CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2023-24

BE (Electronics and Communication Engineering)

SEMESTER – III

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	22MTC08	Transform Theory and Complex Analysis	3	-	-	3	40	60	3
2	22CSC29	C and Data Structures	3	-	-	3	40	60	3
3	22ECC01	Electronic Devices	3	-	-	3	40	60	3
4	22ECC02	EM Waves and Transmission Lines	3	-	-	3	40	60	3
5	22ECC03	Network Analysis and Synthesis	3	-	-	3	40	60	3
6	22ECC04	Signals and Systems	3	-	-	3	40	60	3
PRACTICALS									
7	22CSC30	C and Data Structures Lab	-	-	2	3	50	50	1
8	22ECC05	Electronic Devices Lab	-	-	2	3	50	50	1
9	22ECC06	Network Analysis and Synthesis Lab	-	-	2	3	50	50	1
10	22ECI01	MOOCs / Training / Internship	3-4 weeks / 90 hours				50	-	2
Total			**18**	**-**	**6**	**27**	**440**	**510**	**23**
Clock Hours Per Week: 24									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

22MTC08

TRANSFORM THEORY AND COMPLEX ANALYSIS

Instruction	3 L Hours per week
Duration of Semester end Examination	3 Hours
Semester end Examination	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: The Student should be familiar about elementary Calculus and Complex variables.

Course Objectives:
This course aims to:
1. To learn the Laplace, Z- Transform concepts.
2. To solve linear and Non-Linear partial differential equations.
3. To learn concepts of analytic functions and complex integration.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Find Laplace, Inverse Laplace and solution of engineering problems.
2. Find the solution of Difference Equation.
3. Understand the methods to find solution of linear and non-linear PDE and solution of wave equation.
4. Solve the problems on analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Complex integrals by using Cauchy's Residues theorem.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	1	1	1	1	1	1	1	2	1	1	1
CO 2	3	3	2	2	1	1	1	1	1	1	1	2	1	1	1
CO 3	3	3	3	3	1	1	1	1	1	1	1	2	1	1	1
CO 4	3	3	2	2	1	1	1	1	1	1	1	2	1	1	1
CO 5	3	3	2	2	1	1	1	1	1	1	1	2	1	1	1

UNIT - I

Laplace Transforms: Laplace Transform of Elementary functions, Linearity property, First Shifting property, Change of scale property. Laplace Transform of Periodic functions, Transforms of derivatives, integral's, Multiplication by t and division by t. Evaluation of Integrals by Laplace Transforms. Inverse Laplace transforms of elementary functions, Inverse Laplace Transform by Method of partial fractions and Convolution theorem, Solution of Ordinary Differential Equations by Laplace Transform method.

UNIT - II

Z-Transforms: Z-transforms of standard functions, linearity property, damping rule, shifting theorems, multiplication by 'n', Initial value theorem. Inverse Z-transforms of standard functions, Inverse Z-transform by Convolution theorem and partial fractions method. Z-transform application to different equations.

UNIT - III

Partial Differential Equations: Linear Equations of First Order (Lagrange's Linear Equations), Solution of First Order Non-linear Partial Differential Equations (Standard forms) and Charpit's Method. Solutions by method of separation of variables, solution of One dimensional wave equation and its applications.

UNIT – IV

Function of Complex Variables: Limit continuity and derivative of complex function, Analytic functions ,C'R equations ,Harmonic functions , Conjugate harmonic function, Complex integration, Cauchy's theorem (without Proof), Cauchy-integral formula (without proof).

UNIT - V

Series of Complex terms: Taylor's Series, Laurent's Series, Types of Singularities, Residues, Cauchy's Residue theorem (without proof), Calculation of Residues.

Series Solution: Bessel's Equations, Recurrence relations, Expansions of $J_0, J_1, J_{\frac{1}{2}}, J_{-\frac{1}{2}}$

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2017.
2. Sharma J.N , "Functions of a Complex variables", Krishna Prakashan Media, 49th Edition.
3. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.

Suggested Reading:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2008.
3. James ward Brown, Ruel V. Churchill", Complex variables an Applications", McGraw Hill Higher Education, 2013.

22CSC29

C AND DATA STRUCTURES
(Common for ECE and EEE)

Instruction	3 L Hours per week
Duration of Semester end Examination	3 Hours
Semester end Examination	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Problem Solving and Programming.

Course Objectives:
This course aims to:
1. To discuss the concepts of Functions, Arrays, Pointers and Structures.
2. To familiarize with Stack, Queue and Linked lists data structures.
3. To explain the concepts of non-linear data structures like graphs and trees.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Analyze the basic concepts of C Programming language.
2. Design applications in C, using functions, arrays, pointers and structures.
3. Apply the concepts of Stacks and Queues in solving the problems.
4. Explore various operations on Linked lists.
5. Demonstrate various tree traversals and graph traversal techniques.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	1	1	1	1	1	1	1	1	1	1	1	1
CO 2	3	3	3	1	1	1	1	1	1	1	1	1	1	2	1
CO 3	3	3	3	1	1	2	1	1	1	1	1	1	1	2	1
CO 4	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1
CO 5	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1

UNIT - I
Introduction to C Language: C language elements, variable declarations and data types, operators and expressions, decision statements – If and switch statements, loop control statements – while, for, do-while statements, arrays.

UNIT - II
Functions: Types of functions, Recursion and argument passing, pointers, storage allocation, pointers to functions, expressions involving pointers, Storage classes – auto, register, static, extern, Structures, Unions, and Command line arguments, File Operations.

UNIT - III

Data Structures: Overview of data structures, Types of Data Structures.

Stacks: Introduction, Operations on Stack, implementation of stack, Applications of Stacks- infix, prefix, and postfix notations, infix to postfix conversion, evaluation of arithmetic expressions, evaluation of postfix expression, recursion.

Queues: Introduction, Operations-representation of queue, insertion, deletion, searching operations, Applications of queues.

UNIT - IV

Linked Lists: Introduction, Types of linked list-Single linked list, Double linked lists, Circular linked lists, dynamic linked stacks and queues. Operations on all types of linked lists.

Application of Linked Lists: Polynomial representation.

UNIT - V

Trees: Tree terminology, representation, types of trees, Binary trees, representation, tree traversals, binary search tree and its operations.

Graphs: Graph terminology, representation, elementary graph operations, Graph traversals-Breadth First Search (BFS) and Depth First Search (DFS), spanning trees.

Text Books:

1. Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition, 2011.
2. E. Balaguruswamy, “C and Data Structures”, 4th Edition, Tata Mc Graw Hill.
3. A.K. Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.

Suggested Reading:

1. M.T. Somashekara, “Problem Solving Using C”, PHI, 2nd Edition 2009Pearson, 2013.
2. Kamala Krithivasan, Rama R. “Introduction to Automata Theory, and Computation”, Pearson 2009.

NPTEL/SWAYAM Course:

1. Programming and Data Structure,IIT Kharagpur Dr.P.P.Chakraborty -https://nptel.ac.in/courses/106105085
2. Programming, Data Structures and Algorithms using C - https://archive.nptel.ac.in/courses/106/106/106106127/

22ECC01

ELECTRONIC DEVICES

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Students should have the knowledge of semiconductor fundamentals.

Course Objectives:

This course aims to:

1. The concepts of semiconductor devices like PN junction diode, Transistor, and special diodes.
2. The applications of diodes and transistors.
3. The various configurations and characteristics of transistors – BJT, JFET & MOSFET.

Course Outcomes:

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

1. Demonstrate the understanding of the characteristic behaviour of Diodes.
2. Apply the acquired knowledge in the analysis of various diode circuits.
3. Compare and Contrast the characteristics of BJT in various configurations.
4. Analyze the operation and characteristics of JFET and MOSFET.
5. Choose an appropriate electronic device for a specific application.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	1	1	1	1	1	2	1	1	1	2	3	3	1
CO 2	2	3	1	3	2	1	1	2	1	1	1	2	3	3	1
CO 3	1	2	1	1	1	1	1	2	1	1	1	2	3	3	1
CO 4	2	3	1	3	2	1	1	2	1	1	1	2	3	3	1
CO 5	1	3	1	2	2	1	1	2	1	1	1	2	3	3	1

UNIT - I

Semiconductor Diode Characteristics: The p-n junction Diode, Current equation, V-I characteristics, Diode resistance, Diode equivalent circuits, Temperature dependence, Transition capacitance, Diffusion capacitance, Diode switching times, Diode specifications, Zener diode – V-I characteristics, Zener diode as voltage regulator.

UNIT - II

Diode Applications: Diode as a circuit element: series diode configurations, parallel and series-parallel configurations, Clipping and clamping circuits, Clamping circuit theorem. Half wave, Full wave and Bridge Rectifiers - operation, ripple factor and efficiency calculations. Filters: L, C, LC and CLC filters with FWR – operation and ripple factor calculation.

UNIT - III

Bipolar Junction Transistor: Transistor: Construction and Operation, current components, Modes of operation, Early effect, BJT input and output characteristics: CB, CE, CC configuration. h-parameters, determination of h-parameters from transistor characteristics. BJT applications: BJT as an amplifier and as a switch.

UNIT - IV

Field Effect Transistor: Construction and Operation, Drain and transfer characteristics, Transconductance and drain resistance.

MOSFETs: Enhancement & Depletion mode MOSFETs, Drain and transfer characteristics. FET applications: FET as an amplifier and as a switch.

UNIT - V

Special Purpose Semi-Conductor Devices: Operation and V-I characteristics of UJT, SCR, Diac, Triac, Tunnel diode, Schottky diode, LED, Photodiode, Solar cell.

Text Books:

1. Millman and Halkias, "Electronic Devices and Circuits", 2nd Edition, McGraw Hill Publication, 2007.
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009.

Suggested Reading:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.
2. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.

22ECC02

EM WAVES AND TRANSMISSION LINES

Instruction	3 L Hours per week
Duration of Semester end Examination	3 Hours
Semester end Examination	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Students should have prior knowledge about coordinate systems, vector calculus, Electrostatics and Steady Magnetic Fields.

Course Objectives:

This course aims to:

1. Provide the concepts of boundary conditions.
2. Understand the Maxwell's equations and conceptualize the wave propagation characteristics in different mediums.
3. Provide the concepts of transmission lines.

Course Outcomes:

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

1. Comprehend the boundary conditions, time varying fields and understand Maxwell's equations in different forms.
2. Illustrate the Electromagnetic wave properties with respect to different transmission mediums and predict the behavior of reflection and refraction of the waves in different mediums.
3. Understand the concepts of transmission lines and the significance of Open and Short circuit Lines.
4. Estimate the transmission line properties, reflection, and matching concepts.
5. Conceptualizing Microwaves and analyzing the waves in the waveguides.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	3	2	2	1	3	1	1	2	1	1	2	3	3	3
CO 2	2	3	2	1	1	3	2	1	2	1	1	2	3	3	3
CO 3	2	2	1	3	1	3	1	2	3	1	1	2	3	3	3
CO 4	2	2	1	3	1	3	1	2	1	1	1	2	3	3	3
CO 5	2	2	1	2	1	3	1	1	3	1	1	2	3	3	3

UNIT - I

Time varying fields: Review of coordinate systems, Boundary conditions: Boundary conditions on Electric and Magnetic fields across a conductor interface and across two mediums. Time varying fields, Faradays Law, Modified Amperes Law, Gauss Law for Electric and Magnetic Fields, Maxwell equations: Integral form and Point form.

UNIT - II

Electromagnetic Waves: Wave equations, Uniform plane waves in lossy and lossless medium, Skin Depth, Polarization, Instantaneous and Average Poynting theorem and its applications, Reflection and Refraction of Plane Waves - Normal and Oblique Incidence for perfect Conductor and perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection.

UNIT - III

Transmission Lines - I: Types, Parameters, Transmission Line Equations, Primary and Secondary Constants, Characteristics Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Impedance at any point on the transmission line. RF and UHF Lines, Open and Short circuit lines and their significance, Properties of λ/2, λ/4 and λ/8 Lines.

UNIT - IV

Transmission Lines - II: Distortion and distortion less transmission line, Concept of loading of a transmission line, Campbell's formula, Reflection and VSWR, Matching- Quarter wave transformer, Single Stub matching, Smith chart and its applications.

UNIT - V

Introduction to Microwaves: Microwave frequency spectrum, Advantages and Applications of Microwaves. Rectangular Waveguides: TE and TM waves, Impossibility of TEM wave in waveguides.

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics" 6th edition, 2015, Newyork Oxford University Press.
2. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd edition., 2000, PHI.
3. Samuel Y. Liao, "Microwave Devices and Circuits," 3/e, Pearson Education, 2003.

Suggested Reading:

1. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", 8th edition, 2016, TMH
2. John D. Ryder, "Networks Lines and Fields", 2nd edition, 2015, PHI.
3. R.K. Shevgaonkar, "Electromagnetics Waves", Tata McGraw Hill India, 2005.
4. Sunil Bhooshan, "Fundamentals of Engineering Electromagnetics", 2012, Oxford University Press Publication.

22ECC03

NETWORK ANALYSIS AND SYNTHESIS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge on Elements of Electrical Engineering.

Course Objectives:
This course aims to:

1. Make understand the concepts of Electric Circuits, Network Theorems and the Transient Analysis.
2. Make understand the concept of steady state and applying phasor analysis to AC circuits and analyzing magneticcoupled circuits.
3. Familiarize resonant circuits, two port network parameters, concept of Passive Filters and Network Synthesis.

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

1. Recall basics of electrical circuits with Nodal and Mesh analysis.
2. Illustrate electrical theorems for AC and DC Circuits.
3. Develop time domain and frequency domain analysis for circuits.
4. Analyze the electrical network and two port network parameters for different applications i.e., magnetic coupledcircuits, Filters.
5. Synthesize different network functions using Foster and Cauver form.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	1	1	1	1	2	3	1	3	3	2	3
CO 2	3	3	2	2	1	1	1	1	2	3	1	3	3	2	3
CO 3	3	3	2	2	1	1	1	1	2	3	1	3	3	2	3
CO 4	3	3	2	2	1	1	1	1	2	3	1	3	3	2	3
CO 5	3	3	3	2	1	1	1	1	2	3	1	3	3	2	3

UNIT - I

Network Theorems: Network reduction techniques, Super Nodal and Super Mesh Analysis, Superposition, Thevenin's and Norton's theorems, Reciprocity, Maximum Power Transfer, Compensation, Millman's, Duality and Tellegen's Theorems using dependent and independent sources.

UNIT - II

Transients: Introduction, Study of initial conditions, DC transients RL, RC circuits, RLC circuits, Formulation of integral, differential equations. Circuit analysis using Laplace Transform and inverse Laplace Transform, Pole-Zero Plots, Zero Input Response, Zero State Response.

UNIT - III

Steady State Analysis of AC Circuits: Phasor and vector representations, impedance and admittance, Average power, Apparent Power, Complex Power, Power triangle.
Coupled circuits: Concept of self, mutual inductance, co-efficient of coupling, dot convention rules and analysis of simplecircuits.

UNIT - IV

Frequency Domain Analysis: Concept of complex frequency, impedance and admittance functions, Series and parallelresonance, Q-factor, selectivity, bandwidth.

Two Port Networks: Z, Y, h, g, ABCD and Inverse ABCD parameters, equivalence of two port networks. Inter connection ɗtwo port networks.

UNIT - V

Filters: Introduction to Filters and classification of Filters (Low pass, High pass) and their design aspects.

Network Synthesis: Synthesis vs. analysis, Elements of circuit synthesis, Positive Real Functions: Definition, Necessary and sufficient conditions for a function to be positive real, Testing of driving point functions for positive realness. Synthesis of Foster and Cauer forms of LC, RC and RL networks.

Text Books:

1. William H.Hayt, Jr.,Jck E. Kemmerly and Steven M.Durbin, "Engineering Circuit Analysis", 8th Edition, McGrawHill, 2013.
2. Van Valkenberg M.E, "Network Analysis", PHI, 3rd Edition New Delhi, 2002.

Suggested Reading:

1. C. L. Wadhwai, "Network Analysis and Synthesis", 4th Edition, New Age Publications, 2016.
2. Sudhakar. A. and Shyam Mohan, S. P., "Circuits and Network", Tata McGraw Hill, New Delhi, 1994.

22ECC04

SIGNALS AND SYSTEMS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of Differential and Integral Calculus.

Course Objectives:
This course aims to:
1. Know Signals and systems representation/classification and also the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transforms and Laplace transforms.
2. Understand Sampling, time and frequency domain analysis of discrete time signals with DTFS, DTFT and Z-Transforms.
3. Understand concepts of convolution and correlation integrals.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Classify signals, systems and analyse the signals using Transform techniques.
2. Evaluate signal characteristics using time and frequency domain analysis.
3. Assess the system stability and causality using ROC and Pole-Zero Plot.
4. Describe the sampling process and analyse the DT Signal/systems using DTFS, DTFT and Z-Transform.
5. Apply the Convolution and correlation concepts for analysis of Signal and systems**.**

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	1	1	1	1	1	2	1	2	2	1	1
CO 2	3	2	1	1	1	1	1	1	1	2	1	2	2	1	1
CO 3	3	2	1	1	1	1	1	1	1	2	1	2	2	1	1
CO 4	3	2	1	1	1	1	1	1	1	2	1	2	2	1	1
CO 5	3	2	1	1	1	1	1	1	1	2	1	2	2	1	1

UNIT - I
Continuous Time Signals: Introduction to signals and systems, their representations and classification. Orthogonality of signals, Complete set of mutually orthogonal signals and Harmonic signals. Trigonometric Fourier series, Exponential Fourier series, Existence and Convergence. Symmetry conditions, Amplitude and Phase spectra. Power Spectral Density.

UNIT - II
Fourier Transforms: The direct and inverse Fourier transforms, Existence, Frequency spectrum and properties of Fourier Transforms, Fourier Transform of singularity functions and periodic signals. Energy Spectral Density.

UNIT - III
Laplace transforms: The Bilateral and unilateral Laplace transforms. Region of convergence and its properties. Properties of Laplace transform, Inverse Laplace transform, Laplace transform of causal periodic signals.
LTI System: Impulse response, System transfer function, Stability and Causality.

UNIT - IV

Discrete Time Signals: Sampling of continuous time signals. Sampling Theorem, DTS representation. Discrete Time Fourier Series, Discrete Time Fourier Transform and properties.

Z–Transform: The Direct Z-Transform, Region of convergence and its properties. S–Plane and Z–Plane correspondence, Z–Transform properties. Inverse Z–Transform.

Discrete LTI system: Impulse response and System transfer function. Stability and Causality.

UNIT - V

Convolution: Continuous convolution, Graphical interpretation and its properties. Discrete convolution and its properties.

Correlation: Continuous Cross correlation, Auto correlation and properties. Discrete Cross correlation, Auto correlation and properties.

Text Books:

1. B. P. Lathi, "Signals, Systems and Communications", BS Publications, 3rd Edition, 2008.
2. Simon Haykin, "Signals and Systems", Wiley India, 5th Edition, 2009.
3. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawad, "Signals and Systems", PHI 2nd Edition, 2015.

Suggested Reading:

1. M. J. Robert, "Fundamentals of signals and systems", McGraw Hill, 2008.
2. A. Rajeswari, "Signals and Systems", Wiley India Pvt. Ltd, Publications 2021.

22CSC30

C AND DATA STRUCTURES LAB
(Common for ECE and EEE)

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Problem Solving and Programming.

Course Objectives:

This course aims to:

1. Master the concepts of Functions, Arrays, Pointers and Structures.
2. Learn data structures such as Stack, Queue and Linked lists.
3. Write C programs to implement Trees and Graphs.

Course Outcomes:

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

1. Understand and trace the execution of programs written in C language.
2. Apply the concepts of looping and decision-making statements for a given problem.
3. Solve problems using functions, arrays , structures and pointers.
4. Implementation various operations on stack , queue, tree and graph.
5. Apply the knowledge of data structure in problem solving.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	3	2	1	1	1	1	1	1	1	1	1	1	1	1
CO 2	3	3	3	1	1	1	1	1	1	1	1	1	1	2	1
CO 3	3	3	3	1	1	1	1	1	1	1	1	1	1	2	1
CO 4	2	3	3	1	1	1	1	1	1	1	1	1	1	1	1
CO 5	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1

Laboratory / Practical Experiments:

1. Using if and Switch Constructs Programs.
2. Demonstration of Looping Statements Problems.
3. Demonstration of Functions and Recursive Programs.
4. Demonstration of Structures and Union Programs.
5. Demonstration of Command line arguments.
6. Demonstration of Pointers and Arrays Programs.
7. Implementation of Stacks and Queues.
8. Implementation of Linked List Programs: Single , Double and Circular Linked List.
9. Implementation of Trees: Tree operations and its traversals.
10. Implementation of Graph traversals- DFS and BFS.

Text Books:

1. Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition, 2011.
2. E. Balaguruswamy, “C and Data Structures”, 4th Edition, Tata Mc Graw Hill.
3. A.K. Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.

Suggested Reading:

1. M.T. Somashekara, “Problem Solving Using C”, PHI, 2nd Edition 2009Pearson, 2013.
2. Kamala Krithivasan, Rama R. “Introduction to Automata Theory, and Computation”, Pearson 2009.

NPTEL/SWAYAM Course:

1. Programming and Data Structure,IIT Kharagpur Dr.P.P.Chakraborty - https://nptel.ac.in/courses/106105085
2. Programming, Data Structures and Algorithms using C - https://archive.nptel.ac.in/courses/106/106/106106127/

22ECC05

ELECTRONIC DEVICES LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Students should have the knowledge of semiconductor fundamentals.

Course Objectives:

This course aims to:

1. The V-I characteristics of diodes and special semiconductor devices.
2. The design and performance evaluation of various diodes as rectifiers.
3. The characteristics of transistor in various configurations.

Course Outcomes:

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

1. Demonstrate the characteristic behaviour of PN junction diode and Zener diode.
2. Design various non-linear wave shaping circuits using diodes for a given specification.
3. Analyse the performance of rectifiers with and without filters.
4. Examine the characteristics of BJT and FET in various configurations.
5. Compare the characteristics of special purpose semiconductor diodes.

CO-PO-PSO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	1	1	2	1	1	2	2	2	2	2	3	3	2
CO 2	2	2	1	1	2	1	1	2	2	2	2	2	3	3	2
CO 3	2	2	1	1	2	1	1	2	2	2	2	2	3	3	2
CO 4	2	2	1	1	2	1	1	2	2	2	2	2	3	3	2
CO 5	2	2	1	1	2	1	1	2	2	2	2	2	3	3	2

List of Experiments:

1. V-I Characteristics of Silicon and Germanium diodes and measurement of static and dynamic resistances.
2. Zener diode reverses characteristics and its application as voltage regulator.
3. Simple series clippers, parallel clippers and biased clipping circuits.
4. Clamping Circuits.
5. Performance evaluation of half wave rectifier without filters and with C & π section filters.
6. Performance evaluation of full wave rectifiers without filters and with C & π section filters.
7. BJT characteristics in Common Base configuration and measurement of h-parameters.
8. BJT characteristics in Common Emitter configuration and measurement of h-parameters.
9. BJT characteristics in Common Collector configuration and measurement of h-parameters.
10. Drain and Transfer characteristics of JFET in CS configuration and measurement of Transconductance and Drain resistance.
11. Emitter characteristics of UJT.
12. Characteristics of SCR.
13. Characteristics of Tunnel diode.

14. **Structured Enquiry:** Design a switching circuit using BJT and JFET and analyse its operation.
15. **Open ended Enquiry:** Design a LED running lights circuit for vehicles to avoid accidents in fog / rain condition.

Virtual lab Experiments (https://be-iitkgp.vlabs.ac.in/List%20of%20experiments.html**):**

1. Rectifiers without and with filters.
2. BJT characteristics in Common Base configuration and measurement of h-parameters.
3. BJT characteristics in Common Emitter configuration and measurement of h-parameters.

Note:

1. Wherever possible, Analysis and design of circuits shall be carried out using simulation tools.
2. A minimum of 12 experiments should be performed.

Suggested Reading:

1. Robert Diffenderfer, "Electronic Devices Systems and Applications", Cengage Learning India Private Limited, 2010.
2. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, "Basic Electronics, A Text - Lab Manual", 7th Edition, TMH 2001.
3. Mahesh Jain, "Practical semiconductors data manual No.3", BPB Publications, 1981.
4. Bharath Electronics Ltd., "Semiconductors data manual", IEC Publication 134, 1969.

22ECC06

NETWORK ANALYSIS AND SYNTHESIS LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Knowledge of basic Electrical components and Circuits.

Course Objectives:
This course aims to:

1. Understand the basic Concepts of Electrical Circuits, equipment and verify Network theorems.
2. Analyze Resonant circuits, Attenuators and passive filters.
3. Synthesize different network functions using Foster and Cauer forms.

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

1. Identify and measure the passive and active components using electronic equipment and apply Network theorems to AC and DC Circuits.
2. Determine and analyze two port network parameters.
3. Design and verification of attenuator and filters.
4. Simulation of different networks and circuits using the simulation software.
5. Synthesize different network functions using Foster and Cauer forms.

CO-PO-PSO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO 2	3	3	3	2	2	2	1	1	1	2	1	2	1	3	2
CO 3	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1
CO 4	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1
CO 5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

List of Experiments:

1. Study of RLC components, Bread board, Regulated power supply, Function generator, CRO Measurement of R, L,C components using color code, multimeter and LCR - Q Meter.
2. Practice of Soldering and de -soldering for simple circuits on single and Multi-Layer PCBs.
3. Verification of Superposition theorem and Tellegen's theorem.
4. Verification of Maximum power transfer theorem. Verification of Reciprocity theorem.
5. Verification of Compensation theorem and Millman's theorem.
6. Verification of Transient Response in RC, RLCircuits.
7. Design and Verification of Series Resonance.
8. Determination of two-port network parameters (Z, Y, h, T).
9. Design and Verification of Constant-K low-pass filter.

10. Synthesization of network function using Foster and Cauer form.
11. **Structured Enquiry:** Design and Verification of Parallel Resonance.
12. **Open ended Enquiry:** Design and Verification of Constant-K High-pass filter.
13. **Virtual lab experiment:** Verification of Reciprocity Theorem – https://asnm-iitkgp.vlabs.ac.in/exp/verification-reciprocity-theorem/simulation.html

Note: Experiments are to be simulated by using simulation software.

Suggested Reading:

1. Thomas Petruzzellis, "Build Your Own Electronics Workshop", McGraw-Hill Companies, Inc., 2005.
2. A.M. Zungeru, J.M. Chuma, M. Mangwala, L.K. Ketshabetswe, "Handbook of Laboratory Experiments in Electronics and Communication Engineering", Vol. 2, 1st Edition, Notion press, 2017.

22ECI01

MOOCs / Training / Internship

Instruction / Demonstration /Training	3-4 Weeks / 90 Hours
Duration of Semester End Presentation	--
Semester End Evaluation	--
Continuous Internal Evaluation	50 Marks
Credits	2

Prerequisite: Knowledge of Basic Sciences and Engineering Science.

Course Objectives:
This course aims to:
1. Exposing the students to the industrial environment.
2. Create awareness with the current industrial technological developments relevant to program domain.
3. Provide opportunity to understand the social, economic and administrative considerations in organizations.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand Engineer's responsibilities and ethics.
2. Use various materials, processes, products and quality control.
3. Provide innovative solutions to solve real world problems.
4. Acquire knowledge in technical reports writing and presentation.
5. Apply technical knowledge to real world industrial/rural situations.

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CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	1	1	3	3	1	3	1	3	3	1	1	3
CO 2	1	1	1	3	3	1	2	1	1	1	1	1	3	3	1
CO 3	2	3	3	3	3	2	3	1	1	1	1	1	3	3	1
CO 4	1	1	1	1	1	3	1	1	3	3	1	1	1	1	3
CO 5	1	3	3	3	3	2	3	1	1	1	1	1	3	3	3

For implementation procedures and letter formats, Annexures I and III of Internship document may be referred.

Evaluation of Internship: The Industrial training / Internship of the students will be evaluated in three stages:
a) Evaluation by the Industry (in the scale of 1 to 10 where 1-Unsatisfactory; 10-Excellent).
b) Evaluation by faculty Mentor on the basis of site visit(s) or periodic communication (15 marks).
c) Evaluation through seminar presentation/Viva-Voce at the Institute by the constituted committee (25 marks).

Evaluation through Seminar presentation / Viva-Voce at the institute: Students shall give a seminar before an Expert Committee constituted by college (Director, HoD/Senior faculty, mentor and faculty expert from the same department) based on his/her training/internship carried out.

The evaluation will be based on the following criteria:

- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.

- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall be analyzed along with the Internship report.

Monitoring / Surprise Visits: During the internship program, the faculty mentor makes a surprise visit to the internship site, to check the student's presence physically. If the student is found to be absent without prior intimation to the concerned industry, entire training / internship may be canceled. Students should inform through email to the faculty mentor as well as the industry supervisor at least one day prior to avail leave.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from the AY 2023-24

BE (Electronics and Communication Engineering)

SEMESTER – IV

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	22ECC07	Analog Circuits	3	-	-	3	40	60	3
2	22ECC08	Antennas and Wave Propagation	3	-	-	3	40	60	3
3	22ECC09	Control Systems	3	-	-	3	40	60	3
4	22ECC10	Digital System Design	3	-	-	3	40	60	3
5	22ECC11	Probability Theory and Stochastic Process	3	-	-	3	40	60	3
6	22EEM01	Universal Human Values-II: Understanding Harmony	-	1	-	-	50	-	1
7	22EGM01	Indian Constitution and Fundamental Principles	2	-	-	2	-	50	Non-Credit
PRACTICALS									
8	22ECC12	Analog Circuits Lab	-	-	2	3	50	50	1
9	22ECC13	Digital System Design Lab	-	-	2	3	50	50	1
10	22ECC14	Modelling and Simulation Lab	-	-	2	3	50	50	1
11	22EGC03	Employability Skills	-	-	2	3	50	50	1
Total			**17**	**1**	**8**	**29**	**450**	**550**	**20**
Clock Hours Per Week: 26									

L: Lecture D: Drawing CIE: Continuous Internal Evaluation
T: Tutorial P: Practical/Project Seminar/Dissertation SEE: Semester End Examination

22ECC07

ANALOG CIRCUITS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Student should have knowledge of Electronic Devices.

Course Objectives:
This course aims to:
1. The various biasing circuits for BJT and FET.
2. The analysis of BJT & FET in various configurations using small signal equivalent models.
3. The concepts of multistage, feedback amplifiers, and power amplifier.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Apply the knowledge of BJT behavior in the design of various biasing and amplifier circuits.
2. Relate the knowledge of FET characteristics in the design of various biasing and amplifier circuits.
3. Apply high and low frequency models of transistor in the analysis of single stage and multistage amplifiers.
4. Analyze negative feedback amplifier circuits and compare them.
5. Compare and Contrast different types of Oscillators and Power amplifiers.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	3	1	1	1	1	1	1	1	1	3	2	1
CO 2	3	3	3	2	1	1	1	1	1	1	1	1	3	2	1
CO 3	3	3	3	3	1	1	1	1	1	1	1	1	3	2	1
CO 4	3	3	3	2	1	1	1	1	1	1	1	1	3	2	1
CO 5	3	2	1	2	1	1	1	1	1	1	1	1	3	2	1

UNIT - I
BJT Biasing: Operating point, Bias stability, stability factors, BJT biasing techniques: Fixed Bias, Collector-Base bias, Emitter Bias, Voltage-Divider bias, Thermal runaway.
BJT Amplifiers: CB, CE and CC amplifiers: Analysis using h-parameters ((approximate and exact analysis), Comparison of the three amplifier configurations, Millers Theorem – application circuit, Frequency response of BJT amplifiers.

UNIT - II
JFET biasing: Fixed biasing, Self-bias and Voltage-divider bias configurations, FET biasing for zero current drift.
JFET Amplifiers: CS, CD and CG amplifiers: Analysis using small-signal model, Comparison of three amplifier configurations, Frequency response of FET Amplifiers.

UNIT - III
Multistage amplifiers: Overview of Coupling schemes - RC coupling, Transformer coupling and Direct coupling; Analysis of CE-CE, CE-CB, CC-CC Darlington pair, Multi-stage frequency effects.

Transistor at high frequencies: Hybrid π CE transistor model, Hybrid π Conductances and Capacitances, CE short circuit current gain.

UNIT – IV

Negative Feed Back Amplifiers: The feedback concept, General characteristics of negative feedback amplifiers, Effect of negative feedback on input and output impedances, Method of analysis of feedback amplifiers, Analysis of practical feedback circuits - Voltage series, voltage shunt, current series and current shunt feedback amplifiers.

UNIT - V

Oscillators: Positive feedback and conditions for sinusoidal oscillations, RC Phase Shift Oscillator, LC oscillators – Hartley and Colpitts Oscillators, Crystal oscillator.

Large Signal Amplifiers: Classes of operation, Harmonic distortion, Class A resistive coupled and transformer coupled amplifiers, Class-B Push-pull and complementary symmetry amplifiers, Class AB operation, Power dissipation and efficiency calculations. Heat sinks. Introduction to Tuned Amplifiers

Text Books:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics – Analog and Digital Circuits and Systems", 2nd Edition, McGraw Hill Publication, 2010.
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009.

Suggested Reading:

1. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.
2. Millman and Halkias, "Electronic Devices and Circuits" 2nd Edition, McGraw Hill Publication, 2007.
3. Donald Schilling, Charles Belove, Tuvia Apelewicz Raymond Saccardi, "Electronic Circuits: Discrete and Integrated", TMH, 3rd Edition, 2012.

22ECC08

ANTENNAS AND WAVE PROPAGATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Students should have prior knowledge about Electromagnetic waves.

Course Objectives:

This course aims to:

1. Provide the basic principles of an antenna and its parameters for characterizing its performance.
2. Understand the fundamental concepts of various types of antennas and arrays for customizing the radiation pattern.
3. Understand the propagation behaviour of the radio waves.

Course Outcomes:

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

1. Understand the basic parameters of an antenna.
2. Understand the radiation properties of antenna and analyze different type of wire antennas.
3. Analyze the linear arrays for uniform and non-uniform distribution.
4. Learn the concept of different types of planar antenna.
5. Study the behaviour of radio waves in various mode of wave propagation.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	3	3	1	1	2	3	1	3	1	1	2	3	3	3
CO 2	2	3	2	2	3	1	1	1	3	3	1	3	3	3	3
CO 3	3	3	2	2	3	1	2	1	3	3	3	3	3	3	3
CO 4	3	3	2	2	3	1	2	1	3	3	3	3	3	3	3
CO 5	3	3	2	2	3	1	2	1	3	3	3	3	3	3	3

UNIT - I

Antenna Basics: Principles of radiation, Retarded potential, Isotropic, Directional and Omni-directional radiators. Basic Antenna Parameters: Radiation patterns, radiation intensity, region separation, gain and directivity, Antenna polarization, Effective aperture and efficiency, Friis Transmission equation, Point sources and current distribution.

UNIT - II

Antenna Analysis: Analysis of Infinitesimal dipole, Half wave dipole, Loop antenna, Calculation of radiation resistance and directivity.

UNIT - III

Antenna Arrays: Uniform and Non-Uniform Arrays: Concept of Antenna Array, N-Element Uniform array, Two element array of Infinitesimal dipoles. Broadside and End fire arrays, Calculation of Directivity. Qualitative treatment of Non-Uniform array: Binomial and Tschebyscheff distribution and Qualitative treatment of Phased antenna array.

UNIT - IV

Microstrip Antennas: Radiation mechanism, different types, advantages and disadvantages. Design of rectangular Microstrip antenna. Reflectors: Paraboloidal Reflectors, Qualitative treatment of Smart Antennas.

Antenna Measurements: Measurement of Radiation Pattern and Gain.

UNIT - V

Wave Propagation: Frequency Spectrum, Ground wave propagation, Space and Surface waves, Tropospheric refraction and reflection, Duct propagation. Sky wave propagation: Critical frequency, Maximum Usable Frequency (MUF), Ionospheric Delay and Skip distance, Line of sight propagation.

Text Books:

1. Constantine A. Balanis, "Antenna Theory: Analysis and Design", 4th Edition, John Wiley, 2016.
2. Edward C. Jordan and Kenneth G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, 2001.

Suggested Reading:

1. John D. Krauss, Ronald J. Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation", 4th Edition, TMH, 2010.
2. Dennis Roody and John Coolen, "Electronic Communications", 4th Edition, Prentice Hall, 2008.
3. I.J.Bhal and P.Bhartia, "Micro-strip antennas", Artech house, 1980.

22ECC09

CONTROL SYSTEMS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: The student is expected to have knowledge of Laplace transform and electrical and electronic circuits.

Course Objectives:
This course aims to:

1. Introduce various control systems (Open and closed loop) and their equivalent mathematical models using block diagrams, signal flow graphs and state space techniques.
2. Analyze the time and frequency response of control system to access the transient response and steady state response.
3. Study different types of stability concepts in control systems and Design various controllers and compensators to improve the system dynamic performance.

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

1. Distinguish the closed-loop control systems from open-loop control systems and develop mathematical models in time domain (differential equations, state equations) and S-domain (Transfer function using Laplace transform).
2. Evaluation of transfer function from block diagram and signal flow graph by using block diagram reduction techniques and Mason gain formula, respectively.
3. Investigate the stability of control system via Routh-Hurwitz criteria, Root-locus method and Nyquist Plot.
4. Utilize standard test signals to analyze the time response of first and second-order control systems and frequency response analysis of the control system.
5. Design and develop various controllers and compensators to control the steady state error, stability and transient response.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	1	1	1	1	1	1	1	1	1	1	3	2	2
CO 2	3	3	1	2	1	1	1	1	1	1	1	1	3	2	2
CO 3	3	3	3	3	2	1	1	1	1	1	1	1	3	2	2
CO 4	3	3	2	3	2	1	1	1	1	1	1	1	3	2	2
CO 5	3	3	3	2	1	1	1	1	1	1	1	1	3	2	2

UNIT - I

Control System Fundamentals: Classification of control systems, Open and Closed Loop control systems, Block diagram reduction and signal flow graphs, Mathematical modelling of a Mechanical system and conversion into Electrical system.

UNIT - II

Time Response Analysis: Transfer function and Impulse Response, Types of Inputs, Transient Response of first and second Order System with different inputs, Time domain Specifications. Types of Systems, Static error coefficients, Error series, PD, PI and PID controllers.

UNIT - III

Root Locus: Routh-Hurwitz criteria for stability, Root Locus Techniques, Analysis of typical systems using Root Locus Techniques, Effect of location of roots on system response.

UNIT - IV

Frequency Response Analysis: Frequency domain specifications, Bode plot, Principle of Argument, Nyquist plot and stability criterion, Gain and Phase Margins from the Bode and Nyquist diagrams, Lead and Lag compensators.

UNIT - V

State Space Analysis: Concept of State, State Variable, State vector and State space. State space representations of linear time invariant systems, State transition matrix, Solution of state equation, Controllability, Observability and Design of control systems using state variable feedback.

Text Books:

1. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International Publishers, 5th Edition 2012.
2. Benjamin C. Kuo, "Automatic Control Systems", 7th Edition, PHI, 2010.

Suggested Reading:

1. K. Ogata, "Modern Control Engineering", EEE, 5th Edition, PHI, 2003.
2. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", 11th Edition Pearson, 2008.
3. Gopal Madan, "Digital control engineering" 1st Edition, New age publishers, 2008.

22ECC10

DIGITAL SYSTEM DESIGN

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of Electronic device concepts.

Course Objectives:
This course aims to:
1. Learn various techniques for logic minimization.
2. Comprehend the concepts of various combinational circuits and sequential circuits.
3. Learn the Language fundamentals of Verilog HDL and also able to simulate and synthesize various digital modules.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand the basic concepts related to digital system design.
2. Design the combinational and sequential circuits.
3. Analyze the behavior of the digital system design.
4. Develop the digital system using various Verilog HDL modeling.
5. Apply the design concepts of digital system using Verilog HDL.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	3	2	1	1	1	1	1	1	1	3	2	2
CO 2	3	2	2	3	2	1	1	1	1	1	1	1	3	3	2
CO 3	3	3	3	3	2	1	1	1	1	1	1	2	3	2	2
CO 4	3	3	3	3	2	2	1	2	2	1	1	2	3	2	3
CO 5	3	3	3	3	2	2	1	2	2	1	1	2	3	2	2

UNIT - I
Logic Simplification and Combinational Logic Design: Number system representation and conversion, Binary Arithmetic, Complements, Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Quine –McCluskey Tabular Minimization Method, Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT - II
Introduction to Combinational Design: Binary Adders and Subtractor, Code converters: Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display. Decoders, Encoders, Priority Encoders, Multiplexers, De-multiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

UNIT - III
Sequential Logic Design: Latches, Flipflops, Difference between latch and flipflop, types of flipflops like S-R, D, T, JK and Master-Slave JK Flip Flop, Flip flop conversions, setup and hold times, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts.

UNIT - IV

Introduction to HDLs: VLSI Design flow, Basic Concepts of Verilog HDL, Data Types, System Tasks and Compiler Directives. Gate Level Modelling: Gate Types and Gate Delays. Dataflow Modelling: Continuous Assignment and Delays. Design of Stimulus Block.

UNIT - V

Behavioral Modelling: Structured Procedures, Procedural Assignments, Timing control, Conditional statements, Sequential and Parallel Blocks. Switch level Modelling, Introduction to tasks and functions, Useful modelling Techniques, Procedural continuous assignments, Overriding parameters, Conditional compilation and execution, Introduction to Logic Synthesis. Concept of Programming using FPGA.

Text Books:

1. Morris Mano M. and Michael D.Ciletti, "Digital Design, With an Introduction to Verilog HDL", 5th Edition,Pearson 2013.
2. Samir Palnitkar, "Verilog HDL, A guide to Digital design and synthesis", 2nd Edition, Pearson Education, 2008.

Suggested Reading:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th Edition, 2009.
2. Thomas L. Floyd, "Digital Fundamentals", Pearson, 11th Edition, 2015.

22ECC11

PROBABILITY THEORY AND STOCHASTIC PROCESS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: A prior knowledge of probability.

Course Objectives:
This course aims to:

1. Apply the knowledge of probability, random variables and random processes gained in this course to several complex engineering problems.
2. Model a random variable/process into a mathematical model. Compute probability distributions and estimate statistical / time variations.
3. Learn the basic concepts of noise, characterize the noise and estimate the response of a linear system to a random process such as noise.

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

1. Understand fundamentals of Probability and the concept of random variables.
2. Characterize random distributions.
3. Determine the Spectral and temporal characteristics of Random Signals.
4. Analyze the Noise in Communication systems.
5. Estimate the auto-correlation and power spectral density of linear system response.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	1	1	1	1	1	2	1	1	1	2	3	3	1
CO 2	2	3	1	3	2	1	1	2	1	1	1	2	3	3	1
CO 3	1	2	1	1	1	1	1	2	1	1	1	2	3	3	1
CO 4	2	3	1	3	2	1	1	2	1	1	1	2	3	3	1
CO 5	1	3	1	2	2	1	1	2	1	1	1	2	3	3	1

UNIT - I

Probability and Random Variables: Review of Probability, Joint and Conditional Probability, Total Probability, Bayes' Theorem, Independent Events, Concept of Random Variables, Continuous Distributions: Uniform, Exponential, Gaussian and Rayleigh Distributions. Discrete Distributions: Binomial and Poison Distributions. Conditional and Joint Distributions and Density Functions.

UNIT - II

Operations on Single Random Variables: Expectation, Moments about Origin and Central Moments, Chebychev's Inequality and Markov's Inequality. Functions that give Moments: Characteristic Function, Moment Generating Function, Central Limit Theorem (proof not expected).

Operations on Multiple Random Variables: Expected Value of a Function of Random Variables, Joint Moments about the Origin, Joint Central Moments, Jointly Gaussian Random Variables and Properties.

UNIT - III

Stochastic Processes – Temporal Characteristics: The Random Process Concept, Classification of Processes. Stationarity and Independence: Distribution and Density Functions, Wide-Sense Stationarity, Strict-Sense Stationarity, Time Averages and Ergodicity. Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Function, Gaussian Random Process.

Stochastic Processes – Spectral Characteristics: Power Density Spectrum and its Properties, Relationship between Power Spectrum and Autocorrelation Function, Cross-Power Density Spectrum and its Properties. Relationship between Cross-Power Spectrum and Cross-Correlation Function.

UNIT -IV

Noise: Thermal Noise, White Noise and Colored Noise, AWGN, Noise Temperature, Noise in Two-Port Network: Noise Figure, Equivalent Noise Temperature and Noise Bandwidth. Noise Figure and Equivalent Noise Temperature for Cascaded Systems.

UNIT - V

Linear System with Random Inputs: Random Signal Response of Linear Systems: System Response, Convolution, Mean and Mean Squared Value of System Response, Auto Correlation of Response and Cross Correlation functions of Input and Output. Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.

Text Books:

1. Peyton Z.Peebles JR., "Probability Random Variables and Random Signal Principles", Tata McGraw Hill, Edition, 4/e, 2002.
2. Herbert Taub, Donald Schilling and Goutam Saha, "Principles of Communication", Tata McGraw Hill, 4th Edition, 2017.
3. Athanasios Papolis and S.Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", McGraw Hill, Inc., 4th Edition, 2006.

Suggested Reading:

1. Henry Stark and John W Woods, "Probability & Random Process with Application to Signal Processing", Pearson Education, 3rd Edition, 2014.
2. Simon Haykin, "Communication Systems" John Wiley & Sons, Inc. 5th Edition, 2009.
3. B.P.Lathi, "Signals, Systems & Communications", B.S.Publications, 2003.

22EEM01

UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY

(BE/B.Tech – Common to all Branches)

Instruction	1 T Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	1

Introduction

This course discusses the role of human values in one's family, in society and in nature. During the Induction Program, students would get an initial exposure to human values through Universal Human Values–I. This exposure is to be augmented by this compulsory full semester foundation course.

Prerequisite: Universal Human Values–I Student Induction Program

Course Objectives:

This course aims to:

1. Understand the concept of universal human values
2. Cultivate empathy and respect for diversity
3. Inspire the social responsibility and global citizenship

Course Outcomes

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

1. Become familiar about themselves, and their surroundings (family, society, nature).
2. develop empathy and respect for diversity by gaining an appreciation for different cultures, perspectives and identities
3. Exhibit responsible and ethical behavior by adhering to principles of integrity, honesty, compassion, and justice.
4. Recognize their role as global citizens.
5. Exhibit a sense of social responsibility.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1
CO 2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO 3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
CO 4	1	1	1	3	2	1	1	2	1	1	1	1	2	2	2
CO 5	1	1	1	2	2	1	1	1	1	1	1	1	2	2	2

Module -1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and
- Experiential Validation- as the process for self-exploration.
- Natural acceptance of human values.

- Definitiveness of Ethical Human Conduct.
- Continuous Happiness and Prosperity- A look at basic Human Aspirations.
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current Scenario.
- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include 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.

Module- 2: Understanding Harmony in the Human Being - Harmony in Myself

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

Module-3: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.
- Understanding the meaning of Trust; Difference between intention and competence.
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
- Understanding the harmony in society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co -existence as comprehensive Human Goals.
- Strategy for transition from the present state to Universal Human Order:

  a. At the level of individual: as socially and ecologically responsible engineers, technologists, and managers.

  b. At the level of society: as mutually enriching institutions and organizations.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss scenarios. Elicit examples from students' lives.

Module -4: Understanding Harmony in Nature and Existence - Whole existence as Coexistence.

- Understanding the harmony in Nature.
- Interconnectedness and mutual fulfilment among the four orders of nature - recyclability and self-regulation in nature.

- Understanding Existence as Co-existence of mutually interacting units in all - pervasive space.
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
- Holistic perception of harmony at all levels of existence.
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

Mode of Conduct (L-T-P-C 0-1-0-0)

- While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.
- In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection, and self- exploration.
- Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentors, in a group sitting.
- **Tutorials (experiments or practical) are important for this course**. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignments and/or activities are included.
- The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to the development of commitment, namely behaving and working based on basic human values.
- **It is advised to share the experience of the Faculty to the class in a capsule form.**
- **Involve more in evaluating the student by different activities with proper RUBRCCS**

Assessment:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self- assessment, peer assessment etc. will be used in evaluation.

Example:

Module-1:	10 M
Module -2:	10 M
Module- 3:	10 M
Module-4:	10 M
Attendance & Attitude:	10 M

The overall pass percentage is 50%. In case the student fails, he/she must repeat the course.

Textbooks

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics" 2nd Revised Edition, Excel Books, New Delhi, 2022.

2. R R Gaur, R Asthana, G P Bagaria “Teacher’s Manual for A Foundation Course in Human Values and Professional Ethics”, nd Revised Edition, Excel Books, New Delhi, 2022.

Reference Books

1. A Nagaraj, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. A.N. Tripathi, Human Values, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi, The Story of My Experiments with Truth

22EGM01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

(BE/B.Tech – Common to all Branches)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	--
Credits	No Credits

Prerequisite: Knowledge of Social Studies

Course Objectives:

This course aims to:

1. Understand the history of framing of the Indian Constitution.
2. Awareness on Fundamental Rights, Duties and Directive Principles of State Policy.
3. Explore the organization of Union Government, and functions of President and Prime Minister.
4. Gain an insight into the inter-functionality of Union Legislature and Judiciary
5. Educate on the local governance and problems in development of rural and urban areas.

Course Outcomes:

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

1. Understand the history of framing of the Indian Constitution and its features.
2. Assess the realization of Fundamental Rights and Directive Principles of State Policy.
3. Analyze the challenges to federal system and position of the President and the Prime Minister in the Union Government.
4. Underline the role of the Legislature and the Judiciary in Union Government and their mutual relations.
5. Evolve the development of the local governments in India and assess the role of Collector in district administration.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO 2	1	1	2	1	1	3	2	2	1	1	1	1	1	1	1
CO 3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO 4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO 5	1	1	2	1	1	3	2	1	1	1	1	1	1	1	1

UNIT - I

Constitutional History and Framing of Indian Constitution: East India Company rule (1757-1857): Social, Economic, Political and Administrative impact of Company rule in India. British Rule (1858-1947): Indian National Movement, Government of India Acts 1909, 1919 and 1935, and Indian Independence Act 1947. Framing of the Indian Constitution: Constituent Assembly, Preamble and Salient Features.

UNIT - II

Fundamental Rights, Duties and Directive Principles of State Policy: The Fundamental Rights**:** Features and significance of Rights. Fundamental Duties: Importance and the legal status of Duties. Directive Principles of State Policy: Socialist, Gandhian and Liberal-intellectual principles, importance and relevance.

UNIT - III

Union Government and its Administration: Federalism: Division of legislative and financial powers between the Union and the State. Union Executive: Role and position of President, Prime Minister and Council of Ministers. Emergency Provisions: National Emergency, Constitutional Emergency and Financial Emergency.

UNIT - IV

Union Legislature and Judiciary: Union Legislature: Parliament of India-Composition and functions of Parliament, and Parliamentary Committees. Union Judiciary: Supreme Court of India-Composition and Functions.

UNIT - V

Local Self Governments: Rural Local Governments: Zilla Parishad- CEO and functions of Zilla Parishad, Mandal Parishad- Role of Elected and Officials, Gram Panchayat- Sarpanch, Secretary and Gram Sabha. Urban Local Governments: Structure and functions of Municipalities and Municipal Corporations. District Collector: Powers and functions of Collector.

Text Books:

1. Indian Government & Politics, Ed Prof V Ravindra Sastry, Telugu Akademy, 2nd edition, 2018.
2. Indian Constitution at Work, NCERT, First edition 2006, Reprinted in 2022.

Suggested Reading:

1. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition, 2015.
3. Granville Austin, The Indian Constitution: the Cornerstone of a Nation, OUP, 2nd Edition 1999.
4. M.V. Pylee, India's Constitution, S. Chand Publishing, 16th Edition, 2017.
5. Rajeev Bhargava (ed), Politics and Ethics of the Indian Constitution, OUP, 2008.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

22ECC12

ANALOG CIRCUITS LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Knowledge on Electronic Devices Lab and Electronic Workshop and Networks Lab.

Course objectives:
This course aims to familiarize:
1. Design and analysis of Biasing circuits and Single stage amplifiers.
2. The frequency response of Multistage and Feedback amplifiers.
3. The generation of sinusoidal signals using Oscillators.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Design various BJT and FET biasing circuits to identify the appropriate circuit for faithful amplification.
2. Experiment with single stage and multistage BJT/FET amplifiers to compare the Gain and Bandwidth.
3. Compare and contrast different types of feedback topologies.
4. Develop and test various oscillator circuits.
5. Evaluate the performance of large signal amplifiers.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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CO 2	2	1	3	2	2	1	1	1	2	1	1	1	3	2	1
CO 3	2	1	3	2	2	1	1	1	2	1	1	1	3	2	1
CO 4	2	1	3	2	2	1	1	1	2	1	1	1	3	2	1
CO 5	2	1	3	2	2	1	1	1	2	1	1	1	3	2	1

List of Experiments:
1. Design of BJT and FET Biasing Circuits for given specifications.
2. Common Emitter BJT amplifier and study of its frequency response.
3. Common Source FET amplifier and study of its frequency response
4. Frequency response of Two RC - Coupled CS FET amplifier
5. Voltage series feedback amplifier.
6. Voltage shunt feedback amplifier.
7. Current series feedback amplifier.
8. RC Phase Shift Oscillator.
9. Hartley Oscillator.
10. Colpitts Oscillator.
11. Class-A power amplifier.
12. Class-B power amplifier.
13. **Structured enquiry:** Design a circuit that converts a given D.C Voltage to Frequency using BJTs and verify its operation.
14. **Open ended Enquiry:** Design and implement a classroom sound monitoring system using BJTs and a 0.5W speaker.
15. **Virtual lab experiment:** Study of CE Amplifier (https://be-iitkgp.vlabs.ac.in/exp/ce-amplifier/)

Note: Wherever possible, Analysis and design of circuits should be carried out using SPICE tools.

Suggested Reading:

1. Robert Diffenderfer, “Electronic Devices: Systems and Applications”, Cengage Learning India Private Limited, 2010.
2. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, “Basic Electronics, A Text - Lab Manual”, 7th Edition, TMH 2001.

22ECC13

DIGITAL SYSTEM DESIGN LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Digital concepts and C language concepts.

Course Objectives:

This course aims to:

1. Simulate and synthesize combinational logic circuits.
2. Simulate and synthesize sequential logic circuits.
3. Learn and implement procedure for any digital system design.

Course Outcomes:

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

1. Design a Digital circuit using Verilog HDL.
2. Understand various abstraction levels of a digital design.
3. Verify the functionality of a design using Test bench.
4. Simulate and synthesize combinational logic circuits.
5. Simulate and synthesize sequential logic circuits.

CO-PO-PSO Articulation Matrix

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CO 2	3	2	2	2	3	1	1	1	3	2	1	1	2	3	3
CO 3	3	3	2	2	3	2	2	1	3	2	2	2	2	3	3
CO 4	3	3	2	3	3	2	2	2	3	2	2	2	3	3	3
CO 5	3	3	2	3	3	2	2	2	3	2	2	2	3	3	3

List of Experiments:

Write a Verilog HDL code to Simulate and synthesize the following in Gate level, Data flow and Behavioral Modeling styles.

1. Logic Gates.
2. Binary Adders.
3. Binary Subtractors.
4. Multiplexers and De-multiplexers.
5. Encoders, Decoders and Comparator.
6. Implementation of logic function using Multiplexers and Decoders.
7. Arithmetic and Logic Unit.
8. Flip-Flops:SR,D,T,JK.
9. Implementation of SSI Circuits using FPGA.
10. **Structured Enquiry:** Design of a counter for the given specifications.
11. **Open ended Enquiry:** Design of a simple Digital System for real time applications.

12. **Virtual Lab Experiments: V**erify the truth table of RS, JK, T and D flip-flops using NAND & NOR gates**.** https://de-iitr.vlabs.ac.in/exp/truth-tables-flip-flops/simulation.html

Note: A minimum of 10 experiments should be performed.

Suggested Reading:

1. Samir Palnitkar, "Verilog HDL, A guide to Digital design and synthesis", 2nd Edition, Pearson Education, 2008.

22ECC14

MODELLING AND SIMULATION LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Knowledge of Signals and Systems, Control Systems.

Course Objectives:

This course aims to:

1. To understand the simulation of generation of Various (Continuous/Discrete) signals.
2. To study various arithmetic operations on signals and various transforms applied for signals.
3. To understand the characteristics of control system and its characteristics.

Course Outcomes:

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

1. Simulate the given waveform using standard test signals and sequences in MATLAB.
2. Analyze the effect of various transformations applied on signals in MATLAB.
3. Understand the second order system characteristics in LabView.
4. Simulate the Bode plot and Nyquist plot of the system and analysis its performance characteristics in Lab-View.
5. Understand the fundamentals of electronic circuits using Multisim simulation.

CO-PO-PSO Articulation Matrix

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CO 2	3	3	2	1	3	1	1	1	1	1	1	1	3	2	1
CO 3	3	3	2	1	3	1	1	1	1	1	1	1	3	2	1
CO 4	3	3	2	1	3	1	1	1	1	1	1	1	3	2	1
CO 5	3	3	1	1	3	1	1	1	1	1	1	1	3	2	1

List of Experiments:

PART-A

Signal analysis using MATLAB software

1. Basic Operations on Matrices.
2. Generation of various signals and sequences: Unit Impulse, Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc and Random signals.
3. a) Operations on signals and sequences: Addition, Multiplication, Scaling, Shifting, Folding.
   b) Computation of Energy and Average Power.
4. Linear Convolution, Auto Correlation and Cross Correlation of Sequences.
5. Find the Fourier Transform of a given signal and plotting its magnitude and phase Spectrums.
6. Generation of Gaussian noise, Computation of its mean, Mean Square Value, Skew, PSD and PDF.

PART-B

Modelling of system and its characteristics using Lab VIEW and Multisim

1. a) Representation of the transfer function in LabVIEW.
   b) Conversion of transfer function to state space representation of the system.
2. Plot unit step response of a standard second order system and also finds the characteristics of second order system using LabVIEW.
3. Plot bode plot of given transfer function and also determine the gain and phase margins using LabVIEW.
4. Plot Nyquist plot for given transfer function and to discuss closed loop stability using LabVIEW.
5. Design and develop Low pass and High pass Filter using Multisim.
6. Simulate and study Integrator and Differentiator using Multisim.

Note: Minimum of five experiments in PART-A and five experiments in PART-B

Suggested Reading:

1. B. P. Lathi, “Signals, Systems and Communications”, BS Publications, 3rd Edition, 2008.
2. J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International Publishers, 5/e, 2012.
3. Jeffrey Travis and Jim Kring, “Lab VIEW for Everyone: Graphical Programming Made Easy and Fun”, 3rd Edition, Prentice Hall, 2007.
4. Multisim User Manual – National Instruments, 2009.

Code : 22EGC03

EMPLOYABILITY SKILLS

(BE/BTech - Common to all Branches)

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Basic of Communication Skills in English

Course Objectives:
This course aims to:

1. Learn the art of communication, participate in group discussions and case studies with confidence and to make effective presentations.
2. With- resume packaging, preparing them to face interviews.
3. Build an impressive personality through effective time management, leadership qualities, self-confidence and assertiveness.
4. Understand professional etiquette and to make them learn academic ethics and value system.
5. To be competent in verbal aptitude.

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

1. Become effective communicators, participate in group discussions with confidence and be able to make presentations in a professional context.
2. Write resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals, learn to manage time effectively and deal with stress.
4. Make the transition smoothly from campus to work, use media with etiquette and understand the academic ethics.
5. Enrich their vocabulary, frame accurate sentences and comprehend passages confidently.

CO-PO-PSO Articulation Matrix

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CO 3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO 4	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1
CO 5	1	1	2	1	1	3	2	1	1	2	1	1	1	1	1

UNIT I

Verbal Aptitude: Error Detection, Articles, Prepositions, Tenses, Concord and Transformation of Sentences-Jumbled Words/Sentences- Vocabulary, Synonyms, Antonyms, One Word Substitutes, Idioms and Phrases, Word/Sentence/Text Completion- Reading Comprehension.

UNIT II

Group Discussion & Presentation Skills: Dynamics of Group Discussion-Case Studies- Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Accuracy, Coherence. Elements of Effective Presentation – Structure of a Presentation – Presentation tools – Body language - Preparing an Effective PPT

UNIT III

Behavioral Skills: Personal strength analysis-Effective Time Management- Goal Setting- Stress management- **Corporate Culture** – Grooming and etiquette-Statement of Purpose (SOP).

UNIT IV

Mini Project: Research-Hypothesis-Developing a Questionnaire-Data Collection-Analysis-General and Technical Report - Writing an Abstract –Technical Report Writing-Plagiarism-Project Seminar.

UNIT V

Interview Skills: Cover Letter and Résumé writing – Structure and Presentation, Planning, Defining the Career Objective, Projecting ones Strengths and Skill-sets – Interviews: Concept and Process, Pre-Interview Planning, Opening Strategies, Answering Strategies, Mock Interviews.

Text Books:

1. Leena Sen, "Communication Skills", Prentice-Hall of India, 2005
2. Dr. Shalini Verma, "Body Language - Your Success Mantra", S Chand, 2006
3. Edgar Thorpe and Showick Thorpe , "Objective English", 2nd edition, Pearson Education, 2007
4. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010

Suggested Reading:

1. Gulati and Sarvesh, " Corporate Soft Skills", New Delhi: Rupa and Co. , 2006
2. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004
3. A Modern Approach to Verbal & Non-Verbal Reasoning by R S Aggarwal, 2018
4. Covey and Stephen R, "The Habits of Highly Effective People", New York: Free Press, 1989