boolean algebra. Review of Number systems. Binary codes: BCD, Excess-3, Gray, EBCDIC, ASCII, Binary arithmetic, Error detection and correction codes. Karnaugh map and Quine Mcluskey methods of simplification

Digital Logic Families: Switching mode operation of p-n junction, bipolar and MOS devices. Bipolar logic families: RTL, DTL, DCTL, HTL, TTL, ECL, MOS, and CMOS logic families. Tristate logic

UNIT-II

Combinational Circuit Design: Circuit design using gates, adder, subtractor, comparator, BCD to seven segment, code converters etc.

Design Using MSI Devices: Multiplexers and Demultiplexers and their use as logic elements, Decoders, Encoders, Adders / Subtractors, BCD arithmetic circuits.

UNIT-III

Flip Flops: S-R, J-K, T, D, master-slave, edge triggered, flip flop conversions Shift registers, bidirectional shift register, sequence generators, Ring counters and Johnson Counter, Design of Asynchronous and Synchronous Counters

Finite State Machines: Timing diagrams (synchronous FSMs), Moore versus Mealy, FSM design procedure, State diagram, State-transition table, State minimisation, State encoding, Next-state logic minimisation, Implement the design

UNIT IV

A/D and D/A Convertors: Weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters: Quantisation, parallel -comparator, successive approximation, counting type, dualslope ADC, specifications of ADCs
PLDs: ROM, PLA, PAL, FPGA and CPLDs, Implementation of combinational circuits using ROM, PLA and PAL

TEXT BOOK:

l. Modem Digital Electronics (Edition Ill): R. P. Jain; TMH

REFERENCE BOOKS:

1. Digital Integrated Electronics: Taub & Schilling; MGH
2. Digital Principles and Applications: Malvino& Leach; McGraw Hill.
3. Digital Design: Morris Mano; PHI.

CO-PO Articulation matrix: Digital Electronics (PC/ECE/1-T)

List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1:Outline the general concepts and terminology related to logic gates, number systems, logic families, combinatorial and sequential logic circuits.LOTS: Ll (Remember)	2	2	2												
CO2:Discuss the basic analog/digital components and their interconnections in logic families, combinatorial and sequential circuits.LOTS: L2 (Understand)	2	2	2												
CO3:Applydifferent methods/techniques to design various digital circuits.LOTS: L3 A I	2	2	2												
CO4:Analyse day to day problems and industrial problems for their solutions using digital circuits. HOTS: L4 (Analyse)	2	2	2												
CO5:Contrast different types of digital circuits and their designing methods.HOTS L5 Evaluate	3	3	3												
CO6Design digital circuit for various Practical problems.HOTS: L6 Create	3	3	3												
Level of attainment															

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

ANALOG ELECTRONICS-I
PC/ECE/2-T

General Course Information

Course Credits: 3 Mode: Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration: 03 Hours	Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70) Two minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end-semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Physics

Course Outcomes

Sr. No.	Course Outcomes At the end of the semester students will be able to:	RBT Level
CO1	Define & describe the terminology and fundamental principles related to the construction & characteristics of the semiconductor, diodes, BJT and BJT amplifiers.	LOTS: LI(Remember)
CO2	Understand & explain various models, methods/techniques for analysis and synthesis of analog circuits.	LOTS: L2 (Understand)
CO3	Apply various models, methods/techniques to solve and synthesize related Analog Circuits.	LOTS: L3 (Apply)
CO4	Analyse & evaluate the analog devices and circuits in terms of their gain, bandwidth, efficiency, impedance, V-I characteristics and other desired parameters.	HOTS: L4 & L5 (Analyze&Evaluate)
CO5	Design basic analog circuits for a given/desirable set of circuit/device parameters.	HOTS: L6 (Create)

Course Contents

UNIT-I

Semiconductors: Intrinsic Semiconductors, Doped Semiconductors, Current Flow in Semiconductors, PN Junction structure and operation with open circuit Terminals, The PN Junction with an Applied Voltage, Capacitive Effects in the PN Junction

Diodes: Terminal Characteristics of junction diodes, Zener diode, Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifier with a filter capacitor, Limiter circuits, Clamping circuits, voltage doubler.

UNIT-II

BJT: Device Structure and Physical Operation, Current-Voltage Characteristics, Early Effect, BJT as an Amplifier, Effect of Bias Point location on Allowable Signal swing, BJT operation as a switch, BJT circuits atDC

BJT Biasing: Load Line, Operating Point, Voltage divider Bias, Collector to base bias, Biasing using Constant current source

UNIT -III

BJT Small-Signal Operation and Models: The Collector Current and the Transconductance, The Base Current and the Input Resistance at the Base, The Emitter Current and the Input Resistance at the Emitter, Voltage Gain, Separating the Signal and the DC Quantities, The Hybrid-n Model, The T Model, Application of the Small-Signal Equivalent Circuits, Small-Signal Models with Early Effect.

BJT Amplifiers Configurations: Common Base amplifier, Common Emitter Amplifier, Common Emitter Amplifier with Emitter Resistance, Common Collector Amplifier or Emitter Follower, Comparisons

UNIT-IV

Frequency Response of Common Emitter Amplifier: The Three Frequency Bands, High-Frequency Response, Low-Frequency Response, Transistor breakdown and temperature effects.

Regulated Power Supplies: General Filter Considerations, Capacitor Filter, RC Filter, Series voltage regulators, shunt voltage regulators, IC voltage regulator

TEXT BOOKS:

1. Microelectronics Circuits, theory and applications: Sedra& Smith; OXFORD
2. Electronic Devices & Circuits: Boylestad&Nashelsky; Pearson
3. Electronic devices and Circuits (4e): Millman, Halkias and Jit; McGraw Hill

REFERENCE BOOKS:

1. Electronic circuit analysis and design (Second edition): D.A.Neamen; TN'IH.
2. Electronics Principles: Malvino; McGrawHiII
3. Electronics Circuits: Donald L. Schilling & Charles Belove; McGrawHill

CO-PO Articulation matrix: Analog Electronics-I(PC/ECE/2-T)															
List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1: Define & describe the terminology and fundamental principles related to the construction & characteristics of the semiconductor, diodes, BJT and BJT amplifiers.LOTS: LI(Remember)	2	2	2	1	1	-	-	-	1	-	-	-	2	2	2
CO2: Understand & explain various models, methods/techniques for analysis and synthesis of analog circuits.LOTS: L2 (Understand)	2	3	3	1	1	-	-	-	1	-	-	-	2	2	2
CO3: Apply various models, methods/techniques to solve and synthesize related Analog Circuits. LOTS: L3 (Apply)	2	3	3	2	1	1	-	-	1	-	-	2	2	2	2
CO4:Analyse& evaluate the analog devices and circuits in terms of their gain, bandwidth, efficiency, impedance, V-I characteristics and other desired parameters.HOTS: L4 & L5(Analyze&Evaluate)	3	3	3	2	1	1	-	-	1	-	-	2	3	3	3
CO5:Design basic analog circuits for a given/desirable set of circuit/device parameters. HOTS: L6 (Create)	3	3	3	3	2	2	-	-	1	-	-	3	3	3	3
Level of attainment															

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

NETWORK ANALYSIS & SYNTHESIS
PC/ECE/3-T

General Course Information

Course Credits: 3 Mode: Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration: 03 Hours	Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70) Two minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end- semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Mathematics, Physics, Electrical Technology

Sr. No.	Course Outcomes At the end of the semester students will be able to:	RBT Level
CO1	Define & describe the terminology and fundamental principles related to electric networks, their representation and synthesis.	LOTS: Ll (Remember)
CO2	Understand & explain various theorems and methods/techniques for analysis and synthesis of electric networks.	LOTS: L2 (Understand)
CO3	Apply Laplace transform, transient response approach, network functions/parameters and graphical approach to solve and synthesize various electric networks.	LOTS: L3 (Apply)
CO4	Analyze& evaluate the electric networks, including filters in terms of their realizability, time and frequency domain behavior and stability.	HOTS: L4 & L5 (Analyze&Evaluate)
CO5	Design basic electric networks for a given / desirable set of network parameters.	HOTS: L6 (Create)

Course Contents

UNIT-I

LAPLACE TRANSFORM: Introduction to Laplace transform & its properties, Laplace transform of special signal waveforms, Inverse Laplace transform, Use of Laplace Transform in solving electrical networks.

TRANSIENT RESPONSE: Initial Conditions of resistive, inductive & capacitive Elements, Time- domain analysis of simple linear circuits: Transient & Steady-state Response of RC, RL, RLC Circuits to various excitation signals such as step, ramp, impulse and sinusoidal excitations using Laplace transform.

UNIT-II

NETWORK FUNCTIONS: Terminal pairs or Ports, Network functions for one-port and two-port networks, poles and zeros of Network functions, Restrictions on pole and zero locations for driving point functions and transfer functions, Time domain behaviour from the pole-zero plot.

PARAMETERS OF TWO PORT NETWORKS: Relationship of two-port variables, short-circuit Admi parameters, open circuit impedance parameters, Transmission parameters, hybrid parameters, relationships between parameter sets, Inter-connection of two- port networks.

UNIT-III

NETWORK SYNTHESIS; Concept & significance of Positive real functions, concept of network synthesis, driving point immittance function and structure of LC network, LC network synthesis using Foster and Cauer form, driving point immittance function and structure of RC & RL network, RC & RL network synthesis by Foster and Cauer form.

UNIT-IV

NETWORK GRAPH THEORY: Concept of network graph, Terminology used in network graph, relation between Twigs and Links, properties oftree in a graph, formation of incidence Matrix, number of trees in a graph, Graph matrices: cut-set matrix, tie set matrix, formulation of network equilibrium equations, network analysis using graph theory.

FILTERS: Introduction to filters, Characteristics of filters, Filter Classification, Passive Filters: Analysis & Design of prototype HPF, LPF, BPF, & BSE, introduction to m-derived filters, Active Filters: Introduction of active filters.

TEXT BOOKS:

1. Circuit Theory: A Chakrabarty; Dhanpat Rai Publication.
2. Network Analysis: Van Valkenburg; Pearson Education.
3. Engineering Network Analysis & Filter Design: G.G Bhise, P.R Chadha, D.C Kulshreshtha; Umesh Publication.

REFERENCE BOOKS:

1. Engineering Circuit Analysis: W H Hayt, Kemmerly, Durbin; McGraw Hill Publication
2. Network Analysis & Synthesis: S.P Ghosh; McGraw Hill.
3. Network Analysis & Synthesis: K.M. Soni; S.K Kataria& Sons Publication.
4. Network Analysis & Synthesis: F.F. Kuo; John Wiley & Sons Inc.

CO-PO Articulation matrix: Network Analysis &Synthesis (PC/ECE/3-T)

List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1: Define & describe the terminology and fundamental principles related to electric networks, their representation and synthesis.LOTS: Ll (Remember)	1	1	1	1	-	-	-	-	1	-	-	1	2	2	2
CO2: Understand & explain various theorems and methods/techniques for analysis and synthesis of electric networks.LOTS: L2 (Understand)	1	1	1	1	-	-	-	-	1	-	-	1	2	2	2
CO3:Apply Laplace transform, transient response approach, network functions/parameters and graphical approach to solve and synthesize various electric networks. LOTS: L3 (Apply)	2	2	2	2	1	-	-	-	1	-	-	2	2	2	2
CO4:Analyze& evaluate the electric networks, including filters in terms of their realizability, time and frequency domain behavior and stability. HOTS: L4 & L5(Analyze&Evaluate)	3	3	3	3	1	-	2	-	1	-	-	3	3	3	3
CO5: Design basic electric networks for a given / desirable set of network parameters.HOTS: L6 (Create)	3	3	3	3	2	-	2	-	2	-	-	3	3	3	3
Level of attainment															

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

ANALOG COMMUNICATION
PC/ECE/4-T

General Course Information

Course Credits: 3 Mode: Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration: 03 Hours	Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70) Two minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end- semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Sr. No.	Course Outcomes At the end of the semester students will be able to:	RBT Level
C01	Outline & recall the terminology, general principles and application areas of analog and digital communication.	LOTS: Ll (Remember)
C02	Understand & interpret the working of communication systems with the help of mathematical expressions, block diagrams and circuit diagrams.	LOTS: L2 (Understand)
C03	Apply the knowledge gained to predict the behaviour of communication systems in the presence of distortion and noise.	LOTS: L3 (Apply)
C04	Analyze& evaluate the performance of various communication systems.	HOTS: L4 & L5 Analyze&Evaluate

Course Contents

UNIT-I

AMPLITUDE MODULATION: Elements of Communication system, Concept of Modulation, Theory of Amplitude Modulation, various forms of AM: DSB-SC, SSB, VSB and their generation, AM Envelope Detector, concept of Coherent Detection, Super-heterodyne receiver.

UNIT-II

ANGLE MODULATION: Theory of FM and PM, Frequency spectrum of FM wave, Relation between M and PM, Narrow Band and Wideband FM, Generation of FM using Direct and Indirect method FM Demodulators: Slope detector, Balanced Slope Detector, Foster-Seeley Discriminator, Ratio Detector, PLL demodulator, Noise and FM, Pre-emphasis and De-emphasis, Comparison of AM, FM and PM.

UNIT -III

PULSE MODULATION: Sampling Process, PAM, PWM, PPM, Quantization, PCM, DPCM, Delta modulation, Quantization noise in PCM System, Companding.

UNIT-IV

NOISE ANALYSIS: External Noise, Internal Noise, White Noise, Noise Figure, Noise Temperature, Narrow Band Noise and its representation in terms of In-phase and Quadrature Components, Noise in AM and FM receivers.

TEXT BOOKS:

1. Electronic Communication Systems, George Kennedy, Bernard Davis & SRM Prasanna, McGraw Hill.
2. Radio Engineering, G. K. Mithal
3. Communication Systems, Simon Haykin, John Wiley & Sons.

3, Principles of Communication, Taub & Schilling, McGraw Hill.

CO-PO Articulation matrix: ANALOG COMMUNICATION(PC/ECE/4-T)															
List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01: Outline & recall the terminology, general principles and application areas of analog and digital communication.LOTS: Ll (Remember)	3	1	1	1	1	1	-	-	-	-	-	1	3	1	1
C02: Understand & interpret the working of communication systems with the help of mathematical expressions, block diagrams and circuit diagrams.LOTS: L2 (Understand)	3	2	2	1	1	1	-	-	-	-	-	1	3	1	1
C03:Apply the knowledge gained to predict the behaviour of communication systems in the presence of distortion and noise. LOTS: L3 (Apply)	3	3	2	2	1	1	1	-	-	-	-	2	3	3	3
C04: Analyze& evaluate the performance of various communication systems. HOTS: L4 & L5Analyze&Evaluate	3	3	3	2	1	1	1	-	-	-	-	2	3	3	3
Level of attainment															

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

Practical Courses

DIGITAL ELECTRONICS LAB
PC/ECE/1-P

General Course Information

Course Credits: 1 Contact Hours: 2/week (L-T-P: 0-0-2) Mode : Lab Work	Course Assessment Methods (Internal: 50; External: 50) The internal and external assessment is based on the level of participation in laboratory sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE Il) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE Il must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the lab course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator / Internal Examiners/ External Examiners will maintain and submit the bifurcation of marks obtained by the students in their respective internal/external evaluations in the specified proformas (attached herewith as Annexures I and Il) to the respective departments in addition to the submitting and uploading of overall marks on the university portal as per-the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Pre-requisites: Basic Electronics

Sr. No.	Course outcomes At the end of the course, students will be able to:	RBT Level
CO1	Perform Experimental work and acquire sound technical knowledge to solve field problems of Digital Electronics.	HOTS: L4 (Analyse)
CO2	Evaluate and analyse truth tables/function tables, characteristics and performance of the given digital components.	HOTS: L5 (Evaluate)
CO3	Design and of combinational and sequential circuits.	HOTS: L6 Create
CO4	Create reports based on experiments performed with effective demonstration and analysis of results.	HOTS: L6 (Create)
CO5	Inculcate ethical practices while performing experiments individually and in groups.	LOTS: L3 (Apply)

LIST OF EXPERIMENTS

1. Study of TTL gates AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR. Realisation of basic gates using Universal logic gates.
2. Design & realise a given function using K-maps and verify its performance.
3. Design and realise adder and subtractor circuits.
4. Design and realise comparator and parity generator circuits.
5. Design and realise 3-bit binary to gray code converter.
6. Implementation of multiplexer/encoder using logic gates.
7. Implementation and verification of Decoder/De-muItipIexer
8. To verify the truth tables of S-R, J-K, T & D type flip flops.
9. Design a 4-bit shift-register and verify its operation.
10. To verify the operation of 4-bit synchronous and 4-bit asynchronous counters.
11. Design, and verify the 4-bit ring counter and twisted ring counter.
12. Mini Project. Implementation of any digital circuit on multipurpose board.

Note: At least eight experiments are to be performed in the semester, out of which atleast six experiments should be performed from the given list. The remaining two experiments may either be performed from the list or designed & setup by the concerned institution as per the scope of the syllabus. The students must prepare Mini Project (Ex. No. 12) in the group of two-three students before the semester ends.

CO-PO Articulation matrix: Digital Electronics Lab (PC/ECE/1-P)															
List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1: Perform Experimental work and acquire sound technical knowledge to solve field problems of Digital Electronics.HOTS: L4 (Analyse)	2	2	2	2	2	-	1	-	3	-	-	2	2	2	2
CO2: Evaluate and analyse truth tables/function tables, characteristics and performance of the given digital components.HOTS: L5 (Evaluate)	3	3	3	3	3	-	1	-	-	-	-	3	3	3	3
CO3:Design and of combinational and sequential circuits.HOTS: L6 Create	3	3	3	3	3	-	1	-	-	-	2	3	3	3	3
CO4:Create reports based on experiments performed with effective demonstration and analysis of results.HOTS: L6 (Create)	-	-	-	-	-	2	1	3	3	3	3	-	-	-	-
CO5:Inculcate ethical practices while performing experiments individually and in groups.LOTS: L3 (Apply)	-	-	-	-	-	2	1	3	3	3	3	-	-	-	-
Level of attainment															

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

ANALOG ELECTRONICS-I LAB
PC/ECE/2-P

General Course Information

Course Credits: 2 Contact Hours: 4/week (L-T-P: 0-0-4) Mode: Lab Work	Course Assessment Methods (Internal: 50; External: 50) The internal and external assessment is based on the level of participation in laboratory sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE Il) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE Il must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the lab course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator / Internal Examiners/ External Examiners will maintain and submit the bifurcation of marks obtained by the students in their respective internal/external evaluations in the specified proformas (attached herewith as Annexures I and Il) to the respective departments in addition to the submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory coursecoordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT Level
CO1	Examine the characteristics of devices/circuits.	LOTS: L3 A I
CO2	Analyse & evaluate the analog devices and circuits in terms of their gain, bandwidth, efficiency, impedance, V-l characteristics and other desirable parameters.	HOTS: L4 & L5 (Analyse &Evaluate)
CO3	Design analog circuits for a given/desirable)set of circuit/device parameters.	HOTS: L6 (Create)
CO4	Create written records for the given experiments with problem definition, solution observations and conclusions.	HOTS: L6 (Create)
CO5	Demonstrate ethical practices while performing lab experiments individualiy or in groups.	LOTS: L3 (Apply)

LIST OF EXPERIMENTS

1. To study and verify V-I characteristics of P N junction diode.
2. To study and verify V-I characteristics of Zener diode.
3. To study and verify the characteristics of half wave rectifier with filter circuit.
4. To study and verify the characteristics of full wave rectifiers with filter circuit.
5. To design clipper circuit and observe their output waveforms.
6. To design the clamper circuit and observe their output waveforms.
7. To design the voltage doubler circuit.
8. To study and verify the characteristics of Common Base configurations of a transistor.
9. To study and verify the characteristics of Common Emitter configurations of a transistor.
10. To study and verify the characteristics of Common Collector configurations of a transistor.
11. Design series Voltage regulator circuit.
12. Design shunt Voltage regulator circuit.
13. To study IC voltage regulator.
14. To design a constant current source circuit using BJT.
15. Project (Any topic related to the scope of the course).

Note: At least 10 experiments are to be performed in the semester, out of which minimum 7 experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed and set by concerned institution as per the scope of the syllabus. The students must prepare Mini Project (Ex. No. 15) in the group of two-three students before the semester ends.

CO-PO Articulation matrix: Analog Electronics-I Lab (PC/ECE/2-P)															
List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1:Examine the characteristics of devices/circuits.LOTS: L3 A I	3	2	2	-	1	1	-	1	2	-	-	1	3	3	3
CO2:Analyse& evaluate the analog devices and circuits in terms of their gain, bandwidth, efficiency, impedance, V-l characteristics and other desirable parameters. HOTS: L4 & L5(Analyse &Evaluate)	3	2	2	-	1	1	-	1	2	-	-	1	3	3	3
CO3:Designanalog circuits for a given/desirable)set of circuit/device parameters.HOTS: L6 (Create)	3	3	3	1	2	2	1	2	3	-	3	2	3	3	3
CO4:Create written records for the given experiments with problem definition, solution observations and conclusions.HOTS: L6 (Create)	-	-	-	-	-	2	1	3	3	3	3	2	-	-	-
CO5: Demonstrate ethical practices while performing lab experiments individuality or in groups. LOTS: L3 (Apply)	-	-	-	-	-	2	1	3	3	3	3	3	-	-	-
Level of attainment															

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

NETWORK ANALYSIS & SYNTHESIS LAB
PC/ECE/3-P

General Course Information

Course Credits: 1 Contact Hours: 2/week (L-T-P: 0-0-2) Mode: Lab Work	Course Assessment Methods (Internal: 50; External: 50) The internal and external assessment is based on the level of participation in laboratory sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE Il) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the lab course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator / Internal Examiners/ External Examiners will maintain and submit the bifurcation of marks obtained by the students in their respective internal/external evaluations in the specified proformas (attached herewith as Annexures I and Il) to the respective departments in addition to the submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Pre-requisites: Electrical Technology

S.No.	Course Outcomes: At the end of the semester students will be able to:	RBT Level
CO1	Apply theoretical concepts related to electric circuits and two port network parameters on hardware.	LOTS: L3 (Apply)
CO2	Analyze and evaluate the transient response, frequency response and two port network representations in practical manner.	HOTS: L4 & L5 Analyze&Evaluate
CO3	Integrate knowledge of electric circuits like One port networks and filters and design basic circuits for given seofnetworkparameters.	HOTS: L6 (Create)
CO4	Create written records for the given experiments with problem definition, solution, observations and conclusions.	HOTS: L6 (Create)
CO5	Demonstrate ethical practices while performing lab experiments individually or in groups.	LOTS: L3 (Apply)

LIST OF EXPERIMENTS

1. To study the step response of series RC circuit.
2. To study the step response of series RL circuit.
3. To study of phenomenon of resonance in RLC series circuit.
4. To calculate and verify 'Z' parameters of a two-port network.
5. To calculate and verify "Y" parameters of a two-port network.
6. To calculate and verify "ABCD" parameters of a two-port network.
7. To calculate and verify "H" parameters of a two-port network.
8. To determine equivalent parameter of parallel connections of two port network.
9. To plot the frequency responses of low pass filter (LPF) and determine half-power frequency.
10. To plot the frequency responses of high pass filter (HPF) and determine the half- power frequency.
11. To plot the frequency responses of band-pass filters (BPF) and determine the band- width.
12. To synthesise a network of a given network function and verify its response.

Note: At least eight experiments are to be performed in the semester, out of which atleast six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed & set by the concerned course coordinator/institution as per the scope of the syllabus.

CO-PO Articulation matrix: Network Analysis and Synthesis Lab (PC/ECE/3-P)

List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1: Apply theoretical concepts related to electric circuits and two port network parameters on hardware. LOTS: L3 (Apply)	2	2	2	-	1	1	1	-	-	-	1	1	2	2	2
CO2:Analyze and evaluate the transient response, frequency response and two port network representation in practical manner.HOTS: L4 & L5 Analyze&Evaluate	3	3	3	2	1	1	1	-	-	-	1	1	3	3	3
CO3:Integrate knowledge of electric circuits like One port networks and filters and design basic circuits for given set of network parameters. HOTS: L6 (Create)	3	3	3	2	1	1	1	-	-	-	1	2	3	3	3
CO4: Create written records for the given experiments with problem definition, solution, observations and conclusions. HOTS: L6 (Create)	-	-	-	-	-	2	1	3	3	3	3	2	-	-	-
CO5: Demonstrate ethical practices while performing lab experiments individually or in groups. LOTS: L3 (Apply)	-	-	-	-	-	2	1	3	3	3	3	3	-	-	-
Level of attainment															

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

INDIAN CONSITUTION

General Course Information:

Course Code: **MC/3-T** Course Credits: 0.0	Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70) Two minor examinations (20 marks), Class Performance measured through

Mode: Lecture (L) Type: Program Core Teaching Schedule L T P: 3 0 0 Examination Duration: 3 hours	percentage of lectures attended (4 marks), assignments (6 marks), and the end-semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Course Content: Basic features and fundamental principles

1. Meaning of the Constitution law and Constitutionalism.
2. Historical perspective of the Constitution of India.
3. Salient features and characteristics of the Constitution of India.
4. Scheme of the fundamental rights.
5. The scheme of the fundamental duties and its legal status.
6. The directive principles of state policy- its importance and implementation.
7. Federal structure and distribution of legislative and financial power between the Union and the States.
8. Parliamentary form of government in India- the constitution power and status of the President of India.
9. Amendment of the constitutional powers and procedure.
10. The historical prospective of the constitutional amendments in India.
11. Emergency provisions: national emergency, President rule, financial emergency.
12. Local self-government: constitutional scheme in India.
13. Scheme of the fundamental rights of equality.
14. Scheme of the fundamental rights to certain freedom under Article 19.
15. Scope of the right to Life and personal liberty under Article 21.

Text and Reference Books:

1. M, Laxmikanth, Indian Polity for Civil Services Examination, 5th edition, McGraw Hill Education (India) Private Limited, 2017.

Detailed Syllabus of

B.Tech(ECE)

4th Semester

Theory Courses

SENSORS AND MEASURING INSTRUMENTS
PC/ECE/5-T

General Course Information

Course Credits: 3 Mode: Lectures (L) Teaching schedule L TP : 3 0 0 Examination Duration: 03 Hours	Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70) Two minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end-semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Analog and Digital Electronics

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
C01	Define and describe the terminologies and fundamental principles related to measuring instruments, signal conditioners, sensors and transducers.	LOTS: Ll (Remember)
C02	Understand and explain the operation of different sensors, transducers, signal conditioners and measurement tools.	LOTS: L2 (Understand)
C03	Apply the working principles of the measuring instruments, sensors, transducers and signal conditioning elements for some application design.	LOTS: L3 (Apply)
C04	Analyze and evaluate the instruments, sensors, transducers and signal conditioning elements required for any application design.	HOTS L4 & L5 (Analyze and Evaluate)

Course Contents

UNIT-I

Introduction: Introduction to Measurement, Classification of measurement errors, Static characteristic of Instrument: Accuracy, Precision, Resolution, Sensitivity, Range, Span, Significant Figures, Digital measurement instruments: Multimeter, Frequency Meter, Capacitance Meter, Phase Meter, Tachometer, pH meter, Q meter, General Microprocessor-based impedance measuring instrument, IEEE 488 Bus.

UNIT -II

Signal Generators and Analyzers: Signal generators, Audio generators, Function generators, Pulse generators, R.F Signal generators, Random noise generator, Sweep frequency generators, Frequency synthesizer, Basic wave analyzer, Frequency selective wave analyzer, Heterodyne wave analyzer, Harmonic distortion analyzer Spectrum analyzer, Digital Storage Oscilloscope (DSO).

UNIT -III

Transducers: Introduction, Electrical transducers, Selection criteria of transducers, Resistive transducer, Resistive position transducer, Strain gauge inductive transducer, Differential output transformer, LVDT, Capacitive transducer, load cell, Thermal transducers, thermistor, thermocouple, RTD, Photoelectric transducer, Photoconductive cells (LDR), Photovoltaic cell, transmitter-receiver, Photodiode, Phototransistor, Piezoelectric transducers.

UNIT -IV

Sensors and their applications: Introduction to Automotive Sensors, Sensors for manufacturing, Aerospace sensors, medical diagnostic sensors, Sensors for environmental monitoring, Proximity sensor for robotics and its characteristics.

Signal conditioning: Introduction, Types of signal conditioning, Amplifier, Differential amplifier, Instrumentation amplifier, Filters, A/D conversion, D/A conversion, Signal transmission, LM358 transducer amplifier, LM 386 Audio power amplifier.

TEXT BOOKS:

1. Electronic Instrumentation and Measurements, David A. Bell, Oxford, 3rd Edition.
2. Electronic Instrumentation, H. S. Kalsi, TMH, 2nd Edition.
3. Sensors and Transducers, D. Patranabis, Prentice-Hall, 2nd Edition.
4. Measurement, Instrumentation, and Sensors Handbook, John G. Webster, CRC Press, 1st Edition.

REFERENCE BOOKS:

1. Electronic Instrumentation and Measuring Techniques, W. D. Cooper, PHI.
2. Modern Electronic Instrumentation & Measuring Techniques, Helfrick& Copper, PHI.
3. Measurement Systems, E. O. Doebilin, McGraw Hill.
4. Sensors and signaling conditioning, R. Pallas & J. G. Webster, John Wiley & Sons.

CO-PO Articulation matrix: Sensors and Measuring Instruments (PC/ECE/5-T)															
List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01: Define and describe the terminologies and fundamental principles related to measuring instruments, signal conditioners, sensors and transducers.LOTS: Ll (Remember)	2	2	1	1	2	1	-	-	-	-	-	1	2	2	2
C02: Understand and explain the operation of different sensors, transducers, signal conditioners and measurement tools.LOTS: L2 (Understand)	2	2	2	1	2	1	-	-	-	-	-	1	2	2	2
C03: Apply the working principles of the measuring instruments, sensors, transducers and signal conditioning elements for some application design. LOTS: L3 (Apply)	3	2	2	1	2	1	-	-	-	1	-	2	2	2	2
C04: Analyze and evaluate the instruments, sensors, transducers and signal conditioning elements required for any application design. HOTS L4 & L5(Analyze and Evaluate)	3	3	3	1	2	1	-	-	-	1	-	2	2	2	2
Level of attainment															

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

DIGITAL COMMUNICATION AND INFORMATION THEORY
PC/ECE/6-T

General Course Information

Course Credits: 3 Mode: Lectures (L) Teaching schedule L TP : 3 0 0 Examination Duration: 03 Hours	Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70) Two minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end-semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basics of Electronic circuits and introductory concepts of Communication systems.

Sr. No	Course Outcomes At the end of the semester students will be able to:	RBT Level
C01	Recall the terminology, general principles and application areas of digital communication	LOTS: Ll (Remember)
C02	Understand & interpret the working of digital communication systems with the help of mathematical expressions, block diagrams and circuit diagrams.	LOTS: L2 (Understand)
C03	Understand the process of information transmission in digital communication systems and apply different coding schemes to enhance capacity of the system	LOTS: L3 (Apply)
C04	Analyze& evaluate the performance of various error control codes in communication systems.	HOTS: L4 & L5 Analyze&Evaluate

Course Contents

UNIT-I

DIGITAL MODULATION: Pulse Code Modulation,Differential Pulse code Modulation , Adaptive Differential Pulse Code Modulation, Delta Modulation , Adaptive Delta Modulation, Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT-II

DIGITAL TRANSMISSION:Digital Communication system**,** General description of ASK, FSK and PSK. Transmission, Reception and Signal space representation: BPSK, DPSK, QPSK, M-ary PSK, ASK, QASK, BFSK, MSK; Power spectra of digitally modulated signals, Comparison of different digital modulation schemes.

UNIT -III

INFORMATION THEORY FUNDAMENTALS:Uncertainty, Information and Entropy ,Sourcecoding Theorem, Huffman coding ,Shannon Fano coding , Discrete Memory less channels , channel capacity, channel coding Theorem ,Channel capacity Theorem.

UNIT-IV

ERROR CONTROL CODING:Linear Block codes, Syndrome Decoding,Minimum distance consideration, cyclic codes, Generator Polynomial,Parity check polynomial, Encoder for cyclic code, calculation of syndrome, Convolutional codes.

TEXT BOOKS:

1. Electronic Communication Systems, George Kennedy, Bernard Davis & SRM Prasanna, McGraw Hill.
2. Communication Systems, Simon Haykin, John Wiley & Sons.
3. Principles of Communication, Taub & Schilling, McGraw Hill.

REFERENCE BOOKS:

1. Modern Digital & Analog Communication Systems, B.P. Lathi, Oxford University Press.
2. Communication Systems, A. Bruce Carlson, P.B Crilly, J.C Rutledge, McGraw Hill.
3. Digital Communication, John G. Proakis, PHI.

CO-PO Articulation matrix: Digital Communicationand Information theory (PC/ECE/6-T)															
List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1:Recall the terminology, general principles and application areas of digital communication	3	1	1	1	1	1	-	-	-	-	-	1	3	1	1
CO2: Understand & interpret the working of digital communication systems with the help of mathematical expressions, block diagrams and circuit diagrams.	3	2	2	1	1	1	-	-	-	-	-	1	3	1	1
CO3:Understand the process of information transmission in digital communication systems and apply different coding schemes to enhance capacity of the system	3	3	2	2	1	1	1	-	-	-	-	2	3	3	3
CO4:Analyze& evaluate the performance of various error control codes in communication systems.	3	3	3	2	1	1	1	-	-	-	-	2	3	3	3
Level of attainment															

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

ANALOG ELECTRONICS-II
PC/ECE/7-T

General Course Information

Course Credits: 3 Mode: Lectures (L) Teaching schedule L TP : 3 0 0 Examination Duration: 03 Hours	Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70) Two minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end- semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Analog Electronics-I

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO1	Define & describe the terminology and fundamental principles related to construction & characteristics of MOSFET, amplifiers and oscillators.	LOTS: Ll (Remember)
CO2	Understand & explain various models, methods/techniques for analysis and synthesis of analog circuits.	LOTS: L2 (Understand)
CO3	Apply various models, methods/techniques to solve and synthesize related Analog Circuits.	LOTS: L3 (Apply)
CO4	Analyze& evaluate the analog devices and circuits in terms of their gain, bandwidth, efficiency, impedance, V-I characteristics and other desirable parameters.	HOTS: L4 & L5: (Analyze& Evaluate)
CO5	Design basic analog circuits networks for a given/desirable set of circuitdevice parameters.	HOTS: L6 (Create)

Course Contents

UNIT-I

MOSFET: Device Structure and Physical Operation, MOS Capacitor, Current—Voltage Characteristics, Body Effect, MOSFET as an Amplifier, MOSFET operation as a switch, MOSFET circuits at DC.

MOSFET Biasing: Biasing by Fixing VGS, Biasing by Fixing VG and connecting a resistance in source, Drain to Gate Feedback resistor bias, Biasing using Constant current source.

UNIT-II

MOSFET Small Signal Operation and Models: DC Bias Point, Signal Current in the Drain Termina Voltage Gain, Small-Signal Equivalent-Circuit Models, Transconductance gm , T Equivalent-Circuit Model.

MOSFET Amplifiers Configurations: Common Gate amplifier, Common Source Amplifier, Common Source Amplifier with a source Resistance, Common Drain Amplifier.

UNIT -III

Output Stages and Power Amplifiers: Classification of Output Stages-Class A, B, and C operations; Class A large Signal amplifiers, Second and higher order harmonic distortion, efficiency, transformer coupled power amplifier, Class B amplifier: efficiency & distortion, push-pull amplifiers, Class C amplifier, Class AB operation.

UNIT-IV

Feedback Amplifiers: Classification of amplifiers, Feedback concept, transfer gain with feedback, general characteristics of negative feedback amplifiers, effect of negative feedback on input and output resistance, voltage series feedback, current series feedback, current shunt feedback, voltage shunt feedback.

OSCILLATORS: General form of oscillator circuit, Barkhausen's criteria, R-C phase shift oscillator, Hartley oscillator, Colpitts oscillator, Wien-bridge oscillator, Crystal oscillator.

TEXT BOOKS:

1. Microelectronics Circuits, theory and applications:Sedra& Smith; OXFORD
2. Electronics Devices & Circuits: Boylestad&Nashelsky ; Pearson
3. Electronics devices and Circuits(4e): Millman, Halkias and Jit; McGrawHiII

REFERENCE BOOKS:

1. Electronic circuit analysis and design (Second edition): D.A.Neamen; TMH.
2. Electronics Principles: Malvino; McGrawHill
3. Electronics Circuits: Donald L. Schilling & Charles Belove; McGrawHill

CO-PO Articulation matrix: Analog Electronics-II (PC/ECE/7-T)															
List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1: Define & describe the terminology and fundamental principles related to construction & characteristics of MOSFET, amplifiers and oscillators.LOTS: Ll (Remember)	1	1	2	1	1	-	-	-	-	-	-	1	2	2	2
CO2: Understand & explain various models, methods/techniques for analysis and synthesis of analog circuits.LOTS: L2 (Understand)	1	3	2	1	2	-	-	-	-	-	-	1	3	2	1
CO3: Apply various models, methods/techniques to solve and synthesize related Analog Circuits.LOTS: L3 (Apply)	2	3	2	2	2	-	-	-	-	-	-	1	3	2	2
CO4: Analyze& evaluate the analog devices and circuits in terms of their gain, bandwidth, efficiency, impedance, V-I characteristics and other desirable parameters. HOTS: L4 & L5: (Analyze& Evaluate)	3	3	3	2	2	-	1	-	-	-	-	3	3	2	3
CO5: Design basic analog circuits networks for a given/desirable set of circuitdevice parameters.HOTS: L6 (Create)	3	3	3	3	2	-	1	-	-	-	-	3	3	2	3
Level of attainment															

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

ELECTROMAGNETIC THEORY
PC/ECE/8-T

General Course Information

Course Credits: 3 Mode: Lectures (L) Teaching schedule L TP : 3 0 0 Examination Duration: 03 Hours	Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70) Two minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end- semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Communication Engineering

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO1	Memorize & define different electromagnetic laws and fundamental principles related to electromagnetic wave propagation, transmission line theory, and waveguides.	LOTS: LI (Remember)
CO2	Derive & explain theorems related to vector algebra, electrostatics, magnetostatics, and electromagnetic wave propagation.	LOTS: L2 (Understand)
CO3	Apply the laws to solve problems related to electrostatics, magnetostatics, electromagnetic wave propagation, vector algebra, transmission lines and waveguides.	LOTS: L3 (Apply)
CO4	Analyze all the laws and theorem and evaluate their utility in solving practical problems.	HOTS: L4 & L5 (Analyze&Evaluate)

Course Contents

UNIT-I

VECTOR ALGEBRA: Cartesian coordinates, cylindrical coordinates, spherical coordinates, Vector calculus: Differential length, area and volume, line, surface and volume integrals and their significance, Del operator, gradient of a scalar, divergence of a vector and divergence theorem, curl of a vector and Stokes's theorem, classification of vector fields.

REVIEW OF ELECTRIC FIELDS: Coulomb's law and electric field intensity, field due to a continuo charge distribution: field of a line charge, field of a sheet of charge, electric flux density, Gauss's law d applications, electric potential, relationship between E and V, electric dipole, energy density in electro fields.

UNIT-II

REVIEW OF MAGNETIC FIELDS: Convection and conduction currents, conductors, dielectric constant, continuity equation, boundary conditions, Poisson's, and Laplace's equations, capacitance, Biot-Savart's Law, Ampere's circuit Law, magnetic flux density, Maxwell's equation for static fields, magnetic scalar and vector potentials, forces due to magnetic field, magnetic torque, magnetic boundary conditions, inductor, magnetic energy.

UNIT-III

TIME VARYING FIELDS AND MAXWELL'S EQUATIONS: Faraday's law, displacement current, Maxwell's equations in point form and integral form, retarded potentials.

ELECTROMAGNETIC WAVE PROPAGATION: Three-dimensional wave equations, Plane Waves & its Properties, Propagation of Plane Waves in : free space, lossy dielectrics, lossless dielectrics, Good Conductors. Power and Poynting Vector.

UNIT-IV

ELECTROMAGNETIC WAVE PROPERTIES: Skin Effect, Wave Polarization, Reflection of Uniform Plane Waves (Normal Incidence).

TRANSMISSION LINES: Transmission line parameters, transmission line equations, input impedance, standing wave ratio. and power, Smith chart.

REFERENCE BOOKS:

1. Elements of Electromagnetics, Matthew N. O. Sadiku, Oxford University Press, 7th Edition.
2. Electromagnetic Waves and Radiating Systems, E. C. Jordan and K. G. Balmain, PHI, 3 rdEdition.
3. Field and Wave Electromagnetics, David K. Chang, Addison Wesley, 3rd Edition.
4. Engineering Electromagnetics, W. H. Hayt, Tata Mc-Graw, 8th Edition.

CO-PO Articulation matrix: Electromagnetic Theory (PC/ECE/8-T)															
List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1: Memorize & define different electromagnetic laws and fundamental principles related to electromagnetic wave propagation, transmission line theory, and waveguides.LOTS: LI (Remember)	3	1	1	1	1	1	-	-	-	-	-	1	3	1	1
CO2: Derive & explain theorems related to vector algebra, electrostatics, magnetostatics, and electromagnetic wave propagation.LOTS: L2 (Understand)	3	2	2	1	1	1	-	-	-	-	-	1	3	1	1
CO3:Apply the laws to solve problems related to electrostatics, magnetostatics, electromagnetic wave propagation, vector algebra, transmission lines and waveguides. LOTS: L3 (Apply)	3	3	2	2	1	1	1	-	-	-	-	2	3	3	3
CO4: Analyze all the laws and theorem and evaluate their utility in solving practical problems. HOTS: L4 & L5(Analyze&Evaluate)	3	3	3	2	1	1	-	-	-	-	-	2	3	2	3
Level of attainment															

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

SIGNALS & SYSTEMS
PC/ECE/9-T

General Course Information

Course Credits: 3 Mode: Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration: 03 Hours	Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70) Two minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end- semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Physics, Maths.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO1	Define & describe terminology and categorization related to signals, systems and transformation techniques.	LOTS:Ll (Remember)
CO2	Understand & explain properties of various signals & systems along with concept of conversion/transformation of signals like analog to digital conversion, time to frequency transformation.	LOTS:L2 (Understand)
CO3	Apply signal properties and transformation techniques on various periodic/aperiodic analog/discrete signal.	LOTS: L3 (Apply)
CO4	Analyse & evaluate LTI system response using transformation techniques.	HOTS: L4 & L5 (Analyze&Evaluate)
CO5	Compare the properties of various signals and systems along with transformation techniques and their convergence region.	HOTS: L5 (Evaluate)

Course Contents

UNIT-I

INTRODUCTION TO SIGNALS: Signal definition, classification of signals, basic/singularity continuous and discrete-time signals, basic operations: time shifting, time reversal, time scaling on signals, signal representation in terms of singular functions, correlation of signals and its properties, representation of a continuous-time signal by its samples: the sampling theorem, reconstruction, aliasing.

UNIT-II

SYSTEM & ITS PROPERTIES: system, classification of systems: linear & nonlinear systems; static & dynamic systems, causal & non-causal system, invertible & non-invertible, stable & unstable system, time variant & time invariant systems with- examples, -linear-time-invariant systems: definition and properties, impulse response, convolution sum and its properties, representation of LTI systems using differential and difference equations.

UNIT-III

FOURIER SERIES & FOURIER TRANSFORM: Introduction to Frequency domain Representation, Fourier Series Representation of Periodic Signals, Properties of Fourier Series, Fourier Transform for periodic and Aperiodic signals, Convergence of Fourier Transform, Properties of Fourier Transform, Applications of Fourier Transform.

DISCRETE-TIME FOURIER TRANSFORM: Fourier Transform representation for Discrete-Time Aperiodic & Periodic Signals, Properties of Discrete-Time Fourier Transform.

UNIT-IV

Z-TRANSFORM: Introduction to Z-Transform, Region of Convergence (ROC) for Z-Transform, Z-Transform Properties, Inverse Z-Transform, Analysis of LTl Systems Using Z-Transform, Application of Z transform, Introduction to Hilbert Transform.

TEXT BOOKS:

1. Oppenheim, A. S. Willsky, with S. Nawab "Signals &Systems",Prentice -Hall India.
2. Tarun K. Rawat, "Signal & Systems", Oxford University Press.

3. Farooq Husain, "Signals & Systems", Umesh Publications.

REFERENCE BOOKS:

l. S. Salivahanan, A. Vallavraj, C. Gnanapriya, "Digital Signal Processing", Tata McGraw Hill.
2. J. G. Proakis, D. G. Manolakis, "Digital Signal Processing, Principles, Algorithms, & Applications", Prentice-Hall India.
3. B. Kumar, "Signals and Systems", New Age International Publishers.

CO-PO Articulation matrix: Signals and Systems(PC/ECE/9-T)															
List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1:Define & describe terminology and categorization related to signals, systems and transformation techniques.LOTS:Ll (Remember)	3	3	2	1	1	-	-	-	-	-	-	1	2	2	2
CO2:Understand & explain properties of various signals & systems along with concept of conversion/transformation of signals like analog to digital conversion, time to frequency transformation.LOTS:L2 (Understand)	3	3	2	1	1	-	-	-	-	-	-	1	2	2	2
CO3:Apply signal properties and transformation techniques on various periodic/aperiodic analog/discrete signal.LOTS: L3 (Apply)	3	3	2	1	1	1	-	-	-	-	-	2	2	2	2
CO4:Analyse & evaluate LTI system response using transformation techniques.HOTS: L4 & L4(Analyze&Evaluate)	3	3	3	2	2	2	-	-	-	-	-	2	3	3	3
CO5:Compare the properties of various signals and systems along with transformation techniques and their convergence region.HOTS: L5 (Evaluate)	3	3	2	2	2	2	-	-	-	-	-	2	3	3	3
Level of attainment															

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

Practical Courses

SENSORS AND MEASURING INSTRUMENTS LAB
PC/ECE/5-P

General Course Information

Course Credits: 1 Contact Hours: 2/week (L-T-P: 0-0-2) Mode: Lab Work	Course Assessment Methods (Internal: 50; External: 50) The internal and external assessment is based on the level of participation in laboratory sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE Il) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE Il must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the lab course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator / Internal Examiners/ External Examiners will maintain and submit the bifurcation of marks obtained by the students in their respective internal/external evaluations in the specified proformas (attached herewith as Annexures I and Il) to the respective departments in addition to the submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Pre-requisites: Analog and Digital Circuits

S. No.	Course Outcomes: At the end of the semester, students will be able to:	RBT Level
CO1	Apply theoretical concepts related to measurement instruments, signalling conditioning elements, transducers on hardware.	LOTS: L3 (Apply)
CO2	Analyze and evaluate the working principles and performance of the devices/instruments used in experiment.	HOTS: L4 & L5 (Analyze&Evaluate)
CO3	Integrate knowledge of signal conditioning elements and transducers to design basic circuits for a given application.	HOTS•. L6 (Create)
CO4	Create written records for the given experiments with problem definition, solution, observations and conclusions.	HOTS: L6 (Create)
CO5	Demonstrate ethical practices while performing lab experiments individually or in groups.	LOTS: L3 (Apply)

LIST OF EXPERIMENTS

1. To familiarize with the control panel and various measurements using DSO and Function Generator.
2. To familiarize with the control panel and various measurements using spectrum analyzer.
3. To study the Lissajous pattern for frequency and phase measurement.
4. To measure values of different components and Q of a coil using LCR-Q meter.
5. To findthe least count of a micrometre.
6. To determine the thickness of a given object using LVDT.
7. 7. To measure linear displacement using LVDT.
8. To measure the distance using LDR.
9. To study the working principle of RTD and use it for temperature measurement..
10. To study the characteristics of thermocouple and use it for temperature measurement.
11. To measure the variation of pressure using Strain Gauge.
12. To study the piezo-electric transducer and its characteristics.
13. To measure the angular displacement using Capacitive Pick-up.
14. To measure linear displacement using Inductive Pick-up.
15. To measure speed using photoelectric and magnetic sensor kit.
16. Implementation of Simple project (Any topic related to the scope of the course).

NOTE: At least eight experiments are to be performed in the semester, out of which at least six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

CO-PO Articulation matrix: Sensors and Measuring Instruments Lab (PC/ECE/5-P)															
List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1: Apply theoretical concepts related to measurement instruments, signalling conditioning elements, transducers on hardware.LOTS: L3 (Apply)	3	1	1	-	1	1	-	-	2	-	-	1	3	2	1
CO2:Analyze and evaluate the working principles and performance of the devices/instruments used in experiment.HOTS: L4 & L5 (Analyze&Evaluate)	2	2	1	-	1	1	-	-	2	-	-	1	3	2	1
CO3: Integrate knowledge of signal conditioning elements and transducers to design basic circuits for a given application.HOTS:. L6 (Create)	2	1	3	1	2	2	1	-	3	-	2	2	3	2	3
CO4: Create written records for the given experiments with problem definition, solution, observations and conclusions.HOTS: L6 (Create)	-	-	-	-	-	2	1	3	3	3	3	2	-	-	2
CO5: Demonstrate ethical practices while performing lab experiments individually or in groups.LOTS: L3 (Apply)	-	-	-	-	-	2	1	3	3	3	3	3	-	-	2
Level of attainment															

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

ANALOG AND DIGITAL COMMUNICATION LAB
PC/ECE/6-P

General Course Information

Course Credit:1 Contact Hours: 2/week (L-T-P: 0-0-2) Mode: Lab Work	Course Assessment Methods (Internal: 50; External: 50) The internal and external assessment is based on the level of participation in laboratory sessions, timely submission of experiments/assignments, the quality of solutions for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE Il) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE Il must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the lab course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator / Internal Examiners/ External Examiners will maintain and submit the bifurcation of marks obtained by the students in their respective internal/external evaluations in the specified proformas (attached herewith as Annexures I and I l) to the respective departments in addition to the submitting and uploading of overall marks On- the university portal as per the requirement-of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Pre-requisites: Analog and Digital Circuits

Sr. No.	Course Outcomes: At the end of the lab course a student would be able to:	RBT Level
CO1	Apply theoretical concepts related to analog, digital and pulse modulation/demodulation techniques on hardware.	LOTS: L3 (Apply)
CO2	Analyze and compare the time domain response of various modulation/demodulation techniques in practical manner.	HOTS: L4 (Analyze)
CO3	Evaluate the performance of various modulation/demodulation techniques.	HOTS: L5 (Evaluate)
CO4	Create written records for the given assignments with problem definition, design of solution and conclusions.	HOTS: L6 (Create)
CO5	Demonstrate ethical practices while performing lab experiments individually or in groups.	LOTS: L3 (Apply)

LIST OF EXPERIMENTS

1. To familiarize with the control panel and various measurements using CRO/DSO & Function Generator.
2. To study Amplitude Modulation & Demodulation and determination of Modulation index.

3. To study Frequency Modulation and Demodulation.
4. To study Pulse Amplitude Modulation and Demodulation.
5. To study Pulse Width Modulation and Demodulation.
6. To study Pulse Code Modulation.
7. To study ASK Modulation Technique.
8. To study FSK Modulation Technique.
9. To study BPSK Modulation Technique.
10. To study QPSK Modulation Technique
11. Simple project (Any topic related to the scope of the course).

Note: Atleast eight experiments are to be performed in the semester, out of which minimum six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed and set by concerned institution as per the scope of the syllabus.

CO-PO Articulation matrix: Analog and Digital Communication Lab (PC/ECE/6-P)															
List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1: Apply theoretical concepts related to analog, digital and pulse modulation/demodulation techniques on hardware.LOTS: L3 (Apply)	3	2	2	-	3	1	-	1	2	-	-	1	3	2	2
CO2: Analyze and compare the time domain response of various modulation/demodulation techniques in practical manner.HOTS: L4 (Analyze)	2	2	2	-	3	1	-	1	2	-	-	1	3	2	2
CO3: Evaluate the performance of various modulation/demodulation techniques.HOTS: L5 (Evaluate)	2	2	2	-	3	1	-	1	2	-	-	1	3	2	2
CO4: Create written records for the given assignments with problem definition, design of solution and conclusions.HOTS: L6 (Create)	-	-	-	-	-	2	1	3	3	3	3	2	-	-	2
CO5: Demonstrate ethical practices while performing lab experiments individually or in groups.LOTS: L3 (Apply)	-	-	-	-	-	2	1	3	3	3	3	3	-	-	2
Level of attainment															

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

ANALOG ELECTRONICS-II LAB
PC/ECE/7-P

General Course Information

Course Credits: 2	Course Assessment Methods (Internal: 50; External: 50)

Contact Hours: 4/week (L-T-P: 0-0-4) Mode: Lab Work	The internal and external assessment is based on the level of participation in laboratory sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE and MLE Il) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE Il must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the lab course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator / Internal Examiners/ External Examiners will maintain and submit the bifurcation of marks obtained by the students in their respective internal/external evaluations in the specified proformas (attached herewith as Annexures I and Il) to the respective departments in addition to the submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conductlaboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO1	Examine the characteristics of devices/circuits	LOTS: L3 A I
CO2	Analyze& evaluate the analog devices and circuits in terms of their gain, bandwidth, efficiency, impedance, V-I characteristics and other desirable parameters.	HOTS: L4 & L5 (Analyze&Evaluate)
CO3	Design basic analog circuits for a given/desirable set of circuit/device parameters.	HOTS: L6 (Create)
CO4	Create written records for the given experiments with problem definition, solution, observations and conclusions.	HOTS: L6 (Create)
CO5	Demonstrate ethical practices while performing lab experiments individually or in groups.	LOTS: L3 (Apply)

LIST OF EXPERIMENTS

1. To study and design Class A power amplifier and determine its efficiency.
2. To study and design Class B power amplifier and determine its efficiency.

3. To study and design Class C power amplifier and determine its efficiency.
4. To Design the RC phase shift oscillator circuit.
5. To Design the Wein bridge oscillator circuit.
6. To Design the Hartley oscillator circuit.
7. To Design the Colpitts oscillator circuit.
8. To study the effect of BJT voltage series feedback amplifier and determine the gain, frequency response, input and output impedance with and without feedback
9. To study the effect of FET voltage series feedback amplifier and determine the gain, frequency response, input and output impedance with and without feedback.
10. To study the V-I characteristics of MOSFET in Common Gate configurations.
11. To study the V-I characteristics of MOSFET in Common Source configurations
12. To study the V-I characteristics of MOSFET in Common Drain configurations .
13. To design a R-C coupled single stage amplifier and determine Gain, Bandwidth, Input impedance and output impedance.
14. To design a BJT Darlington Emitter Follower and determine Gain, Bandwidth, Input impedance and output impedance.
15. Project (Any topic related to the scope of the course).

Note: At least 10 experiments are to be performed in the semester, out of which minimum 7 experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed and set by concerned institution-as per-- the scope of the syllabus. The students must prepare Mini Project (Ex. No. 15) in the group of two-three students before the semester ends.

CO-PO Articulation matrix: Analog Electronics-II Lab (PC/ECE/7-P)															
List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1: Examine the characteristics of devices/circuitsLOTS: L3 A I	3	1	1	-	1	1	-	1	2	-	-	1	3	2	1
CO2: Analyze& evaluate the analog devices and circuits in terms of their gain, bandwidth, efficiency, impedance, V-I characteristics and other desirable parameters. HOTS: L4 & L5(Analyze&Evaluate)	2	2	1	-	1	1	-	1	2	-	-	1	3	2	1
CO3:Design basic analog circuits for a given/desirable set of circuit/device parameters.HOTS: L6 (Create)	2	1	3	1	2	2	1	2	3	-	1	2	3	2	3
CO4: Create written records for the given experiments with problem definition, solution, observations and conclusions.HOTS: L6 (Create)	-	-	-	-	-	2	1	3	3	3	3	2	-	-	2
CO5: Demonstrate ethical practices while performing lab experiments individually or in groups.LOTS: L3 (Apply)	-	-	-	-	-	2	1	3	3	3	3	3	-	-	2
Level of attainment															

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

PROBLEM SOLVING USING MATLAB
PC/ECE/10-P

General Course Information

Course Credit:1	Course Assessment Methods (Internal: 50; External: 50)

Contact Hours: 2/week (L-T-P: 0-0-2) Mode: Lab Work	The internal and external assessment is based on the level of participation in laboratory sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MIÆ Il) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE Il must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the lab course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator / Internal Examiners/ External Examiners will maintain and submit the bifurcation of marks obtained by the students in their respective internal/external evaluations in the specified proformas (attached herewith as Annexures I and Il) to the respective departments in addition to the submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Pre-requisites: Basic Programming Skills

Sr.No.	Course Outcomes: At the end of the lab course a student would be able to:	RBT Level
CO1	Study basic commands and apply programming skills to implement solutions to the given assignments usingMATLAB	LOTS:L3 (Apply)
CO2	Analyze and Evaluate the output of various Matrices operation usingMATLAB	HOTS:L4 & L5 (Analyse &Evaluate)
CO3	Devise software solutions for common processes of communications systems	HOTS:L6 (Create)
CO4	Create written records for the given assignments with problem definition, design of solution and conclusions.	HOTS: L6 (Create)
CO5	Demonstrate ethical practices while solving problems individually or in groups.	LOTS: L3 (Apply)

LIST OF EXPERIMENTS/ASSIGNMENTS

1. Introduction to MATLAB
2. To study various commands of MATLAB
3. Write a program to perform different matrices operations as addition, subtraction, multiplication, inverse and determinant.

4. Write a program to demonstrate output of various plotting commands.
5. Write a program to plot different signals as impulse, step, ramp, sinusoidal, cosine and exponential.
6. Write a program to find convolution of two sequences.
7. Write a program to find correlation and Auto-correlation between two sequences
8. Write a program to perform Amplitude modulation and Demodulation
9. Write a program to perform Amplitude modulation and Demodulation
10. Write a program for signal sampling and reconstruction.
11. Write a program to perform basic image processing functions
12. Write a program to perform basic control system functions.
13. Design a communication system using SIMULINK

Note: Atleast eight experiments are to be performed in the semester, out of which minimum six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed and set by concerned institution as per the scope of the syllabus.

CO-PO Articulation matrix: Problem solving using MATLAB (PC/ECE/10-P)															
List of Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1:Study basic commands and apply programming skills to implement solutions to the given assignments using MATLAB	2	2	2	1	3	1	-	-	-	-	-	-	2	2	2
CO2:Analyze and Evaluate the output of various Matrices operation using MATLAB	2	2	2	3	3	1	-	-	-	-	-	-	2	2	2
CO3:Devise software solutions for common processes of communications systems	3	3	2	3	3	1	-	-	-	-	-	-	2	2	2
CO4:Create written records for the given assignments with problem definition, design of solution and conclusions.	-	-	-	-	-	2	1	3	3	3	3	-	-	-	2
CO5:Demonstrate ethical practices while solving problems individually or in groups.	-	-	-	-	-	2	1	3	3	3	3	-	-	-	2
Level of attainment															

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

General Course Information

Course code-MC/4-T Course Credits: 0 Mode: Lectures (L) Teaching schedule L T P: 2 0 0 Examination Duration:03Hours	Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70) Two minor tests, each of 20 marks, will be conducted. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

About the Course and its Outcomes:

This course is designed to acquaint the students with Indian Knowledge traditions. It introduces the students to Vedic Period, Post-Vedic period, Sufi and Bhakti Movement in India and social reform movements of 19th Century.

Course outcomes:

Sr.No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO 1	Recognize the forms and sources of Indian Traditional Knowledge	L1 (Remembering)
CO 2	Identify the contribution of great ancient Indian Scientists and spiritual leaders to the World of Knowledge	L2 (Understanding)
CO 3	Apply the reasoning based on the objectivity and contextual knowledge to address the social and cultural issues prevalent in the Indian Society.	L3 (Applying)
CO 4	Differentiate the myths, superstitions form the reality in context of traditional knowledge to protect the physical and social environment.	L4(Analyzing)
CO 5	Suggest means of creating just a fair and social environment that is free from any prejudices and intolerance for different opinions and cultures.	L5 (Evaluating)

Course Content

UNIT-I

Introduction to Indian Traditional Knowledge: Definition traditional knowledge, forms, resources and dissemination of traditional knowledge.

Vedic Period: Vedas and Upnishads, Yogsutras of Patanjali.

Post Vedic Period: Budhism, Jainism and Indian Materialism, Charvak Schools of Thoughts.

UNIT-II

Sufi and Bhakti Movement (14th to 17th Century):सगुण-निर्गुण भक्ति, Sufism and Sufi Saints, Kabir, Dadu, Soordas, Tulsidas,Guru Nanak Dev Ji and Guru Jambheshwar Ji Maharaj, composite cultural of Indian sub-continent.

UNIT- III

Jyotirao Phule, Savitri Bai Phule, Arvind, Vivekanand and Other 18th&19th Century Social Reform Movements; India's Cultural Heritage.

UNIT-IV

India's Contribution to the World of Knowledge: प्राचीन भारत के महान विज्ञानिक, बोधायन, चरक,कोमारभरित्य, जीवन,सुश्रुत, आर्यभट्ट, बारहमिहिर,ब्रह्मगुप्त, नागार्जुन,वाग्भट्ट, Astrology and Astronomy, Myths and Realities.

TEXT AND REFERENCES BOOKS:

1. A.L. Bansham, The Wonder That was India, A Survey of the culture of the, Indian Sub- Continent before, the Coming of the Muslims, Vol 1, Groove Press, New York,1959.
2. S. A.A Rizvi, Wonder That was India, A survey of the history and culture of the Indian sub-continent from the coming of the Muslims to the British conquest 1200-1700, Vol-II, Rupa and Co.2001.
3. JambhavaniMoolSanjiviniVyakhya
4. प्रतियोगितादर्पणअतिरिक्तांकसीरीज–5 भारतीयकलाएवंसंस्कृति
5. B. V. Subbarayappa,*A Historical Perspective: Science in India:,* Rupa Publications, New Delhi 2013.
6. Bishnoi, K.R. and N.R. Bishnoi (eds). Religion and Environment. Vol. II, New Delhi: ArihantPrakashanPvt. Ltd., 2002.

Course Articulation Matrix:

Course/Course Code: Essence of Indian Traditional Knowledge (MC/4-T),										Semester: IV		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	-	-	-	-	-	-	-	-	1
CO2	-	2	1	-	-	-	-	-	-	-	-	1
CO3	-	3	3	2	-	3	-	-	-	-	-	3
CO4	-	2	3	3	-	3	1	-	-	-	-	3
CO5	-	3	3	3	-	3	-	-	-	-	-	3

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

HUMAN VALUES AND PERSONALITY DEVELOPMENT

General Course Information

Course Code: **HSMC/2-T** Course Credits: 0.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 0 0 Examination Duration: **Internal Examination**	**Course Assessment Methods: Total Marks: 100** **(Internal Examination only)** The internal assessment of 30 marks will be on the minor tests, class attendance, assignments, and class performance. Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The assessment of 70 marks will be at the end of Semester through Interview/ VIVA-VOCE only by a committee of Two Faculty Members including course coordinator and a faculty member appointed by Chairperson/Head of concerned Department.

Pre-requisites: None

About the Course: This course is designed to develop a holistic perspective based on self-exploration and co-existence in society and nature. The focus is on to understand harmony and being in harmony with the society and the environment around us. The student will nurture a habit of self-reflection and courage to act. This course includes practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking).

Sr.No.	Course Outcomes At the end of the semester, students will be able to:
CO 1	Exhibit awareness about oneself, one's surroundings and goals in one's life.
CO 2	Stay in harmony with society and nature.
CO 3	Develop healthy and harmonious relationships.
CO 4	Understand groups and develop team spirit
CO 5	Manage stress effectively.
CO6	Exhibit leadership qualities.
CO7	Excel in Personal and Professional Life.

Course Content

Unit I

Understanding the concept of self. Exploration of self with JOHARI-Window. Self-Esteem, Characteristics of individuals with low and high self-esteem. Self Confidence, strategies of building self-confidence.

Personality: Definition. Types & Traits; Relevance & Importance of nature and nurture 'n the development of personality.

Unit II

Nature of socialization, Socialization process. contribution to society and nation, importance of discipline and handwork, ecological responsibility of engineers, professional Ethics: Competence in Professional values and ethics. Personal and Professional Excellence: Identifying of long-term choices and goals.

Unit III

Meaning and nature of teams, External and internal factors affecting team building. Leadership Meaning, Nature and Functions. leadership styles in organization. meaning and nature of stress, causes, effects and management.

Unit IV

Meaning and importance of human rights, Human rights awareness. Harmony in nature, understanding co-existence, harmony at all levels of existence. Understanding the concept of happiness and well-being. Role and importance of positive emotions: Gratitude, hope and optimism.

Text and Reference Books:

1. Bates, A. P. and Julian, J. : Sociology - Understanding Social Behaviour.
2. Dressler, David and Cans, Donald: The Study of Human Interaction.
3. Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
4. Organizational Behaviour, Davis, K.
5. Hoover, Judhith D. Effective Small Group and Team Communication, 2002 Harcourt College Publishers
6. Dick, McCann &Margerison, Charles: Team Management, 1992 Edition, viva books
7. Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
8. Dressier, David and Cans, Donald: The Study of Human Interaction
9. Pestonjee, D.M. Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
10. Pestonjee, D.M.; Stress and Coping: The Indian Experience
11. Clegg, Brian: Instant Stress management Bring calm to your life now.