KKR & KSR Institute of Technology and Sciences
(AUTONOMOUS)

Vinjanampadu, Vatticherukuru (Mandal), Guntur, AndhraPradesh-522017

R23 Regulation Course Structure (Choice Based Credit System) Bachelor of Technology (B.Tech)

(Applicable from the batches admitted in AY: 2023-2024 & Lateral Entry AY:2024-2025)

S. No.	Course Category	Course Code	Course Title	L	T	P	C
1	Basic Science	23EC3T01	Probability theory and Stochastic Process	3	0	0	3
2	Engineering Science	23IT3T01	Data Structures	3	0	0	3
3	Professional Core	23EC3T02	Signals and Systems	3	0	0	3
4	Professional Core	23EC3T03	Analog Electronics Circuits	3	0	0	3
5	Professional Core	23EC3T04	Switching Theory and Logic Design	3	0	0	3
6	Professional Core	23EC3L01	Analog Electronics Circuits Lab	0	0	3	1.5
7	Professional Core	23EC3L02	Switching Theory and Logic Design Lab	0	0	3	1.5
8	Skill Enhancement Course	23EC3S01	Skill enhancement- Data Structures	0	0	3	2.0
9	Audit Course	23SH3MXX	Environmental Science	2	0	0	0
						Total Credits	**20.0**

Theory: BSC-1, PCC-3, ESC-1, Practical: PCC-2, SC-1, MC-1

SEMESTER-IV

S. No.	Course Category	Course Code	Course Title	L	T	P	C
1	Professional Core	23EC4T01	Microcontrollers and Interfacing-1	3	0	0	3
2	Engineering Science	23EE4TXX	Control Systems	3	0	0	3
3	Professional Core	23EC4T02	Electro Magnetic Waves and Transmission Lines	3	0	0	3
4	Professional Core	23EC4T03	Electronic Circuit Analysis	3	0	0	3
5	Professional Core	23EC4T04	Analog Communications	3	0	0	3
6	Professional Core	23EC4L01	Microcontrollers and Interfacing-Lab	0	0	3	1.5
7	Professional Core	23EC4L02	Electronic Circuit Analysis lab	0	0	3	1.5
8	Engineering Science	23XX4SXX	Design Thinking & Innovation	0	0	2	1.0
9	Skill Enhancement course	23EC4S02	Soft Skills	0	0	2	2
10	HSMC	23EC4MXX	Human Values-Understanding harmony and Ethical Human conduct	2	0	0	0
						Total Credits	**21.0**

Theory: PCC-4, ESC-1, Practical: PCC-2, SC-1, ESC-1,HS MC-1

Mandatory Community Service Project Internship of 08weeks duration during summer Vacation

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Semester-III

Course Code	Course Name	L	T	P	C
23EC3T01	PROBABILITY THEORY AND STOCHASTIC PROCESS	3	0	0	3

Course Outcomes:

After successful completion of this course, students will be able to

CO1 : Perform operations on single Random variables.

CO2 : Determine Expected Value of a Function of Random Variables

CO3 : Determine the Spectral characteristics of Random Signals.

CO4 : Determine the Spectral characteristics of Random Signals.

CO5 : Understand the concepts of Noise and Information theory in Communication systems

SYLLABUS

UNIT-I : THE RANDOM VARIABLE

Random Variable-Definition, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Methods of defining Conditioning Event, Conditional Distribution, Conditional Density and their Properties.

OPERATIONS ON SINGLE RANDOM VARIABLES

Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic and Non-monotonic

UNIT-II : OPERATION ON MULTIPLE RANDOM VARIABLE-EXPECTATIONS

Joint Distribution Function and its Properties, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence. Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof not expected). Unequal Distribution, Equal Distributions.

Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian

Random Variables.

UNIT-III : Random Processes – Temporal Characteristics

The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second Order and Wide-Sense Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output

Unit-IV: Random Process- Spectral characteristics

The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output

UNIT-V : Noise Sources & Information Theory

Noise Sources: Resistive/Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks.

Information Theory: Entropy, Information rate, Source coding: Huffman coding, Shannon Fano coding. Mutual information, Channel capacity of discrete channel, Shannon-Hartley law; Trade -off between bandwidth and SNR.

TEXTBOOKS:

1. Probability, Random Variables & Random Signal Principles, Peyton Z.Peebles, TMH, 4thEdition, 2001.
2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S.Unni krishna, PHI,4th Edition, 2002.
3. Probability and Random Processes with Applications to Signal Processing, Henry Starkand John W.Woods, Pearson Education, 3rdEdition, 2001.

REFERANCE BOOKS:

1. Schaum's Outline of Probability, Random Variables, and Random Processes, 1997.
2. Probability Theory and Random Processes, P. Ramesh Babu, McGrawHill,2015.
3. Taub and Schilling - Principles of Communication systems, TMH, 2008
4. Bruce Hajck - Random Processes for Engineers, Cambridge unipress, 2015
5. B.P. Lathi - Signals, Systems & Communications, B.S. Publications, 2003.
6. S.P Eugene Xavier -Statistical Theory of Communication, New Age Publications, 2003.

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Semester-III

Course Code	Course Name	L	T	P	C
23IT3T01	Data Structures	3	0	0	3

Course Outcomes:

After successful completion of this course, students will be able to

CO1 : Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
CO2 : Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
CO3 : Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
CO4 : Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges.
CO5 : Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees.
CO6 : Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

Syllabus

UNIT -I

Introduction to Linear Data Structures: Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures. Searching Techniques: Linear & Binary Search, Sorting Techniques: Bubble sort, Selection sort, Insertion Sort, Merge Sort, Quick Sort

UNIT -II

Linked Lists: Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

UNIT -III

Stacks: Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.

UNIT- IV

Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc. Circular Queues: Introduction to circular queues, Operations and their applications.

UNIT -V

Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversal

Hashing: Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique

identifier generation, caching, etc.

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson- Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick

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Semester: III

Course Code	Course Name	L	T	P	C
23EC3T02	SIGNALS AND SYSTEMS	3	0	0	3

COURSE OUTCOMES:

After successful completion of this course, students should be able to

CO1 : Differentiate the various classifications of signals and systems

CO2 : Analyze the frequency domain representation of signals using Fourier concepts

CO3 : Classify the systems based on their properties and determine the response ofLTI Systems.

CO4 : Know the sampling process and various types of sampling techniques.

CO5 : To understand the effect of the sampling of a continuous time signal.

SYLLABUS

UNIT- I : BASICS OF SIGNALS & SYSTEMS

Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Problems on classification and characteristics of Signals and Systems. Complex exponential and sinusoidal signals, impulse function, step function signum function and ramp function. Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions, Orthogonality in complex functions. Related problems

UNIT- II : FOURIER SERIES AND FOURIERTRANSFORM

Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Relation between Trigonometric and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Related problems

UNIT- III : ANALYSIS OF LINEAR SYSTEMS

Introduction**,** Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Transfer function of a LTI system, Related problems. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidthand rise time.

UNIT- IV : CONVOLUTION AND CORRELATION SIGNALS

CORRELATION: Auto-correlation and cross-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between Convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.

SAMPLING THEOREM: Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling –Aliasing, Related problems.

Unit-V :

LAPLACE TRANSFORMS: Introduction**,** Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Inverse Laplace transform, Relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveform synthesis.

Z–TRANSFORMS: Concept of Z-Transform of a discrete sequence. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms. Distinction between Laplace, Fourier and Z transforms

TEXT BOOKS:

1. Signals, Systems &Communications-B.P. Lathi, BS Publications,2003.
2. Signals and Systems-A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI,2nd Edn,1997

REFERENCEBOOKS:

1. Principles of Linear Systems and Signals–B P Lathi, Oxford University Press,2015
2. Signals and Systems–TK Rawat, Oxford University press,2011
3. Signals &Systems-Simon Haykin and VanVeen, Wiley,2nd Edition,2007

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Semester: III

Course Code	Course Name	L	T	P	C
23EC3T03	**ANALOG ELECTRONICS CIRCUITS**	3	0	0	3

COURSE OUTCOMES:

After successful completion of this course, students should be able to

CO1 : Understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation.

CO2 : Analyze the construction, working principle of Semiconductor Devices and Diode Circuits

CO3 : Know the need of transistor biasing, various biasing techniques for BJT and stabilization concepts with necessary expressions

CO4 : Apply small signal low frequency transistor amplifier circuits using BJT in different configurations

CO5 : Estimate the characteristic parameters of FET amplifier circuits using low frequency model.

UNIT-I : P-N JUNCTION DIODES

Junction Diode Characteristics: energy band diagram of PN junction Diode, Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in p-n junction Diode, Diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance.

UNIT-II : DIODE APPLICATIONS

Clipping (limiting) circuits, Clipping at Two Independent Levels, Peak Detector, Clamping circuits, Basic Rectifier setup**,** half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, Filters, Inductor filter, Capacitor filter, π-section Filter, comparison of various filter circuits in terms of ripple factors

UNIT-III : TRANSISTORS

Transistor Characteristics: Junction transistor, transistor current components, transistor equation in CB configuration, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Photo transistor, typical transistor junction voltage values.

Transistor Biasing and Thermal Stabilization: Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self-bias, Stabilization against variations in V_{BE}, Ic, and β, Stability factors, (S,S',S"), Bias compensation, Thermal runaway, Thermal stability.

UNIT-IV : SMALL SIGNAL LOW FREQUENCY TRANSISTOR AMPLIFIER MODELS

Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers.

UNIT-V : SMALL SIGNAL LOW FREQUENCY TRANSISTOR AMPLIFIER MODELS

FET: FET types, JFET operation, characteristics, small signal model of JFET. **(Text book:1)**

MOSFET: MOSFET Structure, Operation of MOSFET: operation in pinch off region, operation in saturation region, MOSFET as a variable resistor, V-I characteristics of MOSFET, Channel length modulation, MOS transconductance, MOS device models: MOS small signal model, PMOS Transistor, CMOS Technology, Comparison of Bipolar and MOS devices.

TEXT BOOKS:

1. J. Millman and C.C.Halkias, "Electronic Devices and Circuits", 4th edition, Tata Mc-Graw Hill, 2015.
2. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits",pearson/Prentice Hall, 4th edition, 2015.
3. Electronic Devices and Circuits- S. Salivahanan, N. Suresh Kumar, Mc-Graw Hill, 5th edition, 2022.

REFERENCE BOOKS:

1. Basic Electronics-Principles and Applications, Chinmoy Saha,Arindam Halder, Debarati Ganguly, Cambridge University Press.
2. Electronics devices & circuit theory- Robert L.Boylestad and Loui Nashelsky, Pearson, 11th edition, 2015.
3. Electronic Devices and Circuits - David A. Bell, Oxford University Press, 5th edition, 2008.
4. Electronic Devices and Circuits - David A. Bell, Oxford University Press, 5th edition, 2008Fundamentals of Microelectronics-Behzad Razavi, Wiley, 3rd edition, 2021.

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Semester: III

Course Code	Course Name	L	T	P	C
23EC3T04	SWITCHING THEORY AND LOGIC DESIGN	3	0	0	3

COURSE OUTCOMES:

After successful completion of this course, students should be able to

CO1 : Convert one number system to another, analyze logic gates and Boolean theorems.
CO2 : Analyze digital circuits using different minimization techniques.
CO3 : Design various combinational circuits along with applications.
CO4 : Design various sequential circuits along with applications.
CO5 : Design counters and state machines by applying the knowledge of synchronous and asynchronous sequential circuits.

SYLLABUS

UNIT-I : Number Systems, Codes and Boolean Algebra:

conversation from one radix to another radix, r-1's compliments and r's compliments of signed members. Arithmetic operations on r- 1's compliments and r's compliments, weighted and non-weighted code, Error Detection and correct code.

LOGIC OPERATIONS:

Logic operations; Basic logic operations, Universal Logic operations, EX-OR, EX- NOR operations. Code conversions (Binary to Gray, Vice versa), Standard SOP and POS Forms, NAND-NAND and NOR-NOR realizations, Realization of three level logic circuits.

UNIT-II : MINIMIZATION TECHNIQUES:

Minimization and realization of switching functions using Boolean theorems, K-Map (up to 6 variables) and tabular method (Quine-mccluskey method) with only four variables and single function.

COMBINATIONAL LOGIC CIRCUITS DESIGN:

Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders; 4-bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit and carry look-a- head adder circuit, Design code converts using Karnaugh method and draw the complete circuit diagrams

UNIT-III : COMBINATIONAL LOGIC CIRCUITS DESIGN USING MSI &LSI

Design of encoder, decoder, multiplexer and de-multiplexers, Implementation of higher order circuits using lower order circuits. Realization of Boolean functions using decoders and multiplexers. Design of Priority encoder, 4-bit digital comparator and seven segment decoder.

INTRODUCTION OF PLD's:

PLDs: PROM, PAL, PLA -Basics structures, realization of Boolean functions, Programming table

UNIT-IV : Sequential Logic Circuits-I

Classification of sequential circuits (synchronous and asynchronous) , operation of NAND & NOR Latches

flip-flops: truth tables and excitation tables of RS flip-flop, JK flip- flop, T flip-flop, D flip-flop with reset and clear terminals. Conversion from one flip-flop to another flip- flop.

Counters: Design of 5-bit ripple counters, design of synchronous counters, Johnson counter, ring counter.

Registers: Design of registers - Buffer register, control buffer register, shift register, bi-directional shift register, universal shift register

Study the following relevant ICs and their relevant functions 7474, 7475, 7476, 7490, 7493, 74121.

UNIT-V : SEQUENTIAL CIRCUITS II

Finite state machine; state diagrams, state tables, reduction of state tables. Analysis of clocked sequential circuits Mealy to Moore conversion and vice-versa. Realization of sequence generator, Design of Clocked Sequential Circuit to detect the given sequence (with overlapping or without overlapping).

Text Books:

1. Digital Design, Morris Mano, PHI, 3rd Edition,2001.
2. Switching and Finite Automata Theory, 2nd Edition, Zvi Kohavi, Tata McGraw-Hill, 1978.

Reference Books:

1. Fundamentals of Digital Circuits by A.Anand Kumar, PHI learning Pvt. Ltd.
2. Fundamentals of Logic Design, charles H Roth, Thomson Publications, 5th edition, 2009.

e-Resources:

1. https://www.geeksforgeeks.org/minimization-of-boolean-functions/
2. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/#blg
3. https://www.cs.ou.edu/~fagg/classes/ame3623_s05/lectures/class_sequential.pdf

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Semester-III

Course Code	Course Name	L	T	P	C
23EC3L01	ANALOG ELECTRONICS CIRCUITS LAB	0	0	3	1.5

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : Understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation.

CO2 : Analyze the construction, working principle of Semiconductor Devices and Diode Circuits

CO3 : Know the need of transistor biasing, various biasing techniques for BJT and stabilization concepts with necessary expressions

CO4 : Apply small signal low frequency transistor amplifier circuits using BJT in different configurations

CO5 : Estimate the characteristic parameters of FET amplifier circuits using low frequency model.

LIST OF EXPERIMENTS

Note: The students are required to perform the experiment to obtain the V-I characteristics and to determine the relevant parameters from the obtained graphs.

List of Experiments:(Minimum of Ten Experiments has to be performed)

1. Phase angle measurement using Lissajous figures
2. Full-wave Bridge Rectifier (with and without filter)
3. LED Characteristics
4. BJT Characteristics -CC Configuration
5. Transistor Biasing
6. Emitter Follower-CC Amplifier
7. CB Amplifier
8. FET Characteristics (CS Configuration)
9. FET-CS Amplifier
10. UJT Characteristics
11. UJT Relaxation Oscillator
12. SCR Charcteristics

Equipment required:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital multi-meters
5. Decade Resistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active& Passive Electronic Components.

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Semester-III

Course Code	Course Name	L	T	P	C
23EC3L02	SWITCHING THEORY AND LOGIC DESIGN LAB	0	0	3	1.5

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : Convert one number system to another, analyze logic gates and Boolean theorems.

CO2 : Analyze digital circuits using different minimization techniques.

CO3 Design various combinational circuits along with applications.

CO4 Design various sequential circuits along with applications.

CO5 Design counters and state machines by applying the knowledge of synchronous and sequential circuits.

List of Experiments: (Minimum of Ten Experiments has to be performed)

1. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit.
2. Verification of functional table of 3 to 8-line Decoder /De-multiplexer
3. 4 variable logic function verification using 8 to1 multiplexer.
4. Design full adder circuit and verify its functional table.
5. Verification of functional tables of (i) JK Edge triggered Flip–Flop ii) JK Master Slave Flip–Flop (iii) D Flip-Flop
6. Design a four-bit ring counter using D Flip–Flops/JK Flip Flop and verify output.
7. Design a four-bit Johnson's counter using D Flip-Flops/JK Flip Flops and verify output
8. Verify the operation of 4 bit universal shift register for different modes of operation.
9. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip-Flops and Test It with a low frequency clock and sketch the output waveforms.
10. Design MOD–8 synchronous counter using T Flip-Flop and verify the result and sketch the output waveforms.
11. (a) Draw the circuit diagram of a single bit comparator and test the output
    (b) Construct 7 Segment Display Circuit Using Decoder and 7 Segment LED and test it.

Additional Experiments:

1. Design BCD Adder Circuit and Test the Same using Relevant IC

2. Design Excess-3 to 9- Complement convertor using only four Full Adders and test t Circuit.
3. Design an Experimental model to demonstrate the operation of 74154

   De-Multiplexer using LEDs for outputs.
4. Design of any combinational circuit using Hardware Description Language
5. Design of any sequential circuit using Hardware Description Language

REFERENCES

1. Department Lab Manual
2. Morris Mano and M.D. Ciletti, "DigitalDesign",4thedition, PearsonEducation,2007.

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Semester-III

Course Code	Course Name	L	T	P	C
23EC3S01	Skill Enhancement- Data Structures	0	0	3	2

List of Experiments:

After successful completion of this course, students should be able to

CO1 : Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
CO2 : Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
CO3 : Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
CO4 : Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges.
CO5 : Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees.
CO6 : Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

List of Experiments:

Exercise 1: Array Manipulation

i) Write a program to reverse an array.
ii) C Programs to implement the Searching Techniques–Linear & Binary Search
iii) C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort

Exercise 2: Linked List Implementation

i) Implement a singly linked list and perform insertion and deletion operations.

ii) Develop a program to reverse a linked list iteratively and recursively.

ii) Solve problems involving linked list traversal and manipulation.

Exercise 3: Linked List Applications

Create a program to detect and remove duplicates from a linked list.

Implement a linked list to represent polynomials and perform addition.

Implement a double-ended queue (deque) with essential operations.

Exercise 4: Double Linked List Implementation

i) Implement a doubly linked list and perform various operations to understand its properties and applications.

ii) Implement a circular linked list and perform insertion, deletion, and traversal.

Exercise 5: Stack Operations

i) Implement a stack using arrays and linked lists.

ii) Write a program to evaluate a postfix expression using a stack.

iii) Implement a program to check for balanced parentheses using a stack.

Exercise 6: Queue Operations

i) Implement a queue using arrays and linked lists.

ii) Develop a program to simulate a simple printer queue system. iii) Solve problems involving circular queues.

Exercise 7: Stack and Queue Applications

i) Use a stack to evaluate an infix expression and convert it to postfix.

ii) Create a program to determine whether a given string is a palindrome or not.

iii) Implement a stack or queue to perform comparison and check for symmetry.

Exercise 8: Binary Search Tree

i) Implementing a BST using Linked List.

ii) Traversing of BST.

Exercise 9: Hashing

i) Implement a hash table with collision resolution techniques.

ii) Write a program to implement a simple cache using hashing.

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson- Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms by Robert Sedgewick.

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Department of Electronics and Communication Engineering

Semester-III

Course Code	Course Name	L	T	P	C
23SH4T05	ENVIRONMENTAL SCIENCE	3	0	0	0

COURSE OUTCOMES:

After successful completion of this course, students should be able to

CO1 : Grasp multi-disciplinary nature of environmental studies and various renewable and non-renewable resources.

CO2 : Understand flow and bio-geo-chemical cycles and ecological pyramids.

CO3 : Understand various causes of pollution and solid waste management and related Preventive measures

CO4 : About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.

CO5 : Casus of population explosion, value education and welfare programmes

Syllabus

UNIT-I : Multidisciplinary Nature of Environmental Studies

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance - Need for Public Awareness.
Natural Resources: Renewable and non-renewable resources - Natural resources and associated problems - Forest resources - Use and over - exploitation, deforestation, case studies - Timber extraction - Mining, dams and other effects on forest and tribal people - Water resources - Use and over utilization of surface and ground water - Floods, drought, conflicts over water, dams - benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources.

UNIT-II :

Ecosystems: Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation: Introduction 0 Definition: genetic, species and ecosystem diversity - Bio-geographical classification of India - Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels - India as a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-III :

Environmental Pollution: Definition, Cause, effects and control measures of:

a. Air Pollution

b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster management: floods, earthquake, cyclone and landslides.

Learning outcomes:

UNIT-IV :

Social Issues and the Environment: From Unsustainable to Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, watershed management - Resettlement and rehabilitation of people; its problems and concerns. Case studies - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies - Wasteland reclamation - Consumerism and waste products - Environment Protection Act -Air (Prevention and Control of Pollution) Act - Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act - Issues involved in enforcement of environmental legislation - Public awareness.

UNIT-V :

Human Population and The Environment: Population growth, variation among nations. Population explosion - Family Welfare Programmes- Environment and human health - Human Rights - Value Education - HIV/AIDS - Women and Child Welfare - Role of information Technology in Environment and human health - Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain - Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds - river, hill slopes, etc.

Textbooks:

1. Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palani swamy, “Environmental Studies”, Pearson education
3. S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M. Anji Reddy, “Textbook of Environmental Sciences and Technology”, BS Publication.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice Hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice Hall of India Private limited.

Online Learning Resources:

1. https://nptel.ac.in/courses/103107084

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Department of Electronics and Communication Engineering

Semester-IV

Course Code	Course Name	L	T	P	C
23EC4T01	MICROCONTORLLERS AND INTERFACING-1	3	0	0	3

COURSE OUTCOMES:

After successful completion of this course, students should be able to

CO1 : Understand and visualize embedded system. Familiarize with IDE and tool chain and familiarize with technical documents of microcontroller.
CO2 : Understand GPIO functionality and use port pins as input or output depending on the need with specific pin mode of operation
CO3 : Define GPIO interrupts and use them in programs. Understand how to use timers for different purposes
CO4 : Generate PWM as required. Understand and use RTC for time keeping and Time stamping
CO5 : Utilize WDT for program error handling

SYLLABUS

UNIT-I :

Introduction to embedded system and ARM architecture: Introduction to embedded system, block diagram view of embedded system, essential characteristics of embedded system. **The ARM architecture-** features of ARM, Versions of ARM, Specific features of ARM cortex, Three stage pipeline, Registers - general purpose and special purpose, memory features, bit band region, Little Endian, Big Endian Architecture, the thumb-2 technology, Difference between ARM and Thumb instructions, Stack memory, Interrupts/Exceptions, Interrupt masking.

UNIT-II :

Instructions: Moving data, memory accesses, arithmetic operations, logic operations, shift and rotate operations, conversion (extend and reverse ordering) operations, bit field processing instructions, program flow control (branch, conditional branch, conditional execution, and function calls), multiply accumulate instructions, divide instructions, memory barrier instructions, exception-related instructions, sleep mode - related instructions etc.
Developing software on microcontroller: Introduction to Keil MDK ARM, Functional aspects of Keil IDE and toolchain- Downloading and installing Keil MDK ARM- Features testing of Keil MDK ARM- Creating a project with appropriate configurations- Downloading onto target board.

UNIT-III :

Understanding technical literature: Systematically follow datasheet, User Manual, Errata Sheet and Application notes - Block level diagram of LPC1769 ARM Cortex M3 controller
Memory Map, System Control, Clocking and Power Control, Flash Acceleration: Memory map and peripheral addressing, Bus faults - System control - external interrupt flag, mode, and polarity registers, reset circuit, Reset source identification, System control and status, Brown-out detection.
Interrupts - Nested Vector Interrupt Controller (NVIC): Interrupt sources, Interrupt registers - Set enable, clear enable, set pending, clear pending, active bit, priority, Software triggered interrupt.

UNIT-IV :

Pin Configuration, Pin connect block: Assign pins for specific functionality by locating and mapping them accordingly with required modes of operation.
General Purpose Input/Output (GPIO): Overview of ARM cortex-M GPIO module, Digital I/O ports, Interrupt generating digital ports, GPIO port direction, set & clear, read pin value, mask port pins.
- Coding: Developing the GPIO driver - Basic configuration using registers, Pin interrupts / pattern match engine, using Set& clear vs PIN with mask.
General Purpose Timer: Using as 32-bit timer with a programmable 32-bit prescaler, understand block diagram - Timer/Counter operation - Capture event, interrupt generation on match, stop or reset timer on match, external outputs set to low/high/toggle when match- Coding: Developing the program to configure timers for variety of purposes

UNIT-V :

Repetitive Interrupt Timer: RI timer operation - Using RIT for generating interrupts at specified time intervals, without using standard timer - Coding: Configure RIT for continuous interrupt generation every 1msec.

Sys Tick Timer: Sys Tick Timer operation, configuring as needed, Coding: Program Sys Tick Timer running from CPU clock which is 100MHz, Program Sys Tick Timer running from the internal RC oscillator factory trimmed to 4MHz.

PWM, Motor Control PWM: PWM operation, configuring for single edge or double edge
- Coding: Program to generate PWM signals - single edge, double edged - Motor Control PWM operation.

Real Time Clock (RTC): RTC operation, Forward and Backward calibration, using 1PPS to calibrate RTC counters - Coding: Program to initialize and capture RTC values, Calibrate with external 1PPS signal or through set time.

Watch Dog Timer (WDT): Operation of Watchdog timer, Clock source selection, running under deep sleep mode to wakeup- Coding: Program to utilize watch dog to bring controller from erroneous state.

Text Books:

1. Embedded Systems Fundamentals with ARM cortex-M based microcontrollers: A practical approach, Alexander G. Dean
2. A Beginner's guide to designing embedded system applications on ARM cortex-M microcontrollers, Ariel Lutenberg, Pablo Gomez, Eric Pernia
3. LPC1769 Datasheet
4. LPC1769 Reference Manual (User)
5. LPC1769 Errata Sheet

Reference Books:

1. Embedded System Design with ARM cortex-M microcontrollers – Applications with C, C++ and Micropython, Cem Ünsalan , Hüseyin Deniz Gürhan , Mehmet Erkin Yücel
2. Embedded System Design with ARM by Prof. Indranil Sengupta, Prof. Kamalika Dutta, IIT Kharagpur (NPTEL)

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Semester-IV

Course Code	Course Name	L	T	P	C
23EE4T02	CONTROL SYSTEMS	3	0	0	3

COURSE OUTCOMES:

After successful completion of this course, students should be able to

CO1 : Derive the transfer function of physical systems by applying block diagram and signal flow graph techniques.

CO2 : Analyze time response of first and specifications of second order systems using time domain specifications and determine error constants.

CO3 : Analyze the stability of system using frequency domain specifications and realize the compensators to improve system performance.

CO4 : Analyze absolute and relative stability of LTI systems.

CO5 : Apply state space analysis concepts to represent physical systems as state models, derive transfer function and determine the response and examine the concepts of controllability and observability.

SYLLABUS

UNIT-I : MATHEMATICAL MODELING OF CONTROL SYSTEMS

Introduction- Type of Control Systems -Open Loop and Closed Loop, Classification of Control Systems, Feedback Characteristics, and Transfer Function of Linear Systems, Differential Equations of Electrical Networks, Translational and Rotational Mechanical Systems, Block Diagram Reduction Techniques, Representation by Signal Flow Graph – Reduction Using Mason's Gain Formula.

UNIT-II : TIME RESPONSE ANALYSIS

Introduction-Standard Test Signals-Time Response of First Order Systems-Time Response of Second Order Systems-Time Domain Specifications, Steady State Errors and Error Constants, Effects of PI, PD and PID Controllers.

UNIT-III : FREQUENCY RESPONSE ANALYSIS AND COMPENSATION

Frequency Response: Introduction-Frequency Domain Specifications-Bode Plot- stability analysis using Bode plots (phase margin and gain margin), Polar Plots.

Compensation: Lag, Lead, and Lag-Lead Compensators

UNIT-IV : STABILITY ANALYSIS

The Concept of Stability- Location of Poles on s-Plane for Stability- Routh's Stability Criterion-Limitations of Routh's Stability, Nyquist Stability Criterion.

UNIT-V : STATE SPACE ANALYSIS of LTI Systems

Concepts of State, State Variables and State Model - State Space Representation of Transfer Function- State Transitions Matrix and Its Properties - Concept of Controllability and Observability.

TEXT BOOKS:

1. J. J Nagarath and M. Gopal, Control Systems Engineering, 6th ed., New Age International Publishers, 2017.
2. Benjamin C. Kuo, Automatic Control Systems, 9th ed., Wiley, 2014
3. Katsuhiko Ogata, Modern Control Engineering, 5th ed., Pearson Education India, 2015

REFERENCE BOOKS:

1. Richard C. Dorf and R. H Bishop, Modern Control Systems, 12th ed., Pearson Education, 2009.
2. John J. D., Azzo Constantine, H. and Houpis Sttuart, N Sheldon, Linear Control System Analysis and Design with MATLAB, 5th ed., CRC Taylor& Francis, 2009.
3. M. Gopal, Control System: Principle and design, 4th ed., McGraw Hill Education, 2012.
4. NPTEL Video Lecture Notes on "Control Engineering" by Prof. S. D. Agashe, IIT Bombay

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Semester-IV

Course Code	Course Name	L	T	P	C
23EC4T02	ELECTROMAGNETIC WAVES AND TRANSMISSION LINES	3	0	0	3

COURSE OUTCOMES:

After successful completion of this course, students should be able to

CO1 : Determine electric field intensity using coulomb's law and Gauss law.

CO2 : Determine magnetic field intensity using Biot-Savarts Law and Ampere's Circuital Law

CO3 Analyze the electromagnetic wave propagation in dielectric and conducting

CO4 : Examine the primary and secondary constants of different types of transmission lines.

CO5 : Derive the expressions for input impedance, reflection coefficient, and VSWR of transmission lines and calculate these parameters using smith chart

SYLLABUS

UNIT-I: ELECTROSTATICS

Review of Co-ordinate Systems, **Electrostatics:** Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Illustrative Problems. Convection and Conduction Currents, Dielectric Constant, Poisson's and Laplace's Equations; Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems.

UNIT-II:

Magnetostatics: Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Inductances and Magnetic Energy, Illustrative Problems**.**

Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements, Conditions at a Boundary Surface, Illustrative Problems.

UNIT-III: EM WAVECHARACTERISTICS

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossy dielectrics, lossless dielectrics, free space, wave propagation in good conductors, skin depth, Polarization & Types, Illustrative Problems.

Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection,

Surface Impedance, Poynting Vector and Poynting Theorem, Illustrative Problems.

UNIT-IV: TRANSMISSIONLINES- I

Transmission Lines - I : Types, Parameters, T & π Equivalent Circuits, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Lossless lines, distortion less lines, Illustrative Problems.

UNITV: TRANSMISSIONLINES–II

Transmission Lines – II: Input Impedance Relations, Reflection Coefficient, VSWR, Average Power, Shorted Lines, Open Circuited Lines, and Matched Lines, Low loss radio frequency and UHF Transmission lines, UHF Lines as Circuit Elements, Smith Chart – Construction and Applications, Quarter wave transformer, Single Stub Matching, Illustrative Problems.

TEXT BOOKS:

1. Elements of Electromagnetic – Matthew N. O. Sadiku, Oxford University Press, 7th edition, 2018.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2008.

REFERENCE BOOK:

1. Engineering Electromagnetics – William H. Hayt, John A. Buck, Jaleel M. Akhtar, TMH, 9th edition, 2020.
2. Electromagnetic Field Theory and Transmission Lines –G. S. N. Raju, Pearson Education 2006
3. Electromagnetic Field Theory and Transmission Lines: G Sasi Bhushana Rao,Wiley India 2013.
4. Networks, Lines and Fields John D. Ryder, Second Edition, Pearson Education, 2015.

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Semester-IV

Course Code	Course Name	L	T	P	C
23EC4T03	ELECTRONIC CIRCUIT ANALYSIS	3	0	0	3

COURSE OUTCOMES:

After successful completion of this course, students should be able to

CO1 : Understand basic behaviour of transistor at high frequencies

CO2 : Design and analyze multistage amplifiers.

CO3 : Understand various negative feedback amplifier circuits

CO4 : Design various oscillators

CO5 : Analyze and design solid state power amplifier circuit and Tuned amplifiers.

SYLLABUS

UNIT-I : Small Signal High Frequency Transistor Amplifier models:

BJT: Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid πconductance, Hybrid π capacitances, validity of hybrid π model, determination of high- frequency parameters in terms of low-frequency parameters, CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response and gain bandwidth product.

UNIT-II : Multistage Amplifiers

Classification of amplifiers, methods of coupling**, c**ascaded transistor amplifier and its analysis, analysis of two stage RC coupled amplifier, high input resistance transistor amplifier circuits and their analysis- Darlington pair amplifier, Cascode amplifier, Boot-strap emitter follower, Differential amplifier using BJT.

UNIT-III : FEEDBACK AMPLIFIERS

Feedback Amplifiers: Feedback principle and concept, types of feedback, classification of amplifiers, feedback topologies, Characteristics of negative feedback amplifiers, Generalized analysis of feedback amplifiers, Performance comparison of feedback amplifiers, Method of analysis of feedback amplifiers.

UNIT-IV : Oscillators:

Oscillator principle, condition for oscillations, types of oscillators, RC- phase shift and Wien bridge oscillators with BJT and FET and their analysis, Generalized analysis of LC Oscillators, Hartley and Colpitt's oscillators using BJT, Frequency and amplitude stability of oscillators

UNIT-V : POWER AMPLIFER and TUNED AMPLIFIER

Power Amplifiers: Classification of amplifiers (A to H), Class A power Amplifiers, Class B Push-pull amplifiers, Complementary symmetry push pull amplifier, Class AB power amplifier, Class-C power amplifier, Thermal stability and Heat sinks.

Tuned Amplifiers: Introduction, Q-Factor, small signal tuned amplifier, capacitance single tuned

amplifier, double tuned amplifiers, staggered tuned amplifiers

TEXT BOOKS:

1. J.Millman & Halkias, Integrated Electronics, TMH, 2008.
2. J.Millman & Arian Grabel, Micro Electronics, 2nd Edition, TMH, 2001.

REFERENCE BOOKS:

1. A.S.Sedra & K.C.Smith, Micro Electronic Circuits, 4th edition, Oxford press
2. J.B.Gupta, Electronic devices and circuits, 4th edition, S.K.Kataria and sons

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Semester-IV

Course Code	Course Name	L	T	P	C
23EC4T04	**ANALOG COMMUNICATIONS**	**3**	**0**	**0**	**3**

COURSE OUTCOMES:

After successful completion of this course, students should be able to

CO1 : Describe and analyze the Modulation and Demodulation techniques of standard AM.
CO2 : Analysis on different types of Amplitude Modulation and Demodulation techniques.
CO3 : Analyze the concepts of generation and detection of Angle Modulated signals.
CO4 : Outline the Radio Receivers with different sections.
CO5 : Illustrate the noise performance in Analog Modulation techniques and also the concepts of Pulse Analog Modulation and Demodulation techniques.

Syllabus

UNIT-I : INTRODUCTIONTOCOMMUNICATIONSYSTEM

Amplitude Modulation: Introduction to communication system, Need for modulation, Frequency Division Multiplexing, Amplitude Modulation, Time domain and Frequency domain descriptions, Single tone modulation, Power relations in AM waves, Generation of AM waves: Square law Modulator, Switching modulator, Detection of AM Waves: Square law detector, Envelope detector, Related problems.

UNIT-II :

DSB & SSB Modulation: Double sideband suppressed carrier modulator: Time domain and frequency domain description, Generation of DSBSC Waves: Balanced Modulator, Ring Modulator, Detection of DSBSC Waves: Coherent detection, Quadrature Null Effect, COSTAS Loop, Squaring Loop.
Single sideband suppressed carrier modulator: Time domain and Frequency domain description, Generation of SSBSC Waves: Frequency discrimination method, Phase discrimination method, Demodulation of SSB Waves: Coherent Detection.
Vestigial sideband modulation: Time domain description, Frequency domain description, Generation of VSB Modulated wave, Envelope detection of a VSB Wave pulse Carrier, Comparison of different AM Techniques, Applications of different AM Systems, Related problems.

UNIT-III : ANGLE MODULATION & DETECTOR

Introduction, Basic concept of phase modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave, Generation of FM Waves: Direct Method, Indirect Method, Detection of FM Waves: Balanced Frequency discriminator, Zero crossing detector, Phase locked loop, Comparison of FM & AM, Related problems

UNIT-IV RADIO RECEIVERS AND PULSE MODULATION

Radio Transmitters: Classification of Transmitters, AM Transmitter, Effect of feedback on performance of AM Transmitter, FM Transmitter: Variable reactance type and Phase modulated FM Transmitter, Frequency stability in FM Transmitter.
Radio Receivers: Receiver Types: Tuned radio frequency receiver, Super heterodyne receiver, RF section and Characteristics, Frequency changing and tracking, Intermediate frequency, AGC,

FM Receiver, Amplitude limiting, Comparison of FM & AM Receivers, Communication Receivers, Extension of super heterodyne principle and additional circuits.

UNIT-V: -NOISE

Noise: Review of noise and noise sources, Noise figure, Noise in Analog communication Systems: Noise in DSB & SSB Systems, Noise in AM System and Noise in Angle Modulation Systems, Threshold effect in Angle Modulation System, Pre-emphasis & De-emphasis.

Pulse Analog Modulation: Types of Pulse modulation, PAM (Single polarity, double polarity), PWM: Generation & Detection of PWM, PPM: Generation and Detection of PPM, Time Division Multiplexing, TDM Vs FDM.

Text Books:

1. Communication Systems, Simon Haykin, Michael Moher, Wiley, 5th Edition, 2009.
2. Principles of Communication Systems, H Taub, D L Schilling, Gautam Sahe, TMH, 4th Edition, 2017.
3. Modern Digital and Analog Communication Systems, B.P.Lathi, Zhi Ding, Hari Mohan Gupta, Oxford University Press, 4th Edition, 2017.

Reference Books:

1. Electronics & Communication Systems, George Kennedy, Bernard Davis, S R M Prasanna, TMH, 6th Edition, 2017.
2. Communication Systems, R P Singh, S D Sapre, TMH, 3nd Edition, 2017.
3. Communication Systems (Analog and Digital), Dr. Sanjay Sharma, Katson Books, 7th Reprint Edition, 2018

Web Links:

1. http://nptel.ac.in/courses/117102059/ Prof. Surendra Prasad.
2. https://ict.iitk.ac.in/wp-content/uploads/EE320A-Principles-Of-Communication-CommunicationSystems-4ed-Haykin.pdf.
3. https://www.scribd.com/document/266137872/sanjay-sharma-pdf.
4. http://bayanbox.ir/view/9144090835198890 86/Book-Modern-Digital-And-AnalogCommunication-Systems-4th-edition-by-Lathi.pdf.
5. https://soaneemrana.org/onewebmedia/ELECTRONICS%20COMMUNICATION%20SYSTEM%20BY%20GEORGE%20KENNEDY.pdf

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Semester-IV

Course Code	Course Name	L	T	P	C
23EC4L01	**Micro controller and Interfacing Lab**	**0**	**0**	**3**	**1.5**

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : Understand and visualize embedded system. Familiarize with IDE and tool chain and familiarize with technical documents of microcontroller.
CO2 : Understand GPIO functionality and use port pins as input or output depending on the need with specific pin mode of operation
CO3 : Define GPIO interrupts and use them in programs. Understand how to use timers for different purposes
CO4 : Generate PWM as required. Understand and use RTC for time keeping and Time stamping
CO5 : Utilize WDT for program error handling

List of Experiments: (Minimum of Ten Experiments has to be performed)

ARM Cortex-M microcontrollers

1. LED
2. Blinking
3. Digital Input/Output
4. Interfacing with LCD
5. Pulse Width Modulation (PWM)
6. Analog-to-Digital Conversion (ADC)
7. UART Communication
8. I2C Communication
9. SPI Communication
10. Real-Time Operating System (RTOS) Basics
11. Sensor Interfacing
12. Basic Robotics
13. Wireless Communication (Bluetooth, Wi-Fi)

ARM Cortex-M Based Microcontroller Boards

- **STM32 Nucleo Boards**: Feature STM32 microcontrollers.
- **NXP LPC Boards**: Feature NXP's LPC microcontrollers.
- **Texas Instruments (TI) LaunchPads**: Feature TI's MSP432 microcontrollers.

Keil uVision IDE

Debugging and Programming Tools

- **In-Circuit Debugger/Programmer**

  - **ST-LINK**: For STM32 microcontrollers.
  - **J-Link**: A widely used tool compatible with many ARM Cortex-M microcontrollers.

· **DAPLink**: An open-source tool compatible with many ARM-based microcontrollers.

Peripherals and Modules

- **LEDs**: For basic GPIO experiments.
- **Push Buttons**: For digital input experiments.
- **LCD Display**: For displaying data and messages.
- **Sensors**: Various sensors such as temperature sensors, light sensors, ultrasonic sensors, etc.
- **Motors**: DC motors or servo motors for motor control experiments.
- **Potentiometers**: For analog input experiments.
- **Communication Modules**:
  - **Bluetooth Module**: Such as HC-05 or HM-10.
  - **Wi-Fi Module**: Such as ESP8266 or ESP32.
  - **I2C and SPI Modules**:

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Semester-IV

Course Code	Course Name	L	T	P	C
23EC4L02	ELECTRONIC CIRCUITS AND ANALYSIS LAB	0	0	3	1.5

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : Understand basic behaviour of transistor at high frequencies

CO2 : Design and analyze multistage amplifiers.

CO3 : Understand various negative feedback amplifier circuits

CO4 : Design various oscillators

CO5 : Analyze and design solid state power amplifier circuit and Tuned amplifiers.

LIST OF EXPERIMENTS

Note: The students are required to design the circuit and perform the simulation using Multisim/ Equivalent Industrial Standard Licensed simulation software tool**.** Further they are required to verify the result using necessary hardware equipment.

List of Experiments: (Minimum of Ten Experiments has to be performed)

1. Determination of Ft of a given transistor.
2. Voltage-Series Feedback Amplifier
3. Current-Shunt Feedback Amplifier
4. RC Phase Shift/Wien Bridge Oscillator
5. Hartley/Colpitt's Oscillator
6. Two Stage RC Coupled Amplifier
7. Darlington Pair Amplifier
8. Boots trapped Emitter Follower
9. Class A Series-fed Power Amplifier
10. Transformer-coupled Class A Power Amplifier
11. Class B Push-Pull Power Amplifier
12. Complementary Symmetry Class B Push-Pull Power Amplifier
13. Single Tuned Voltage Amplifier
14. Double Tuned Voltage Amplifier

Equipment required: Software:

i. Multisim/Equivalent Industrial Standard Licensed simulation software tool.

ii. Computer Systems with required specifications

Hardware Required:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multimeters
5. Decade Resistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components.

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Semester-IV

Course Code	Course Name	L	T	P	C
23XX4SXX	DESIGN THINKING & INNOVATION	0	0	3	1

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : Define the concepts related to design thinking.

CO2 : Explain the fundamentals of Design Thinking and innovation

CO3 : Apply the design thinking techniques for solving problems in various sectors.

CO4 : Analyse to work in a multidisciplinary environment

CO5 : Evaluate the value of creativity

Syllabus

UNIT-I : Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry

UNITs-II : Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development.

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT-III

Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT-IV :

Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

UNIT-V : Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Textbooks:

1. Change by design, Tim Brown, Harper Bollins (2009)

2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons.

Reference Books:

1. Design Thinking in the Classroom by David Lee, Ulysses press
2. Design the Future, by Shrrutin N Shetty, Norton Press
3. Universal principles of design- William lidwell, kritinaholden, Jill butter.
4. The era of open innovation – chesbrough.H

Online Learning Resources:

1. https://nptel.ac.in/courses/110/106/110106124/
2. https://nptel.ac.in/courses/109/104/109104109/
3. https://swayam.gov.in/nd1_noc19_mg60/preview

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BoS Chairman

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Department of Electronics and Communication Engineering

Semester-IV

Course Code	Course Name	L	T	P	C
23EC4S02	SOFT SKILL	0	0	2	1.5

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : understand the single sided PCB and double-sided PCB using EDA.

CO2 : Apply passive and active components in EASYEDA.

CO3 : Analyze PCB design using OrCAD and PROTEUS tool.

CO4 : understand gerber tools, auto routing, soldiering and desoldiering

Syllabus

MODULE-I : Introduction & Brief History

What is PCB, Difference between PWB and PCB, Types of PCBs, Single Sided (Single Layer), Multi-Layer (Double Layer), PCB Materials
Introduction to Electronic Design Automation (EDA): Brief History of EDA, Latest Trends in Market, How it helps and Why it requires, Different EDA tools Introduction and Working of EASYEDA

MODULE-II : Component introduction and their categories

Active Components: Diode, Transistor, MOSFET, LED, SCR, Integrated Circuits (ICs) **Passive Components**: Resistor, Capacitor, Inductor, Transformer, Speaker/Buzzer
Component Package Types: Through Hole Packages, Axial lead, Radial Lead, Single Inline Package(SIP),Dual Inline Package(DIP),Transistor Outline(TO),Pin Grid Array(PGA),Metal Electrode Face(MELF),Leadless Chip Carrier(LCC),Small Outline Integrated Circuit(SOIC),Quad Flat Pack(QPF) and Thin QFP (TQFP),Ball Grid Array(BGA),Plastic Leaded Chip Carrier(PLCC)

MODULE-III

Introduction to PCB Design using OrCAD tool, Introduction to PCB Design using PROTEUS tool

Module-IV

PCB Designing Flow Chart: Schematic Entry, Net listing, PCB Layout Designing, Design Rule Check (DRC), Design For Manufacturing (DFM),
PCB Making: Printing, Etching, Drilling, Assembly of Components,
Electrical Layers: Top Layer, Mid Layer, Bottom Layer
Mechanical Layers: Board Outlines and Cutouts, Drill Details, Documentation Layers, Components Outlines, Reference Designation, Footprint, Pad stacks, Vias, Tracks, Color of Layers, PCB Track, Standard FR-4 Epoxy Glass, Multifunctional FR-4, Tetra Functional FR- ,NelcoN40, GETEK,BT Epoxy Glass, Cyanate Aster, Plyimide Glass Teflon, Rules for Track: Track Length, Track Angle, Rack Joints, Track Size

Module:V

Study of IPC Standards: IPC Standard For Schematic Design, IPC Standard For PCB Designing, IPC Standard For PCB Materials, IPC Standard For Documentation and PCB Fabrication.

Starting the PCB designing: Understanding the schematic Entry, Creating Library & Components, Drawing a Schematic, Flat Design / hierarchical Design, Setting up Environment for PCB, Design a Board

Auto routing: Introduction to Auto routing, Setting up Rules, Defining Constraints, Auto router Setup

PCB Designing Practice: PCB Designing of Basic and Analog Electronic Circuits, PCB Designing of Power Supplies, PCB Designing of Different Sensor modules, PCB Designing of Electronics Projects, PCB Designing of Embedded Projects

Post Designing & PCB Fabrication Process: Printing the Design, Etching, Drilling, Interconnecting and Packaging electronic Circuits (IPC) Standards, Gerber Generation, Soldering and De-soldering, Component Mounting, PCB and Hardware Testing

Project work: Making the schematic of Academic and Industrial projects, PCB Designing of these projects, Soldering and De-soldering of components as per Design, Testing and Troubleshooting Method

TEXT BOOK:

1. PCB Design and LAYOUT Fundamentals for EMC, Roger Hu.
2. The ART of PCB Reverse Engineering by N kong Tiang.

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Semester-IV

Course Code	Course Name	L	T	P	C
23SH3MXX	Human Values-understanding harmony and Ethical Human conduct	0	0	3	0

COURSE OUTCOMES:

After successful completion of this course, students should be able to

CO1 : Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)

CO2 : Identify one's self, and one's surroundings (family, society nature) (L1, L2)

CO3 : Apply what they have learnt to their own self in different day-to-day settings in real life (L3)

CO4 : Relate human values with human relationship and human society. (L4)

CO5 : Justify the need for universal human values and harmonious existence (L5)

SYLLABUS

UNIT I - Introduction to Value Education

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education.

UNIT II - Harmony in the Human Being

Understanding Human being as the Co-existence of the self and the body, Distinguishing between the Needs of the self and the body, Harmony of the self with the body, Sanyam and Health; correct appraisal of Physical needs, Programs to ensure Sanyam and Health.

UNIT III - Harmony in the Family and Society

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, Understanding the meaning of Respect, Understanding Harmony in the Society.

UNIT IV - Harmony in the Nature/Existence

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

UNIT V - Implications of the Holistic Understanding – a Look at Professional Ethics

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Production Systems and Management Models.

Textbook and Teachers Manual

a. The Textbook

- R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

- R R Gaur, R Asthana, G P Bagaria, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Mode of Conduct:

- Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.
- 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 mentor, in a group sitting.

Online Resources:

1.https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf

2.https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf

3.https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf

4.https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf

5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf

6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-

SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf

7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

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Semester-II

Course Code	Course Name	L	T	P	C
23EC3T05	Analog Electronics	3	0	0	3

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : To acquire the basic knowledge on clippers, clampers & biasing circuits.

CO2 : To determine the h-parameters of a transistor circuit & understand the concepts of feedback amplifiers.

CO3 : To know the operation of oscillators and operational amplifier.

CO4 : To understand the applications of operational amplifier.

CO5 : To acquire the knowledge on IC 555 timer and their applications.

Syllabus

Unit – 1:

Diode clipping and clamping circuits: Diode clippers, clipping at two independent levels, Transfer characteristics of clippers, clamping circuit operation.

DC biasing of BJTs: Load lines, Operating Point, Bias Stability, Collector-to-Base Bias, Self-Bias, Stabilization against Variations in V_{BE} and β for the Self-Bias Circuit, Bias Compensation, Thermal Runaway, Thermal Stability.

Unit – II:

Small Signals Modelling of BJT: Analysis of a Transistor Amplifier Circuit using h-parameters, Simplified CE Hybrid Model, Analysis of CE, CC, CB Configuration using Approximate Model, Frequency Response of CE and CC amplifiers.

Feedback Amplifiers: Classification of Amplifiers, the Feedback Concept, General Characteristics of Negative-Feedback Amplifiers, Effect of Negative Feedback upon Output and Input Resistances, Voltage-Series Feedback, Current-Series Feedback, Current-Shunt Feedback, Voltage-Shunt Feedback.

Unit – III:

Oscillator Circuits: Barkhausen Criterion of oscillation, Oscillator operation, R-C phase shift oscillator, Wien bridge Oscillator, Crystal Oscillator.

Operational Amplifiers: Introduction, Basic information of Op-Amp, Ideal Operational Amplifier, Block Diagram Representation of Typical Op-Amp, OP-Amps Characteristics: Introduction, DC and AC characteristics, 741 op-amp & its features.

Unit – IV:

OP-AMPS Applications: Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I cand I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator.

Comparators and Waveform Generators: Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators.

Unit – V:

Timers and Phase Locked Loop: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger, PLL block schematic, principles and description of individual blocks, 565 PLL, Applications of VCO (566).

Digital to Analog And Analog to Digital Converters: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A-D Converters – parallel

Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

Textbooks:

1. Electronic Devices and Circuits- J. Millman, C.Halkias, Tata Mc-Graw Hill, 2nd Edition, 2010.
2. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition, 2003.

Reference Books:

1. Electronic Devices and Circuit Theory – Robert L.Boylestad and Lowis Nashelsky, Pearson Edition, 2021.
2. Electronic Devices and Circuits–G.K. Mithal, Khanna Publisher, 23rd Edition, 2017.
3. Electronic Devices and Circuits – David Bell, Oxford, 5thEdition, 2008.
4. Electronic Principles–Malvino, Albert Paul, and David J. Bates, McGraw-Hill/Higher Education, 2007.
5. Operational Amplifiers and Linear Integrated Circuits– Gayakwad R.A, Prentice Hall India, 2002.
6. Operational Amplifiers and Linear Integrated Circuits –Sanjay Sharma, Kataria & Sons, 2ndEdition, 2010.

Online Learning Resources:

1. https://nptel.ac.in/courses/122106025.
2. https://nptel.ac.in/courses/108102112.

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