KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

VISION:

To make the Department of Electronics and Communication Engineering of this Institution the unique of its kind in the field of Research and Development activities in this part of world.

MISSION:

To impart highly innovative and technical knowledge in the field of Electronics and Communication Engineering to the urban and unreachable rural student folks through Total Quality Education.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO 1:

To establish a strong foundation in Electronics and Communication Engineering necessary to formulate, model, analyze and solve real time problems.

PEO 2:

To inculcate professional skills and life skills for placement or to pursue higher studies in the relevant fields.

PEO 3:

To promote research and development activities and solve industrial problems with creative ideas.

PROGRAM OUTCOMES:

After going through the four years of study, the Electronics and Communication Engineering graduates will have the ability to

	Graduate Attribute	**Programme Outcome**
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1 :

Ability to make use of attained technical knowledge in the field of Electronics and Communication Engineering for successful career and qualifying in competitive examinations at the national level.

PSO2:

Ability to develop workable solutions for real time challenges in Electronics and Communication Engineering

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SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1302	Linear Algebra and Partial Differential Equations	BS	3	1	0	4	4
2	AD1371	Data Structures and Algorithms	ES	3	0	0	3	3
3	EC1371	Digital Electronics	PC	3	0	0	3	3
4	EC1301	Electromagnetic Fields and Waves	PC	3	0	0	3	3
5	EC1302	Electronic Devices	PC	3	0	0	3	3
6	EC1303	Signals and Systems	PC	3	0	0	3	3
PRACTICAL								
7	AD1381	Data Structures and Algorithms Laboratory	ES	0	0	4	4	2
8	EC1311	Digital Circuits and Devices Laboratory	PC	0	0	4	4	2
9	HS1321	Interpersonal Skills - Listening and Speaking	EEC	0	0	2	2	1
			TOTAL	**18**	**1**	**10**	**29**	**24**

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1401	Probability and Random Processes	BS	3	1	0	4	4
2	EC1401	Communication Theory	PC	3	0	0	3	3
3	EC1402	Discrete Time Signal Processing	PC	3	0	0	3	3
4	EC1403	Electronic Circuits - I	PC	3	0	0	3	3
5	EC1404	Linear Integrated Circuits	PC	3	0	0	3	3
6	EE1471	Control Systems Engineering	PC	3	0	0	3	3
PRACTICAL								
7	EC1411	Digital Signal Processing Laboratory	PC	0	0	4	4	2
8	EC1412	Linear Integrated Circuits Laboratory	PC	0	0	4	4	2
9	HS1421	An Introduction to Advanced Reading and Writing	EEC	0	0	2	2	1
			TOTAL	**18**	**1**	**10**	**29**	**24**

SEMESTER III

MA1302 LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

OBJECTIVES:

The course will enable learners to

- To make them understand the basic concepts of vector spaces.
- To describe the concepts of linear transformation and diagonalization.
- To introduce the concept of inner product spaces in orthogonalization.
- To make them understand the procedure to solve partial differential equations.
- To introduce the standard techniques for solving wave and heat equations.

UNIT I VECTOR SPACES 12

Vector spaces – Subspaces – Linear combinations of vectors - Linear Span – Linear independence and linear dependence – Bases and dimensions

UNIT II LINEAR TRANSFORMATION AND DIAGONALIZATION 12

Linear transformation – Null space and range space – Dimension theorem – Matrix representation of a linear transformation – Eigen values and eigenvectors – Diagonalization of linear transformation – Application of diagonalization in linear system of differential equations.

UNIT III INNER PRODUCT SPACES 12

Inner products spaces – Orthogonal vectors- Gram Schmidt orthogonalization process - Orthogonal complement – Least square approximation - Minimal solution to system of linear equations.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS 12

Formation – Solutions of standard types of first order equations – Lagrange's linear equation – Classification of partial differential equations – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT V FOURIER SERIES SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

General Fourier series – Half range sine and cosine series – Method of separation of variables - Solutions of one dimensional wave equation and one dimensional heat equation – Steady

state solution of two dimensional heat equation - Fourier series solutions in Cartesian coordinates.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1 Identify whether the given system of equation is linearly dependent or independent.

CO2 Apply the concept of eigenvalues and eigenvectors for diagonalization of a matrix

CO3 Calculate the orthonormal vector and minimal solution to the system of linear equation using inner product techniques.

CO4 Solve various types of partial differential equations.

CO5 Apply the Fourier series techniques in solving heat flow and wave equations.

TEXT BOOKS:

1. Friedberg, A, H, Insel, A, J, & Spence, L, 2004, *Linear Algebra*, Prentice Hall of India, New Delhi.
2. Grewal, B, S, 2014, *Higher Engineering Mathematics*, Khanna Publishers, 43rd Edition New Delhi.

REFERENCES:

1. James, G, 2007, *Advanced Modern Engineering Mathematics,* Pearson Education.
2. Kolman, B, & Hill, D, R, 2009, *Introductory Linear Algebra*, Pearson Education, New Delhi, First Reprint.
3. Kumaresan, S, 2010, *Linear Algebra, A Geometric Approach*, Prentice, Hall of India, New Delhi, Reprint.
4. Lay, D, C, 2015, *Linear Algebra and its Applications*, Pearson Education, 5th Edition.
5. Sundarapandian, V, 2008, *Numerical Linear Algebra*, Prentice Hall of India, New Delhi.

WEB REFERENCES:

1. https://fdocuments.in/document/introductory-linear-algebra-kolman-8e.html
2. https://soaneemrana.org/onewebmedia/ADVANCED%20ENGINEERING%20MATHEMATICS%20BY%20ERWIN%20ERESZIG1.pdf
3. http://www.math.toronto.edu/ivrii/PDE-textbook/PDE-textbook.pdf

AD1371 DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- Understand the fundamentals of algorithms and the concepts of List ADT.
- Learn linear data structures – stacks and queues.
- Understand the concepts of non-linear data structures, Trees.
- Learn the concepts of non-linear data structures, Graphs.
- Understand sorting, searching and hashing algorithms

UNIT I INTRODUCTION TO ALGORITHMS AND ADTs 9

Time and space complexity - Big O, Omega, Theta notation – List ADT – array based implementation, linked list implementation, singly linked lists, circularly linked lists, doubly linked lists, applications of lists.

UNIT II STACK AND QUEUE 9

Stack ADT – Operations, Applications, Evaluating arithmetic expressions, Conversion of Infix to postfix expression - Queue ADT – Operations, Circular Queue, Priority Queue, dequeue, applications of queues.

UNIT III TREES 9

Tree ADT - tree traversals - Binary Tree ADT - expression trees, applications of trees - binary search tree ADT–AVL Tree - B-Tree - Heap- Binary heap - Applications of heap.

UNIT IV GRAPHS 9

Definition, Representation of Graph, Types of graph, Breadth-first traversal, Depth-first traversal - Topological Sort - Bi-connectivity - Cut vertex - Euler circuits - Applications of graphs.

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching - Linear Search, Binary Search - Sorting - Bubble sort, Selection sort, Insertion sort, Shell sort, Radix sort - Hashing - Hash Functions, Separate Chaining, Open Addressing, Rehashing, Extendible Hashing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to

CO1 Illustrate the basic concepts of List ADT.

CO2 Explain Stack and Queue ADTs.

CO3 Summarize the concepts of non-linear data structures, Trees.

CO4 Outline the concepts of non-linear data structures, Graphs.

CO5 Apply appropriate sorting and searching techniques for problem solving.

TEXT BOOKS:

1. Weiss, M.A., 1997. *Data Structures and Algorithm Analysis in C, 2/e*. Pearson Education India.
2. Reema Thareja, 2011. *Data Structures Using C*, Second Edition, Oxford University Press.

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest & Clifford Stein, 2002. *Introduction to Algorithms*, Second Edition, Mcgraw Hill.
2. Aho, Hopcroft & Ullman, 1983. *Data Structures and Algorithms*, Pearson Education.
3. Kochan, S.G., 2015. *Programming in C*. Pearson education.
4. Ellis Horowitz, SartajSahni, Susan & Anderson-Freed, 2008 *Fundamentals of Data Structures in C*, Second Edition, University Press.

EC1371 DIGITAL ELECTRONICS

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To present the Digital fundamentals, Boolean algebra and its applications in digital systems
- To familiarize with the design of various combinational digital circuits using logic gates
- To design the synchronous and Asynchronous counters and shift registers by using Flip Flops.
- To introduce the analysis and design procedures for synchronous sequential circuits

- To introduce the electronic circuits involved in the making of logic gates

UNIT I DIGITAL FUNDAMENTALS 9

Review of Number systems - Logic gates - Boolean algebra - Boolean postulates and laws - De-Morgan's Theorem, Principle of Duality - Simplification using Boolean algebra - Canonical forms, Sum of product and Product of sum - Minimization using Karnaugh map - NAND and NOR Implementation.

UNIT II COMBINATIONAL CIRCUITS 9

Realization of combinational logic using gates - Design of combinational circuits - Adder , Subtractor, Parallel adder / Subtractor, Carry look ahead adder, Magnitude Comparator, Code converters, Parity generator and checker, Encoder, Decoder, Multiplexer, Demultiplexer - Function realization using Multiplexer, Decoder.

UNIT III SEQUENTIAL CIRCUITS 9

Latches - Flip-Flops - SR, JK, D and T, Master Slave Flip Flops - Shift registers - SISO, SIPO, PISO, PIPO - Binary counters – Synchronous and asynchronous up/down counters, mod - N counter, Counters for random sequence - Johnson counter - Ring counter

UNIT IV SYNCHRONOUS CIRCUIT DESIGN 9

Design of Synchronous Sequential Circuits - State Table and State Diagram - Design of Mealy and Moore FSM - Overlapping & Non-overlapping Sequence detector - Hazards - Hazard free realization - Case study on Vending Machine FSM

UNIT V LOGIC FAMILIES AND PROGRAMMABLE DEVICES 9

Introduction to Logic families – RTL, TTL, ECL and CMOS - Basic memory structure – ROM, PROM, EPROM, EEPROM - RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA), Programmable Array Logic (PAL) – Implementation of combinational logic circuits using PLA, PAL - FPGA - Basic Architecture.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to

CO1 Outline the Boolean functions and various minimization techniques.

CO2 Illustrate the combinational circuits used to perform basic digital operations.

CO3 Develop a synchronous/asynchronous counters and shift registers using sequential logic.

CO4 Apply state machine models to design sequential logic circuits.

CO5 Design combinational circuits using programmable logic devices.

TEXT BOOKS:

1. M Morris Mano, M.D.C., 2017. *Digital design: with an introduction to the verilog HDL, VHDL, and system Verilog*, 6th Edition, Pearson Education.

REFERENCES:

1. Charles H.Roth, 2013. *Fundamentals of Logic Design*, 6th Edition, Thomson Learning.
2. Wakerly J F, 2002. *Digital Design: Principles and Practices*, 2nd Ed., Prentice Hall.
3. D. D. Givone, 2003. *Digital Principles and Design*, Tata Mc-Graw Hill, New Delhi.
4. Thomas L. Floyd, 2011. *Digital Fundamentals*, 10th Edition, Pearson Education Inc.
5. Stephen Brown & Zvonko Vranesic, 2013, *Fundamentals of Digital Logic with Verilog Design*, Third Edition, McGraw-Hill Higher Education, New Delhi, India.

EC1301 ELECTROMAGNETIC FIELDS AND WAVES

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To understand the concept of static electric field.
- To understand the concept of static magnetic field.
- To gain conceptual understanding of static electric and magnetic fields in materials.
- To understand the coupling between electric and magnetic fields in time varying conditions.
- To understand wave propagation in lossless and in lossy media.

UNIT I STATIC ELECTRIC FIELD 9

Coordinate Systems – Gradient , Divergence , Curl – Divergence theorem, Stokes theorem - Coulomb's Law– Electric Field Intensity – Electric Field due to discrete charges, charges distributed uniformly on an infinite line, finite line and infinite sheet. Electric Scalar Potential – Electric Flux Density – Gauss Law and its applications.

UNIT II STATIC MAGNETIC FIELD 9

Biot-Savart's Law– Magnetic Field intensity due to infinite and finite wire carrying current I – Ampere's circuital law. Magnetic flux density –Lorentz force equation – Force on a wire carrying a current placed in a magnetic field – Torque on a loop carrying a current – Magnetic moment – Magnetic Vector Potential.

UNIT III ELECTRIC AND MAGNETIC FIELDS IN MATERIALS 9

Poisson's and Laplace's equation – Electric Polarization - Capacitance – Capacitance of parallel plate capacitor and coaxial cable – Capacitance of parallel plate capacitor with two dielectrics – Electrostatic energy - Energy density – Boundary conditions for electric fields – Electric current – Current density – Point form of ohm's law – Continuity equation for current. Inductance – Inductance of loops and solenoids – Mutual inductance –Energy density in magnetic fields – Magnetization and Permeability - Magnetic boundary conditions.

UNIT IV TIME-VARYING ELECTRIC AND MAGNETIC FIELDS 9

Faraday's law – Transformer and Motional electromotive forces - Displacement current – Maxwell's equations in integral form and differential form –Maxwell's equation in Phasor form - Poynting Vector and the flow of power – Poynting theorem. Case Study - Application of EM waves in Microwaves.

UNIT V ELECTROMAGNETIC WAVES 9

Wave equations for conducting and non-conducting media - Wave equations in Phasor form – Uniform plane waves in perfect dielectrics, conductors and free space - Skin effect- Introduction to EM Shielding Case Study: Biological Effects of Electromagnetic Waves.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of course, the students will be able to

CO1 Describe the fundamental concepts of static electric field.

CO2 Explain the fundamental concepts of static magnetic field.

CO3 Solve electrostatic and magneto static boundary problems.

CO4 Interpret Maxwell's equations for time dependent electromagnetic fields.

CO5 Determine parameters such as frequency, phase constant, velocity, skin depth and associated intrinsic impedance for different media.

TEXT BOOKS:

1. Mathew.N.O. Sadiku 2015, *Elements of Electromagnetics*, 6th Edition, Oxford University Press.
2. W.H. Hayt & J.A. Buck 2012, *Engineering Electromagnetics*, 8th Edition, McGraw-Hill (India).

REFERENCES:

1. D.K. Cheng 1989, *Field and Wave Electro Magnetics*, 2nd Edition, Pearson (India).
2. Kraus, Fleisch 2010, *Electromagnetics with Applications*, 5th Edition, McGraw-Hill.
3. Daniel Fleisch 2008, *A Student's Guide to Maxwell's Equations*, 1st Edition, Cambridge University Press.

EC1302 ELECTRONIC DEVICES

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To analyze simple diode Circuits
- To introduce BJT basic operation, characteristics and application
- To acquaint with the construction, theory and operation of Field Effect Transistors
- To interpret the Special Semiconductor Diodes, Power Devices and Display Devices
- To apply the concepts of DC power supplies

UNIT I SEMICONDUCTOR DIODES 9

PN junction Diodes - Formation of PN junction, working principle, VI characteristics - diode resistance - PN diode currents - diode current equation - transition and diffusion capacitance - voltage breakdown in diodes - Diode models - Diode Circuits

UNIT II BIPOLAR JUNCTION TRANSISTORS 9

Principle and Operation of PNP, NPN transistors, Early effect, Current Equation, BJT as a switch and Amplifier, Breakdown Mechanisms of Transistors - Input and Output Characteristics of CE, CB, CC - Ebers Moll Model - Hybrid Model - Multi Emitter Transistor.

UNIT III FIELD EFFECT TRANSISTORS 9

Principle and Operation of N channel and P channel JFET, Drain and Transfer Characteristics, Current Equation, Pinch off Voltage and its significance, Breakdown mechanisms of JFET. MOSFET - Characteristics, Threshold voltage, Channel Length Modulation, MOSFET Capacitor, D-MOSFET - E-MOSFET Characteristics - Comparison of MOSFET with JFET.

UNIT IV SPECIAL SEMICONDUCTOR DIODES 9

Zener Diode - Varactor diode - Tunnel diode - Schottky diode - LED - Photo Diode - LCD, LDR, Opto Coupler, Solar Cell. SCR - DIAC – TRIAC.

UNIT V DC POWER SUPPLIES 9

HWR, FWR, full-wave bridge rectifier, power supply filters - ripple factor, efficiency analysis - bleeder resistor. Voltage regulation, Zener diode shunt regulator, transistor series regulator, transistor shunt regulator, design of complete DC power supply circuit.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of course, the students will be able to

CO1 Explain the working principle of PN junction diode and its parameters.

CO2 Outline the working principle of BJT and various configuration and models.

CO3 Illustrate the working principle of FET to find equivalent circuits and its parameters.

CO4 Interpret the special semiconductor diodes operation of various power devices and display devices.

CO5 Explain the linear mode power supply and voltage regulators

TEXT BOOKS:

1. Thomas L. Floyd, 2012. *Electronic Devices*, 9th edition, Pearson Education.
2. Donald A Neaman, 2012. *Semiconductor Physics and Devices*, 4th Edition, Tata McGraw Hill.

REFERENCES:

1. R.S.Sedha, 2006. *A Text Book of Applied Electronics*, S.Chand Publications.
2. Ben. G. Streetman & Sanjay Kumar Banerjee, 2015. *Solid State Electronic Devices*, 7th Edition, Pearson Education India.
3. Robert Boylestad & Louis Nashelsky, 2008. *Electron Devices and Circuit Theory,* Pearson Prentice Hall, 10th edition.
4. Yang, 1978. *Fundamentals of Semiconductor devices*, McGraw Hill International Edition.
5. Adel S. Sedra & Kenneth C. Smith, 2017. *Microelectronic Circuits: Theory and Applications*, 7th Edition, Oxford University Press.

EC1303 SIGNALS AND SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To introduce visualization and mathematical representation of continuous-time signals and systems
- To teach the applications of Laplace and Fourier transforms in the analysis of continuous- time signals
- To impart knowledge on the analysis of continuous time system using Fourier and Laplace Transform
- To teach the applications of Z- and Fourier transforms in the analysis of discrete – time signals
- To impart knowledge on the analysis of discrete time system using Fourier and Z transform domain

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids, Basic Operations on Signals, Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals, Classification of systems - CT systems and DT systems, Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable, Static & Dynamic.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 9

Fourier series for periodic signals - Fourier Transform - properties - Laplace Transforms and properties, RoC and its properties, Inverse Laplace transform

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 9

Impulse response – properties of convolution, convolution integrals - Differential Equation-Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Baseband signal Sampling and reconstruction, Aliasing – Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties, Inverse Z Transform - Partial fraction method, Residue method

UNIT V LINEAR TIME INVARIANT DISCRETE TIME SYSTEMS 9

Impulse response – Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems - DT systems connected in series and parallel.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of course, the students will be able to

CO1 To identify the different types of continuous time and discrete time signals/systems.

CO2 To apply Fourier series, Continuous Time Fourier Transform and Laplace transform for the analysis of continuous time signals.

CO3 To make use of Fourier and Laplace transform to analyse continuous time systems.

CO4 To apply Discrete Time Fourier Transform and Z Transform for the analysis of discrete time signals.

CO5 To utilize Fourier and Z transform to analyze discrete time systems.

TEXT BOOKS:

1. Oppenhiem, A.V., Willsky, A.S. & Nawab, S.H., 2015. *Signals and systems*, Pearson.

REFERENCES:

1. Lathi, B.P., 2009. *Principles of Linear Systems and Signals,* Oxford University Press.
2. Ziemer, R.E., Tranter, W.H. & Fannin, D.R., 1993. *Signals and systems: continuous and discrete*, Macmillan College.
3. John Alan Stuller, 2007, *An Introduction to Signals and Systems*, Thomson.

AD1381 DATA STRUCTURES AND ALGORITHMS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

To enable the students to

- Implement the linear Data structures Array, List, Stack and Queue
- Implement non-linear Data Structures – Trees for problem solving
- Implement non-linear Data Structures – Graph for problem solving
- Implement various sorting and searching algorithms.
- Apply appropriate hash functions in a Hash ADT for collision free data storage and retrieval

LIST OF EXPERIMENTS

1. Implementation of List ADT using array and Linked list.
2. Implementation of Stack ADT using array and linked list.
3. Application of Stack - Conversion of infix expression into postfix expression.
4. Implementation of Queue ADT using array and linked list
5. Implementation of Binary Search Tree ADT
6. Implementation of Graph ADT using adjacency matrix and Graph traversal algorithms
7. Implementation of Linear search and binary search algorithms
8. Implementation of Bubble sort and Insertion sort Algorithms
9. Implementation of collision techniques in hashing.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon successful completion of course, the students will be able to

CO1 Make use of linear Data structures Array, List, Stack and Queue to solve problems.

CO2 Apply non-linear Data Structures - Trees for problem solving.

CO3 Make use of non-linear Data Structures - Graph for problem solving

CO4 Utilize various sorting and searching algorithms to solve problems.

CO5 Apply appropriate hash functions in a Hash ADT for collision free data storage and retrieval

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 250 GB, 1 GB RAM)	30
2.	Printer	1
3.	Server (Intel Core i3, 4 GB RAM) (High Speed Processor)	1
4.	Compilers: C / C++	30 users

EC1311 DIGITAL CIRCUITS AND DEVICES LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

The course will enable learners to

- To design and implement the Combinational logic circuits
- To design and implement the sequential logic circuits
- To learn the characteristics of basic electronic devices such as Diode, BJT,FET, SCR
- To analyze the characteristics of rectifiers with and without filters.
- To illustrate basic digital gate operation using Transistor-Transistor Logic (TTL) family.

LIST OF EXPERIMENTS

Digital Circuits Experiments:

1. Verification of Boolean Theorems using basic gates
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters
3. Design and implementation of Half/Full Adder and Subtractor
4. Design and implementation using MSI Devices
   a. 4 – bit binary adder / subtractor
   b. Full Adder using Multiplexers
5. Design and implementation of encoder, decoder, Multiplexer and De-multiplexer logic gates
6. Design and implementation of Shift register (SISO, SIPO, PIPO) using Flip flops
7. Design and implementation of Asynchronous and Synchronous counters (Up/ Down and Mod)

Electronic Devices Experiments:

1. Characteristics of PN Junction diode and Zener diode & Regulator using Zener diode
2. Characteristics of BJT (Common Emitter/ Common base)
3. Characteristics of FET
4. Characteristics of SCR
5. Design of NAND and NOR gates using Transistors
6. Development of DC power supply circuits using devices in PCB – Mini Project

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon successful completion of course, the students will be able to

CO1 Build different combinational circuits.

CO2 Experiment with various sequential circuits.

CO3 Illustrate the working of basic electronic devices such as PN junction diode and Zener diode by plotting its characteristic curves.

CO4 Explain the working of electronic devices such as Transistors, FET and SCR in various modes and configurations.

CO5 Illustrate the various Modes in V-I Characteristics of SCR.

HS1321 INTERPERSONAL SKILLS - LISTENING AND SPEAKING

L	T	P	C
0	0	2	1

OBJECTIVES:

The course will enable learners to

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations

UNIT I LISTENING AS A KEY SKILL 6

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification - Improving pronunciation– pronunciation basics — stressing syllables and speaking clearly – intonation patterns – conversation starters: small talk.

UNIT II LISTEN TO A PROCESS INFORMATION 6

Listen to a process information- give information, as part of a simple explanation — taking lecture notes – preparing to listen to a lecture – articulate a complete idea as opposed to producing fragmented utterances - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics

UNIT III LEXICAL CHUNKING 6

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk – greet – respond to greetings – describe health and symptoms – invite and offer – accept – decline – take leave – listen for and follow the gist- listen for detail

UNIT IV GROUP DISCUSSION 6

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade- negotiate disagreement in group work**.**

UNIT V GROUP & PAIR PRESENTATIONS 6

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and interactive communication – group/pair presentations

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1 Develop their communicative competence in English with specific reference to listening

CO2 Prepare conversation with reasonable accuracy

CO3 Apply lexical Chunking for accuracy in speaking

CO4 Demonstrate their ability to communicate effectively in GDs.

CO5 Explain directions and instructions in academic and business contexts

TEXT BOOKS:

1. Brooks, Margret, 2011, *Skills for Success. Listening and Speaking. Level 4,* Oxford University Press, Oxford.
2. Richards, C, Jack& David Bholke, 2010, *Speak Now Level 3,* Oxford University Press, Oxford.

REFERENCES:

1. Bhatnagar, Nitin & Mamta Bhatnagar, 2010, *Communicative English for Engineers and Professionals,* Pearson, New Delhi.

2. Hughes, Glyn & Josephine Moate, 2014, *Practical English Classroom,* Oxford University Press, Oxford.
3. Vargo, Mari, 2013, *Speak Now Level 4*, Oxford University Press, Oxford.
4. Richards, C, Jack, 2006, *Person to Person (Starter)*, Oxford University Press, Oxford.
5. Ladousse, Gillian Porter, 2014, *Role Play*. Oxford University Press, Oxford.

WEB RESOURCES:

1. https://www.cambridge.org/elt/blog/wp-content/uploads/2019/10/Learning-Language-in-Chunks.pdf
2. https://english.eagetutor.com/english/628-how-to-greet-your-boss-people-in-office.html
3. https://www.groupdiscussionideas.com/group-discussion-topics-with-answers/
4. https://www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness/unit3presentations/1opening.shtml

SEMESTER – IV

MA1401 PROBABILITY AND RANDOM PROCESSES

L	T	P	C
3	1	0	4

OBJECTIVES:

The course will enable learners to

- To describe about probability, random variables and introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To introduce the concepts of two dimensional random variables.
- To make them understand the basic concepts of random processes for applications such as random signals, linear systems in communication engineering.
- To make them understand the concepts of correlation and spectral densities.
- To illustrate the concepts of Linear system with random inputs.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – The axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Distributions: Binomial, Poisson, Uniform, Exponential and Normal.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of Random Variables- Central limit theorem.

UNIT III RANDOM PROCESSES 12

Classification – Stationary process – Markov process : Markov chain -Transition Probability Matrix– Chapman Kolomogrov Equations: Calculation of n step transition Probability, limiting Probability - Classification of States of a Markov Chain - Poisson process – Properties – Semi Random telegraph process - Random telegraph process.

UNIT IV CORRELATION AND SPECTRAL DENSITIES 12

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 12

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and Cross correlation functions of input and output.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to

CO1 Apply the concepts of probability, continuous and discrete random variables using various probability distributions.

CO2 Compute the correlation between two variables and linear regression equation for a set of data.

CO3 Make use of probability concepts in classifying the random processes.

CO4 Interpret the auto correlation and spectral densities of different signals in the random processes.

CO5 Apply the concepts of the linear system in communication Engineering.

TEXT BOOKS:

1. Oliver C Ibe, 2014, *Fundamentals of Applied Probability and Random Processes*, 2nd Edition, Elsevier.
2. Peebles, P Z 2002, *Probability, Random Variables and Random Signal Principles,* 4th Edition, Tata McGraw Hill, New Delhi.

REFERENCES:

1. Cooper, G R, & McGillem, C D, 2012, *Probabilistic Methods of Signal and System Analysis*, 3rd Indian Edition, Oxford University Press, New Delhi.
2. Hwei Hsu 2014, *Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes*, 3rd Edition, Tata McGraw Hill Education, New Delhi.
3. Miller, S L, & Childers, D G, 2004, *Probability and Random Processes with Applications to Signal Processing and Communications*, Academic Press.
4. Stark, H, & Woods, J W, 2012, *Probability and Random Processes with Applications to Signal Processing*, 4th Edition, Pearson Education, Asia**.**
5. Yates, R D, & Goodman D J, 2014, *Probability and Stochastic Processes*, 3rd Edition, Wiley, India.

WEB REFERENCES:

1. Probability and Random Processes, 2nd Edition (wordpress.com)
2. Probability Random Variables and Random Signal Principles Peebles 4th.pdf (engzenon.com)
3. probww.dvi

EC1401 COMMUNICATION THEORY

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To introduce the concepts of amplitude modulations and their spectral analysis
- To understand the generation and detection methods of frequency modulation
- To introduce random processes and their characteristics
- To understand noise impact on modulations
- To introduce analog to digital conversion techniques.

UNIT I AMPLITUDE MODULATION 9

Amplitude Modulation-DSBSC, DSBFC, SSB, VSB -Modulation index, Spectra, Power relations and Bandwidth –AM Generation –Square law and Switching modulator, DSBSC Generation – Balanced and Ring Modulator, SSB Generation –Filter, Phase Shift and Third Methods, VSB Generation –Filter Method, Hilbert Transform, Pre-envelope & complex envelope –comparison of different AM techniques, Superheterodyne Receiver

UNIT II ANGLE MODULATION 9

Phase and frequency modulation, Narrow Band and Wide band FM –Modulation index, Spectra, Power relations and Transmission Bandwidth -FM modulation –Direct and Indirect methods, FM Demodulation –FM to AM conversion, FM Discriminator

UNIT III RANDOM PROCESS 9

Random variables, Random Process, Stationary Processes, Mean, Correlation & Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random Process Through a LTI filter.

UNIT IV NOISE CHARACTERIZATION 9

Noise sources –Noise figure, noise temperature and noise bandwidth –Noise in cascaded systems. Representation of Narrow band noise –In-phase and quadrature, Envelope and Phase –Noise performance analysis in AM &FM systems –Threshold effect and capture effect , Pre-emphasis and de-emphasis for FM.

UNIT V SAMPLING & QUANTIZATION 9

Low pass sampling –Aliasing-Signal Reconstruction-Quantization -Uniform & non-uniform quantization -quantization noise -Logarithmic Companding –PAM, PCM –TDM, FDM.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of course, the students will be able to

CO1 Illustrate the generation and detection methods of amplitude modulation schemes with its spectral characteristics.

CO2 Explain NBFM and WBFM with its generation and detection methods.

CO3 Make use of the probability, random process and noise theory concepts

CO4 Compare the noise performance of various analog modulation schemes.

CO5 Explain the principles of sampling and quantization.

TEXT BOOKS:

1. Simon Haykin, 2014, *Communication Systems*, 4th Edition, Wiley. (UNIT I-V).

REFERENCES:

1. J.G.Proakis & M.Salehi, 2014, *Fundamentals of Communication Systems, Pearson Education*. (UNIT I-IV).
2. B.P.Lathi, 2007, *Modern Digital and Analog Communication Systems*, 3rd Edition, Oxford University Press.
3. D.Roody, J.Coolen, 2006, *Electronic Communications*, 4th edition PHI.

EC1402 DISCRETE TIME SIGNAL PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To learn discrete Fourier transform, properties of DFT and its application to linear filtering.
- To understand the characteristics of digital filters, design digital IIR filters and apply these filters to filter undesirable signals in various frequency bands.
- To learn the characteristics of digital filters, design digital FIR filters.
- To understand the effects of finite precision representation on digital filters.
- To introduce the concepts of Digital Signal Processors

UNIT I DISCRETE FOURIER TRANSFORM 9

Review of signals and systems, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT).

UNIT II INFINITE IMPULSE RESPONSE FILTERS 9

Characteristics of practical frequency selective filters, characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

UNIT III FINITE IMPULSE RESPONSE FILTERS 9

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations, polyphase realization

UNIT IV FINITE WORD LENGTH EFFECTS 9

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

UNIT V MULTIRATE SIGNAL PROCESSING 9

Introduction to multirate signal Processing – Decimation, Interpolation – Polyphase decomposition of FIR filter – Multistage implementation of sampling rate conversion – Design of narrowband filters – Applications of Multirate signal Processing – Design of Phase shifters, Subband coding

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of course, the students will be able to

CO1 Solve Discrete Fourier Transform (DFT) and Fast Fourier transform (FFT) of any discrete time sequences.

CO2 Construct digital Butterworth and Chebyshev IIR filters using backward difference, impulse invariant and bilinear transformation methods.

CO3 Construct FIR filters using Fourier series, windowing and frequency sampling methods.

CO4 Identify the finite word length effects in IIR filters.

CO5 Explain different architectures of Digital Signal Processors with its functionalities.

TEXT BOOKS:

1. John G. Proakis & Dimitris G.Manolakis, 2007. *Digital Signal Processing - Principles, Algorithms & Applications*, Fourth Edition, Pearson Education / Prentice Hall.

REFERENCES:

1. Emmanuel C. Ifeachor & Barrie. W. Jervis, 2002. *Digital Signal Processing*, Second Edition, Pearson Education / Prentice Hall.
2. A. V. Oppenheim, R.W. Schafer & J.R. Buck, 2004. *Discrete-Time Signal Processing*, 8th Indian Reprint, Pearson.
3. Sanjit K. Mitra, 2007. *Digital Signal Processing – A Computer Based Approach*, Tata McGraw Hill.
4. Andreas Antoniou, 2006. *Digital Signal Processing*, Tata McGraw Hill.

EC1403 ELECTRONIC CIRCUITS - I

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To understand the methods of biasing transistors
- To design and analyze single stage and multistage amplifier circuits
- To analyze the frequency response of small signal amplifiers
- To analyze the power amplifiers.
- To troubleshoot and fault analysis of power supplies

UNIT I BIASING OF DISCRETE BJT, JFET AND MOSFET 9

BJT-Need for biasing- DC Load line, operating point - DC analysis of Transistor circuits- Various biasing methods for BJT- Bias Circuit Design -Thermal stability - Stability factors- Bias compensation using Diode, thermistor and sensistor - JFET-DC Load Line and Bias Point - Various biasing methods of JFET-JFET Bias Circuit Design- MOSFET Biasing -Biasing FET Switching Circuits.

UNIT II BJT AMPLIFIERS 9

Small Signal Hybrid π equivalent circuit of BJT - Early effect - Analysis of CE, CC and CB amplifiers using Hybrid π equivalent circuits- AC Load Line Analysis -Darlington Amplifier - Bootstrap technique- Cascade, Cascode configurations- Differential amplifier, Constant current source, Basic BJT differential pair amplifier - Small signal analysis and CMRR.

UNIT III SINGLE STAGE FET, MOSFET AMPLIFIERS 9

Small Signal Hybrid π equivalent circuit of FET and MOSFET - Analysis of CS, CD and CG amplifiers using Hybrid π equivalent circuits - Basic FET differential pair amplifier - BiCMOS circuits.

UNIT IV FREQUENCY RESPONSE OF AMPLIFIERS 9

Amplifier frequency response - Frequency response of transistor amplifiers with circuit Capacitors - BJT frequency response- Short circuit current gain- Alpha Cut off frequency, Beta Cut off frequency and unity gain bandwidth - Miller effect - Frequency response of FET - High frequency analysis of CE and MOSFET CS amplifier - Transistor Switching Times.

UNIT V POWER AMPLIFIERS AND ELECTRONIC DEVICE TESTING 9

Power amplifiers- class A-Class B-Class AB-Class C-Power MOSFET-Temperature Effect-Class AB Power amplifier using MOSFET-Power Supply Performance and Testing - Troubleshooting and Fault Analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of course, the students will be able to

CO1 Elucidate the different biasing circuits in amplifiers using BJT and FET.

CO2 Summarize about how small signal models are needed in various configurations of BJT and its simple, cascade and cascade amplifier circuits.

CO3 Identify the significance of JFET and MOSFET amplifiers using small signal analysis.

CO4 Interpret the low, high frequency response of amplifiers and to derive cut off frequencies for determining bandwidth.

CO5 Illustrate the performance of power amplifiers.

TEXT BOOKS:

1. Donald A Neaman, 2012, *Semiconductor Physics and Devices*, 4th Edition, Tata McGraw Hill Inc.

REFERENCES:

1. Salivahanan & N. Suresh Kumar, 2017, *Electronic Devices and Circuits*, 4th Edition, McGraw Hill Education (India) Private Ltd.
2. Millman J, Halkias.C. & SathyabradaJit, 2015, *Electronic Devices and Circuits*, 4th Edition, McGraw Hill Education (India) Private Ltd.
3. Robert Boylestad & Louis Nashelsky, 2008, *Electron Devices and Circuit Theory*, 10th Edition, Pearson Prentice Hall.
4. Floyd, 2012, *Electronic Devices*, 9th Edition, Pearson Education.
5. David A. Bell, 2008, *Electronic Devices & Circuits*, 5th Edition, Oxford University Press.
6. Rashid M, 2007, *Microelectronics Circuits*, Thomson Learning

EC1404 LINEAR INTEGRATED CIRCUITS

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To introduce the basic building blocks of linear integrated circuits.
- To learn the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of analog multipliers and PLL.
- To learn the theory of ADC and DAC.
- To introduce the concepts of waveform generation and introduce some special function ICs.

UNIT I BASICS OF OPERATIONAL AMPLIFIERS 9

Current mirror and current sources, Current sources as active loads - Voltage sources, Voltage References - Basic information about op-amps – Ideal Operational Amplifier – General operational amplifier stages - DC and AC performance characteristics, slew rate - Open and closed loop configurations - JFET Operational Amplifiers - Features of TL082.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

UNIT III ANALOG MULTIPLIER AND PLL 9

Analog Multiplier using Emitter Coupled Transistor Pair – Gilbert Multiplier cell – Variable transconductance technique - Analog multiplier ICs and their applications - Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator - Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronisation.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS 9

Analog and Digital Data Conversions, D/A converter, specifications – weighted resistor type - R-2R Ladder type, Voltage Mode and Current-Mode – switches for D/A converters - high speed sample and hold circuits, A/D Converter specifications – Flash type – Successive Approximation type – Single Slope type – Dual Slope type – A/D Converter using Voltage to Time Conversion – Over sampling A/D Converters, Sigma Delta converters.

UNIT V WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS 9

Sine-wave generators - Multivibrators - Triangular wave generators, Saw-tooth wave generator - ICL8038 function generator - Timer IC 555, Latch - IC Voltage regulators, Three terminal fixed and adjustable voltage regulators, IC 723 general purpose regulator, Monolithic switching regulator, Low Drop Out (LDO) Regulators, Four quadrant power supply – Switched capacitor filter IC MF10 - Frequency to Voltage and Voltage to Frequency converters - Audio Power amplifiers - Video Amplifiers - Isolation Amplifiers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of course, the students will be able to

CO1 Outline the basic building blocks of Analog ICs such as Current mirror & Current sources, Voltage sources & Voltage References, along with the internal circuitry of op amp-IC 741.

CO2 Utilize the concepts of op amp for developing linear and non linear circuits.

CO3 Explain various types of analog multiplier and PLL ICs with their applications.

CO4 Interpret various A/D and D/A converters using operational amplifiers.

CO5 Build various waveform generators and other circuits using operational amplifier, IC 555 and special function ICs.

TEXT BOOKS:

1. D.Roy Choudhry, Shail Jain, 2018 *Linear Integrated Circuits*, Fifth Edition, New Age International Pvt. Ltd.
2. S.Salivahanan, V.S.Kanchana Bhaaskaran, 2015, *Linear Integrated Circuits*, Second Edition, TMH.

REFERENCES:

1. Ramakant A. Gayakwad, 2008, *Op-amps and linear integrated circuit technology*, 4th Edition, Pearson Education.
2. R. Coughlin, F. Driscoll, 2001, *Operational Amplifiers and Linear Integrated Circuits*, 6th Edition, PHI Publishers.
3. Sergio Franco, 2016, *Design with Operational Amplifiers and Analog Integrated Circuits*, 4th Edition, Tata MC Graw Hill.

EE1471 CONTROL SYSTEMS ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approaches for the state variable analysis.

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION 9

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchros -Multivariable control system

UNIT II TIME RESPONSE ANALYSIS 9

Standard Inputs - Transient response& Steady state response-Measures of performance of the standard first order and second order system- Effect on an additional zero and an additional pole- Steady error constant and system type number-PID control-Analytical design for PD, PI,PID control systems.

UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS 9

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation.

UNIT IV CONCEPTS OF STABILITY ANALYSIS 9

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of course, the students will be able to

CO1 Identify the various control system components and their representations.

CO2 Analyze the various time domain parameters.

CO3 Analysis the various frequency response plots and its system.

CO4 Apply the concepts of various system stability criterions.

CO5 Design various transfer functions of digital control system using state variable models.

TEXT BOOKS:

1. M.Gopal, 2012. *Control System – Principles and Design*, 4th Edition, Tata McGraw Hill.

REFERENCE BOOKS:

1. J.Nagrath & M.Gopal, 2007. *Control System Engineering*, 5th Edition, New Age International Publishers.
2. K. Ogata, 2012. *Modern Control Engineering*, 5th edition, PHI.
3. S.K.Bhattacharya, 2013. *Control System Engineering*, 3rd Edition, Pearson.
4. Benjamin.C.Kuo, 1995. *Automatic control systems*, 7th Edition, Prentice Hall of India.

EC1411 DIGITAL SIGNAL PROCESSING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

The course will enable learners to

- To perform basic signal processing operations such as Linear Convolution, Circular
- Convolution, Auto Correlation, Cross Correlation and Frequency analysis in MATLAB
- To implement FIR and IIR filters in MATLAB and DSP Processor
- To study the architecture of DSP processor
- To design a DSP system to demonstrate the Multi-rate and Adaptive signal processing concepts

LIST OF EXPERIMENTS

I MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Generation of elementary Discrete-Time sequences
2. Convolution and Correlation
3. Frequency Analysis using DFT and FFT
4. Sampling and the effect of aliasing
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filter operations
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrates the filter operations
7. Implement multirate filters

II DSP PROCESSOR BASED IMPLEMENTATION

8. Study of architecture of Digital Signal Processor
9. Perform MAC operation using various addressing modes
10. Generation of various signals
11. Design and demonstration of FIR filter for Low pass, High Pass, Band Pass and Band Stop Filtering
12. Design and demonstration of Butterworth and Chebyshev IIR filters for Low pass, High Pass, Band Pass and Band Stop Filtering
13. Implement an Up-sampling and Down-sampling operation in DSP processor

III MINI PROJECT

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon successful completion of course, the students will be able to

CO1 Develop MATLAB code for generating mathematical signals and various signal processing operations like linear &circular convolution and correlation.

CO2 Analyze the spectral components present in the discrete time signals using Discrete Fourier Transform.

CO3 Analyze FIR and IIR Filters using MATLAB.

CO4 Describe the architecture of Digital Signal Processor.

CO5 Construct various signal processing operations using Digital Signal Processor

EC1412 LINEAR INTEGRATED CIRCUITS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

The course will enable learners to

- To understand the basics of linear integrated circuits and available ICs.
- To understand characteristics of operational amplifier.
- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function IC.
- To get exposed to SPICE software for circuit design

LIST OF EXPERIMENTS

HARDWARE IC BASED EXPERIMENTS:

1. Inverting, Non inverting and Differential amplifiers.
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Active low-pass, High-pass and band-pass filters.
5. Astable & Monostable multivibrators and Schmitt Trigger using op-amp.
6. Phase shift and Wien bridge oscillators using op-amp.
7. Triangular and sawtooth Waveform Generator using op-amp.

8. Astable and monostable multivibrators using NE555 Timer.
9. PLL characteristics and its use as Frequency Multiplier.
10. DC power supply using LM317 and IC723.

SIMULATION USING SPICE:

1. Amplifiers using opamp
2. Active Filters using op-amp
3. Astable and Monostable Multivibrator using opamp and NE555 Timer.
4. Implementation of DA converter using MULTISIM.
5. Astable & Monostable multivibrators and Schmitt Trigger using op-amp in MULTISIM.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon successful completion of course, the students will be able to

CO1 Design filters, amplifiers and oscillators using operational amplifiers.

CO2 Analyze the working of PLL and describe its application as a frequency multiplier.

CO3 Design DC power supply using ICs.

CO4 Analyze the performance of filters, multivibrators, converters and analog multiplier using SPICE

CO5 Design and analyze multivibrators using opamps and 555 Timer ICs.

HS1421 AN INTRODUCTION TO ADVANCED READING AND WRITING

L	T	P	C
0	0	2	1

OBJECTIVES:

The course will enable learners to

- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing
- To develop their critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

UNIT I EFFECTIVE READING 6

Reading – Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and

title. Reading-Read for details-Use of graphic organizers to review and aid comprehension.

UNIT II CRITICAL READING 6

Reading– Understanding pronoun reference and use of connectors in a passage- speed reading techniques. Reading– Genre and Organization of Ideas- Reading– Critical reading and thinking-understanding how the text positions the reader.

UNIT III PARAGRAPH WRITING 6

Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence.-Write a descriptive paragraph Writing-State reasons and examples to support ideas in writing– Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT IV ESSAY WRITING 6

Writing– Elements of a good essay - Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT V EFFECTIVE WRITING 6

Writing– Email writing- visumes – Job application- Report Writing - Project writing-Writing convincing proposals

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1 Understand how the text positions the reader

CO2 Develop critical thinking while reading a text

CO3 Develop a descriptive paragraph

CO4 Make use of sentence structures effectively when creating an essay.

CO5 Demonstrate proper usage of grammar in writing E-Mails, Job application and project proposals

TEXT BOOKS:

1. Gramer, F, Margot & Colin, S, Ward, 2011, *Reading and Writing (Level 3)* Oxford University Press, Oxford.
2. Debra Daise, CharlNorloff, and Paul Carne, 2011, *Reading and Writing (Level 4)* Oxford University Press: Oxford.

REFERENCE BOOKS:

1. Davis, Jason & Rhonda LIss. 2006 *Effective Academic Writing (Level 3)* Oxford University Press: Oxford.
2. E. Suresh Kumar and et al. 2012, *Enriching Speaking and Writing Skills,* Second Edition, Orient Black swan: Hyderabad.
3. Withrow, Jeans and et al. 2004 *Inspired to Write. Readings and Tasks to develop writing skills*, Cambridge University Press: Cambridge.
4. Goatly, Andrew, 2000 *Critical Reading and Writing*, Routledge: United States of America.
5. Petelin, Roslyn & Marsh Durham, 2004 *The Professional Writing Guide: Knowing Well and Knowing Why*, Business & Professional Publishing: Australia.

WEB RESOURCES:

- http://learnenglishteens.britishcouncil.org/skills/reading
- https://learnenglish.britishcouncil.org/skills/reading
- https://www.readingrockets.org/article/25-activities-reading-and-writing-fun
- https://linguapress.com/advanced.htm