COURSE STRUCTURE(R20)
AND
DETAILED SYLLABUS (II YEAR)

ELECTRONICS & COMMUNICATION ENGINEERING

For
B.Tech., Four Year Degree Course
(Applicable for the batches admitted from 2020-21)

LENDI INSTITUTE OF ENGINEERING AND TECHNOLOGY
An Autonomous Institution
Approved by AICTE & Permanently Affiliated to JNTUK, Kakinada
Accredited by NAAC with "A" Grade and NBA (CSE, ECE, EEE & ME)
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Electronics and Communication Engineering							
II Year - I Semester							
S. No.	**Course code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1	R20BSH-MA2101	Complex Variables and Random Variables	BS	3	0	0	3
2	R20CSE-ES2102	Data Structures With 'C'	ES	3	0	0	3
3	R20ECE-PC2101	Electronic Devices and Circuits	PC	3	0	0	3
4	R20ECE-PC2102	Signals and Systems	PC	3	0	0	3
5	R20BSH-HM2101	Managerial Economics and Financial Accountancy	HM	3	0	0	3
6	R20CSE-ES2103	Data Structures With 'C' Laboratory	ES	0	0	3	1.5
7	R20ECE-PC2103	Electronic Devices and Circuits Laboratory	PC	0	0	3	1.5
8	R20ECE-PC2104	Signals and Systems Laboratory	PC	0	0	3	1.5
9	R20ECE-SC2101	Printed Circuit Board Designing Lab (Skill Oriented Course)	SC	1	0	2	2
10	R20BSH-MC2102	Essentials of Indian Tradition Knowledge	MC	2	0	0	0
11	R19ECE-MC2103	MOOCS-1	MC	0	0	0	0
12	R20BSH-MC1203	Community Service Project (Evaluation)	MC	0	0	0	0
		Total		**18**	**0**	**11**	**21.5**
II Year - II Semester							
S. No.	**Course code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1	R20ECE-PC2201	Analog Communication	PC	3	0	0	3
2	R20ECE-PC2202	Analog Circuits	PC	3	0	0	3
3	R20EEE-PC2203	Control Systems	PC	3	0	0	3
4	R20ECE-PC2203	Digital Logic Design	PC	3	0	0	3
5	R20ECE-PC2204	Electro Magnetic Waves and Transmission Lines	PC	3	0	0	3
6	R20ECE-PC2205	Analog Communication Laboratory	PC	0	0	3	1.5
7	R20ECE-PC2206	Analog Circuits Laboratory	PC	0	0	3	1.5
8	R20ECE-PC2207	Digital Logic Design Laboratory	PC	0	0	3	1.5
9	R20BSH-SC2202	Employability Skills -1 (Skill Oriented Course)	SC	1	0	2	2
10	R20ECE-MC2201	Pulse and Digital Circuits	MC	3	0	0	0
11	R20ECE-MC2201	MOOCS-2	MC	0	0	0	0
			Total	**19**	**0**	**11**	**21.5**
Honors Course -1/Minor Course-1							
Summer Internship-1(After Second Year & Evaluated in III-I Semester)							

**The Eligible students who opted the courses for B.Tech with Honors/Minor only*

Note:L-Lecture, T-Tutorial, P-Practical, C-Credits

II Year –I Semester(ECE)

Subject Code	Subject Name	L	T	P	C
R20BSH-MA2101	Complex Variables and Random Variables	3	0	0	3

Course Objectives:

- To familiarize the learners with concepts of complex variables.
- To impart knowledge in basic concepts and few techniques in probability and statistics in relation to the engineering applications.

Course Outcomes:

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

1. Examine the analyticity of complex functions. (L3)
2. Evaluate complex integration using Cauchy's theorems and Cauchy's residue theorem. (L3)
3. Compute probabilities, theoretical frequencies using discrete and continuous probability distributions for real data. (L3)
4. Compute statistical averages for simple probabilistic problems with single random variable
5. Compute statistical averages for simple probabilistic problems with multiple random variables.

UNIT I

Complex Variables and Analytic Functions: Functions of a complex variable, continuity, differentiation, analytic functions, Cauchy-Riemann equations, Milne-Thompson method, harmonic functions, harmonic conjugate.

Applications: Flow problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- examine continuity and differentiability for complex functions. (L2)
- determine the analyticity using Cauchy-Riemann equations to complex functions. (L3)
- find the analytic function using Milne-Thompson method. (L3)

UNIT II

Complex Integration(All theorems without proofs)**:** Contour integrals, Cauchy theorem, Cauchy integral formula, Taylor's series, Laurent's series, zeros of analytic functions, singularities, residues, Cauchy residue theorem.

Applications: Evaluation of integrals of the type (a) Improper real integrals $\int_0^{2\pi} f(\cos\theta, \sin\theta)d\theta$ (b) $\int_{-\infty}^{\infty} f(x)dx$

Learning Outcomes:

At the end of this unit, the student will be able to

- evaluate the Taylor and Laurent expansions of simple functions.(L2)
- determine the nature of the singularities of an analytic function. (L2)
- find the residues of an analytic function. (L2)
- apply Cauchy residue theorem to evaluate improper real integrals. (L3)

UNIT III

Random Variables: Probability(Read only) : Introduction, probability axioms, addition law and multiplicative law of probability, conditional probability.

Random Variables: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties.

Learning Outcomes:

At the end of this unit, the student will be able to

- evaluate the probabilities of events on various random experiments. (L3)

- apply Baye's theorem to real time problems related to conditional probabilities.(L3)
- differentiate the properties in discrete and continuous probability distribution. (L2)
- apply Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies. (L3)
- interpret the properties of normal distribution and its applications. (L2)

Unit IV

Operation on One Random Variable - Expectations: (Theorem and properties with out proofs) : Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance, Skewness and covariance, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable.

Learning Outcomes:

At the end of this unit, the student will be able to

- evaluate mean and variance of discrete and continuous probability distributions.(L2)
- determine the statistical parameters for discrete and continuous probability distributions with moment generating function. (L3)
- Transforms of a Random Variable with Monotonic and Non-monotonic Transformations of Continuous Random Variable.

Unit V

Multiple Random Variables:(theorems and properties without proofs): Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions.

Operations on Multiple Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the properties of Joint, Marginal and Conditional Distributions to the probabilistic problems.
- Calculate the probability density functions for sums of independent random variables.
- Calculate the conditional probability density function and conditional probability distribution function for continuous random variables.
- Solve expected value problems using the property of expectation of sums of random.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44/e, 2017.
2. Veerarajan T., Probability, Statistics and Random Processes, 3rd edition, Tata McGraw-Hill, New Delhi, 2008.
3. Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles,TMH, 4th Edition,2001.
4. Probability, Random Variables and Stochastic Processes, Athanasios Papoulisand S.Unnikrisha, PHI, 4th Edition,2002.

References:

1. Erwin kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7/e, Mc-Graw Hill, 2004.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

4. Murray R. Spiegel,Seymour Lipschutz, John J. Schiller , Dennis Spellman, Schaum's Outline of Complex Variables, 2ed (Schaum's Outlines) 2nd Edition.
5. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying E. Ye, Probability and Statistics for Engineers and Scientists, 9th Edition, Pearson.
6. Miller and Freunds, Probability and Statistics for Engineers, 7/e, Pearson, 2008.
7. S. C. Guptha and V. K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand and Sons Publications, 2012.

II Year –I Semester(ECE)

Subject Code	Subject Name	L	T	P	C
R20CSE-ES2102	Data Structures With 'C'	3	0	0	3

Course Objectives:

- Describe to algorithmic complexities, recursive algorithms, searching and sorting techniques.
- Applying stack and queue techniques for logical operations
- Describe to list representation models in various types of applications
- Implementation of tree implementation in various forms
- Describe orientation on graphs, representation of graphs, graph traversals, spanning trees

Course Outcomes:

1. Analyze different searching and sorting Techniques.
2. Apply the concepts of stacks and queues in real time applications
3. Analyze concepts of linked lists and with their implementation of different Linked Lists
4. Analyze the non linear data structures trees and their operations
5. Evaluating concepts of graphs and their applications

Unit 1:

Data structure- Definition, types of data structures, Recursion: Definition, Design Methodology and Implementation of recursive algorithms, recursive algorithms for factorial function, GCD computation, Fibonacci sequence, Towers of Hanoi.

Search Techniques: List Searches using Linear Search and Binary Search.

Sorting Techniques: Basic concepts, Sorting by: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort :Iterative Merge Sort, Recursive Merge Sort, Heap Sort.

Learning Outcomes: student will be able to

- Describe algorithms and its analysis procedure (L2).
- Analyze sorting techniques (L4).
- Analysis procedure of search (L4).

Applications: Social Graphs, Knowledge Graphs, Recommendation Engines, Path Optimization Algorithms, sort sets of data that are too large to be loaded entirely into memory, sort is used in programming TV remote to sort channels on the basis of longer viewing time.

Unit 2:

Stacks and Queues: ADT concept, Linear List ADT, Basic Stack Operations, Representation of a Stack using Arrays, Stack Applications: Reversing list, Infix to postfix Transformation, Infix to prefix Transformation, Evaluating Arithmetic Expressions.

Queues: Basic Queues Operations, Representation of a Queue using array, Implementation of Queue Operations using Stack, Applications of Queues, Circular Queues.

Learning Outcomes: Student will be able to

- Understand working process of stack and Queue (L2)
- Evaluating Arithmetic Expressions (L5)
- Apply Transformation of infix to postfix conversion (L3)

Applications: Language processing, Recursive processes, A stack of plates/books in a cupboard, Wearing/Removing Bangles

Unit 3:

Linked Lists: Data structures- Linked representation, Singly linked lists : insertion, deletion, search and Traversal operations, implementation of polynomial, stack and Queue using Single Linked List, doubly linked lists: insertion, deletion and traversal operations, circular lists.

Learning Outcomes: Student will be able to

- Understand the linked list process (L2).
- Analyze operation on different Linked lists (L4).
- Apply linked list into polynomial expressions (L3).

Applications: Adjacency list representation of graphs, Dynamic memory allocation: We use linked list of free blocks, maintaining directory of names.

Unit 4:

Trees: Basic tree concepts, Binary Trees: Properties, Representation of Binary Trees using arrays and linked lists, operations on a Binary tree , Binary Tree Traversals (recursive),Creation of binary tree from in, pre and post order traversals, Binary search tree: Basic concepts, BST operations: insertion, deletion, Threaded Binary Trees.

Learning Outcomes: Student will be able to

- Create Binary Tree using linked list and Arrays(L6)
- Analyze implementation of different Trees.(L4)
- Analyze different Operation of Binary Search Tree (L4)
- Create Binary tree from different Traversals(L6)

Applications: Used in Compilers, Ordered storage to be used in binary search, Decision trees, Binary Search Tree is a tree that allows fast search, insert, delete on a sorted data

Unit 5:

Graphs: Basic concepts, Representations of Graphs: using Linked list and adjacency matrix, Graph algorithms: Graph Traversals (BFS & DFS), Spanning Trees, Minimum Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm. Transitive closure, Single Source shortest Path: Dijkstra's Algorithm.

Learning Outcomes: Student will be able to

- Create the spanning tree from graphs(L6)
- Analyze implementation of Graph Traversals(L4)
- Create minimal spanning tree by using different algorithms(L6)

Applications: Networks to find best path in the Internet , Connecting with friends on social media, where each user is a vertex, and when users connect they create an edge, using GPS/Google Maps/Yahoo Maps, to find a route based on shortest route.

Text Books:

1. Data Structure with C, Seymour Lipschutz, TMH
2. Fundamentals of Data Structures in C++, Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, 2nd Edition, Universities Press (India) Pvt. Ltd.
3. Data Structures using C, Reema Thareja, Oxford
4. Data Structures, 2/e, Richard F, Gilberg , Forouzan, Cengage
5. Data structures and algorithm analysis in C, 2nd edition, mark Allen Weiss

Reference Books:

1. Data Structures and Algorithms, 2008,G.A.V.Pai, TMH
2. Classic Data Structures, 2/e, Debasis ,Samanta,PHI,2009
3. Fundamentals of Data Structure in C, 2/e, Horowitz, Sahni , Anderson Freed,University Prees

Subject Code	Subject Name	L	T	P	C
R20ECE-PC2101	Electronic Devices and Circuits Common to ECE & EEE	3	0	0	3

Course Objectives:

The main objectives of this course are:

- The principle of working and operation of BJT and FET and their characteristics are explained.
- Understand the concept of wave shaping circuits, switching characteristics of Diode and Transistor.
- Explain the need of Transistor Biasing and its significance.

Course Outcomes:

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

1. Understand the working principle of various Diodes. (L2).
2. Design the rectifier using Diodes with and without filters (L4).
3. Analyze the response of non linear wave shaping circuits for different signals (L4).
4. Apply transistors as an amplifier in different configurations(L3)
5. Identify the various stability parameters of a Bipolar Junction Transistor in different biasing methods (L3).

UNIT- I

Junction Diode Characteristics: Review of semi conductor physics: Fermi Dirac function, continuity equation, Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance, energy band diagram of PN junction Diode.

Special Semiconductor Diodes - Zener Diode, Tunnel Diode, LED

Applications: Detection signals, Lighting systems, switching systems.

Learning Outcomes:

At the end of this unit the student will be able to

1. Understand the construction and operation of diode and special type of diodes (L2).
2. Draw characteristics of diode in different configurations (L1).
3. Understand the energy Band variations through energy band spectrum (L2).

UNIT- II

Rectifiers and Filters: Basic Rectifier setup, half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter, Capacitor filter, comparison of various filter circuits in terms of ripple factors.

Applications: power supplies for radio, television and computer equipment,

Learning Outcomes:

At the end of this unit the student will be able to

1. Understand the construction and operation of diode application (L2).
2. Understand the working procedure of different rectifiers with and without filters (L1).
3. Find the efficiency of rectifier (L2).

UNIT – III

Non-Linear Wave Shaping: Diode Clippers, Clipping at two independent levels, Transfer Characteristics of Clippers, Emitter Coupled Clipper, Clamping Operation, Clamping Circuits using diodes with different inputs, Clamping circuit theorem,

Applications: TV transmitter and receiver for processing picture signals, noise eliminations applications, and power supplies.

Learning Outcomes:

At the end of this unit the student will be able to

1. Explain the basic concepts of Non- linear wave shaping circuits (L2).

2. Plot the response of different Clipper and Clamper circuits using Diodes & Transistors (L1).

UNIT- IV

Transistor Characteristics: BJT: Junction transistor, transistor current components, transistor current equation, transistor configurations, transistor as an amplifier, and characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values.

Special transistors: UJT, SCR operations

FET: FET types, construction, operation, characteristics, parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

Applications: regulators, switching devices, amplifiers and oscillators

Learning Outcomes:

At the end of this unit the student will be able to

1. Understand the construction and operation of BJT and FET (L2).
2. Draw the input and output characteristics of BJT and FET in different configurations (L1).
3. Compare the BJT, FET and MOSFET with respect to their parameters (L2).

UNIT- V

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 VBE, Ic, and β, Stability factors, (S, S' , S''), Bias compensation, Thermal runaway, Thermal stability.

Applications: gain controller devices, thermal stability

Learning Outcomes:

At the end of this unit the student will be able to

1. Explain the need of the BJT and FET biasing (L2).
2. Know how to do the load line analysis of transistor (L1).
3. Compare different biasing techniques (L2).
4. Understand the need of Thermal Stability (L2).

Text books

1. J. Millman, C.C.Halkias, "Millman's Integrated Electronics", Tata McGraw-Hill, 2nd Edition, 2001.
2. J. Millman, C.C.Halkias, Satyabrata Jit, ―Millman's Electronic Devices and Circuits‖, Tata McGrawHill, 2nd Edition, 1998.

Reference Books:

1. Sedha.R.S, "A Text Book of Applied Electronics‖, Sultan Chand Publishers",1st Edition, 2008
2. "Electron Devices and Circuits‖, S.K.Kataria & Sons", 2 nd Edition,2012. Salivahanan, N. Suresh Kumar,A. Vallavaraj
3. R L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuits‖, PEI/PHI", 9th edition, 2006.Gupta.J.B,
4. David A. Bell, ―Electronic Devices and Circuits‖, Oxford University Press ,5th Edition,2008

II Year –I Semester

Subject Code	Subject Name	L	T	P	C
R20ECE-PC2102	Signals and Systems	3	0	0	3

Course Objectives:

The main objectives of this course are given below:

- Explain the basic properties of signals and systems and identify the systems based on their properties
- Develop expertise in time domain and frequency domain approaches to the analysis of continuous and discrete systems through Fourier series and Fourier transform tools.
- Analyze the process of sampling and the effect of under sampling.
- Development of mathematical skills to solve problems involving convolution and correlation.
- Apply the Laplace transform as mathematical tool to convert time domain signals in to s-domain signals.
- Analyze DT systems & their realization using Z-transform.

Course Outcomes:

At the end of this course the student will able to:

1. Analyze the signal characteristics, operations on signals and system (L4).
2. Apply the Fourier transform to obtain the spectral characteristics of continuous time signals (L3).
3. Analyze the linear time invariant systems by applying the concepts of convolution and correlation (L4).
4. Use Laplace transform to obtain pole-zero plot with ROC for continuous time signals (L3).
5. Apply Z - transform to obtain pole-zero plot with ROC for discrete time signals (L3).

UNIT- I

Introduction to Signals & Systems: Definition of Signals and Systems, Classification of Signals, Basic continuous and discrete time signals (Exponential, Complex Exponential, Sinusoidal, impulse, step, signum, ramp, rectangular, triangular and sinc), basic operations on continuous and discrete time signals, Classification of Systems,

Fourier Series: Trigonometric Fourier series and Exponential Fourier series representation of continuous time periodic signals, Complex Fourier spectrum, Dirichlet's conditions, properties of Fourier series.

Applications:

1. Time division multiplexing, Radar signal analysis, Electromyography (EMG) signals analysis in clinical/biomedical applications, aircraft control surfaces such as the rudder or ailerons, Motion of the planets, the periodic behavior of the earth's climate and Multipath fading analysis.
2. Telecommunications, Automatic control systems, encoder/decoder, audio systems, Economic data, Biology and Medical image processing.
3. Frequency-selective & Frequency-shaping filtering in audio systems, Signal processing, Forensics, Acoustics, Oceanography, Sonar, Optics, Number theory, Heat distribution mapping and light simplification, Radiation measurements.

Learning outcomes:

At the end of this unit student will able to

1. Define basic continuous and discrete time signals mathematically and sketch the signals that involve simple modification of the independent/dependent variable (L2).
2. Familiar with commonly used signals such as the unit step, ramp, impulse function, sinusoidal signals and complex exponentials (L1).
3. Classify signals as continuous-time Vs. discrete-time, periodic Vs. non-periodic, energy signal Vs. power signal, odd Vs. Even etc. (L4).

4. Calculate the various characteristics of a signal such as even part, odd part, energy, power and period etc., (L3).
5. Construct or represent any arbitrary signal by using basic signals such as impulse and step signals (L3).
6. Test a given system for a linearity, causality, stability, time invariance, invertibility and memory properties (L3).
7. Analyze the systems according their properties (L4).
8. Determine the Fourier series coefficients for any periodic signal and plot the frequency spectrum of that periodic signal (L3).

UNIT –II

Fourier Transform and Sampling Theorem: Development of the Fourier transform representation of an aperiodic signal, Inverse Fourier transform, Fourier transform of standard signals, Fourier transforms involving impulse function and Signum function, Fourier transform of periodic signals, properties of Fourier transforms. Sampling theorem, signal reconstruction, aliasing, introduction to band pass sampling.

Applications:

1. Frequency-domain filtering, Solution of partial differential equations, Signal processing, Frequency division multiplexing, Amplitude modulation
2. Pulse code modulation, Analog-to-digital converter (ADC), Digital audio in telephony
3. Digital audio CDs, digital wireless microphones, DVD-audio

Learning outcomes:

At the end of this unit student will able to

1. Apply Fourier transform to obtain frequency spectrum of periodic and aperiodic signals (L3)
2. Apply properties of the Fourier transform including linearity, shift, symmetry, scaling, modulation and convolution etc., in communication and filtering applications (L3)
3. Determine the continuous-time signal corresponding to their transforms by applying Inverse Fourier transform (L3).
4. Illustrate the effect of sampling of a continuous time signal for various sampling rates (L3).
5. Explain the importance of sampling theorem for both low passand band pass signals (L2).

UNIT-III

Analysis of Linear Time Invariant Systems: Linear system, Response of a linear system, linear time-invariant (LTI) system, linear time variant (LTV) system, impulse response, Transfer function of a LTI system. Properties of linear time-invariant systems, 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 bandwidth and rise time. Energy and Power Spectral Densities

Cross-correlation and auto-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between autocorrelation function and energy/power spectral density function. Relationship between convolution and correlation.

Applications:

1. Tele communication and Radio receivers
2. Frequency-selective & Frequency-shaping filtering in audio systems.
3. Radar signal detection, fractal patterns, Measuring fast signal decay.

Learning outcomes:

At the end of this unit student will able to

1. Determine the impulse response/transfer function of a given LTI system (L3)
2. Find the response of a given LTI system for any input signal (L3)

3. Explain the filter characteristics of linear systems for example LPF, HPF and BPF (L2).
4. Analyse the LTI systems according their properties (L4).
5. Find the energy/power of a signal by applying correlation properties and Parseval's theorem (L3)

UNIT – IV

Laplace Transforms : Review of Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveform synthesis, Analysis and characterization of LTI systems using Laplace – transforms.

Applications:

1. Solution of partial differential equations
2. Transient and steady-state analysis of mechanical, electrical and electronic circuits
3. System modeling in control systems and stability analysis

Learning outcomes:

At the end of this unit student will able to

1. Determine the Laplace transform and the associated region of convergence and pole-zero plot for a continuous time signal (L3).
2. Apply Inverse Laplace transform to obtain the signal in the time domain by using partial fraction expansion method and some specific constraints on the ROC (L3).
3. Find the Laplace transform of certain signals which are synthesized in the form of other basic waveforms (L3).
4. Use the Laplace transform as an analytical tool in the analysis and study of LTI systems which are represented by linear constant -coefficient differential equations (L4).
5. Apply Laplace transform properties to find the Laplace transform and the associated region of convergence and pole-zero plot for a continuous time signal if that signal is represented as (i) linear combination of other signals (ii) time shifted of other signal (iii) time scaling of other signal, (iv) convolution of other signals (v) Differentiation of other signal (vi) Integration of other signal (vii) multiplication of other signals (ix) other signal which is multiplied with time (x) other signal which is multiplied with exponential signal etc. (L3).

UNIT –V

Z–Transforms: Concept of Z- Transform of a discrete sequence. Distinction between Fourier and Z transforms. Region of convergence for the Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms, Analysis and characterization of LTI systems using Z – transforms.

Applications:

1. Analysis of linear discrete system
2. Digital filter designing.

Learning outcomes:

At the end of this unit student will able to

1. Determine the Z - transform and the associated region of convergence and pole-zero plot for a discrete time sequence (L3).
2. Distinguish between Fourier and Z transforms (L2).
3. Apply Inverse Z - transform to obtain the sequence in the time domain by using partial fraction expansion method, long division method and some specific constraints on the ROC (L3).
4. Use the Z - transform as an analytical tool in the analysis and study of LSI systems which are represented by linear constant -coefficient difference equations (L4).
5. Apply Z – transform properties to find the Z – transform and the associated region of convergence and pole-zero plot for a discrete time sequence if that sequence is represented as (i) linear combination of other sequences (ii) time shifted of other

sequence (iii) time reversal of other signal, (iv) convolution of other signals (v) Accumulation of other signals (vi) time expansion of other signal etc. (L3).

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.
3. Signals & Systems- Narayan Iyer and K Satya Prasad, Cenage Pub.

Reference Books:

1. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition.
2. Principles of Linear Systems and Signals – BP Lathi, Oxford University Press, 2015
3. Signals and Systems – K Raja Rajeswari, B VisweswaraRao, PHI, 2009
4. Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition,2008.
5. Signals and Systems – T K Rawat , Oxford University press, 2011

Subject Code	Subject Name	L	T	P	C
R20BSH-HM2101	Managerial Economics and Financial Accountancy Common to ECE,CSE,CIT	3	0	0	3

Course Objectives:

- Inculcate the basic knowledge with the concepts of Economics & Demand and current business environment.(L2)
- Analyze various factors of production with proposed theories in relation to cost - volume profit analysis.(L4)
- Identify micro environment in which markets operate, how price determination is done under different kinds of competitions and know the different forms of Business organization. .(L4)
- Provide fundamental skills about accounting and explain the process of preparing accounting statements and analysis of financial statements. (L3)
- Apply the best investment decisions by means of time value of money.(L4)

Course Outcomes:

1. Equipped with the knowledge of fundamentals of economics, estimating the Demand for a product, Capable of analyzing Elasticity & Forecasting methods(L2)
2. Apply production concepts, assess the costs and Determine Break Even Point (BEP) of an enterprise for managerial decision making(L4)
3. Identify the influence and price determination of various markets structures and knowledge of the forms of business organization and Business cycles(L4)
4. Analyze and interpret the process & principles of accounting & apply financial statements for appropriate decisions to run the business profitably(L4)
5. Analyze how to invest adequate amount of capital in order to get maximum return from selected business activity.(L4)

Unit-I

Introduction to Managerial Economics and demand Analysis:

Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand-Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

Learning Outcomes:

At the end of this unit students will be able to:

- Awareness about basics of managerial economics(L1)
- Knowledge of the concepts of demand, elasticity of demand and methods of demand forecasting(L1)

Application:

1. Analyze the demand of a product by applying methods of the elasticity of demand.

Unit – II:

Theories of Production and Cost Analysis:

Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

Learning Outcomes:

At the end of this unit students will be able to:

- Examine various issues involved in production decision analysis (L1)
- Construct how production function is carried out to achieve least cost combination of inputs(L3)

- Apply Break – Even Analysis and its importance in managerial decision making(L4)

Application:

Compute contribution, revenue, Cost comparison, Margin of safety for making accurate decisions related to profitability of particular Enterprise

Unit – III:

Introduction to Markets, Theories of the Firm & Pricing Policies:

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Goods and services Tax, Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company.

Learning Outcomes:

At the end of this unit students will be able to:

- Identify the various market structures like Monopoly, Monopolistic competition (L4)
- Determine the appropriate pricing strategies to be applied in each market(L2)
- Compare the suitability of various organizational and ownership structures like sole trading, partnership. (L2)

Application: Analyse the leaps and bounds faced by the service providers in estimation of pricing in Telecom sector**.**

Unit – IV:

Introduction to Accounting & Financial Analysis:

Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements.

Learning Outcomes:

At the end of this unit students will be able to

- Knowledge about the framework for accounting process(L1)
- Analyze financial accounting decisions.(L3)

Application:

Prepare the financial accounting statements like Trading account, Profit and Loss account, Balance sheet of any organization.

Unit – V:

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (pay back period, accounting rate of return) and modern methods (Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

Learning Outcomes:

At the end of this unit students will be able to

- Analyze how capital budgeting decisions are carried out(L4)
- Knowledge of the concepts and various methods of capital budgeting(L1)
- Apply traditional or modern methods of Capital budgeting in business decision making(L3)

Application:

1. Assess long term investments and funds required in small scale organization**.**

Text Books:

1. Aryasri, Managerial Economics and Financial Analysis, TMH, 2012.
2. Varshney & Maheshwari, Managerial Economics, Sultan Chand& Sons, 2014.

References:

1. JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition
2. N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd,
3. MaheswariS.N,AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd
4. I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd
5. V. Maheswari, Managerial Economics, S. Chand & Company Ltd,

Web links

1. https://www.smartzworld.com/notes/managerial-economics-and-financial-analysis-mefa/
2. Production and cost analysis- https://slideplayer.com/slide/5708722/
3. Accounting analysis - https://www.readyratios.com/reference/accounting/accounting_analysis.html
4. https://nptel.ac.in/courses/110/101/110101131/

Subject Code	Subject Name	L	T	P	C
R20CSE-ES2103	Data Structures With 'C' Laboratory	0	0	3	1.5

Course Objectives:

- To develop skills to design and analyze simple linear and non linear data structures
- To Strengthen the ability to identify and apply the suitable data structure for the given real world problem
- To Gain knowledge in practical applications of data structures

Course Outcomes:

1. Analyze different searching and sorting Techniques.
2. Analyze concepts of linked lists and with their implementation of different Linked Lists
3. Apply the concepts of stacks and queues in real time applications
4. Analyze the non linear data structures trees and their operations
5. Implementation of different advanced Trees, Graphs with their applications.

List of Programs:

1.Write C programs that uses recursive function to:
- i) Compute factorial of a given number
- ii) Solve the towers of Hanoi problem.

2. Write C programs to implement the following search algorithms:
- i) Linear Search ii) Binary Search

3.Write C programs to implement the following sorting algorithms:
- i) Bubble Sort ii) Insertion Sort iii) Selection Sort.

4.Write C programs to implement the following sorting algorithms
- i) Merge Sort ii) Quick Sort.

5. Write C programs that implement the following data structures using arrays:
- i) Stack ii) Queue.

6. Write C programs to Evaluate postfix expression

7. Write C programs to implement the following types of Lists
- i) Singly linked list ii) Doubly linked list.

8. Write C programs to implement the following data structures using Linked Lists
- i) Stack ii) Queue.

9. Write a C program to perform the following operations
- i)insert an element into a binary search tree.
- ii)Delete an element from a binary search tree.
- iii) Search for a key element in a binary search tree.
- iv) Tree Traversals

10. Write C programs for the implementation of BFS for a given graph.

11. Write C programs for the implementation of DFS for a given graph

12. Write a C program for the implementation of Prim's algorithm to obtain the minimum cost spanning tree from a connected undirected graph.

13.Write a C program to implement Dijkstra's algorithm for the single source shortest path problem.

REFERENCES:

1. G A V PAI, "Data Structures and Algorithms, Concepts,Techniques and Applications", Volume-1, 1st Edition, TataMcGraw-Hill, 2008.

2. Richard F. Gilberg & Behrouz A. Forouzan, "Data Structures,A Pseudo code Approach with C", 2nd Edition, CengageLearning India Edition, 2007.

II Year –I Semester

Subject Code	Subject Name	L	T	P	C
R20ECE-PC2103	Electronic Devices and Circuits Laboratory	0	0	3	1.5

Course Objectives:

- Familiarize the functional behavior of different diodes, BJTs and FETs.
- Demonstrate the characteristic features of BJT, FET
- Observe the response of linear wave –shaping circuits with square-wave input for different time constants
- Demonstrate the Non-Linear wave shaping circuits such as clippers, clampers and switching characteristics of transistor
- Demonstrate the working of various amplifiers based on different biasing techniques.
- Simulate the Simple electronic circuits using spice software.

Course Outcomes:

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

1. Analyze the working principle of BJT and FET in different configurations (L4).
2. Analyze the response of linear wave shaping circuits for different signals(L4).
3. Sketch the response of non linear wave shaping circuits using non linear elements(L.
4. Understand the switching characteristics of Diodes and Transistors applications (L1).
5. Identify the various stability parameters of a Bipolar Junction Transistor, Field Effect Transistor in different biasing methods (L3).

Applications: The experiments prescribed in the syllabus are all application oriented mainly used for the development of DC regulated power supplies, CROs, audio and video amplifiers, frequency and function generators, etc.

Experiments

Part – A

1. PN Junction Diode Characteristics
2. Zener Diode Characteristics(VI Characteristics and Zener Diode as voltage Regulator)
3. Half and Full wave Rectifiers with and without filter
4. Linear Wave Shaping (LPF, HPF)
5. Non Linear Wave Shaping Clippers
6. Non Linear Wave Shaping Clampers
7. BJT Characteristics (CE Configuration)
8. FET Characteristics(CS Configuration)
9. Transistor as a Switch
10. UJT Characteristics Amplifiers
11. CE Amplifier
12. FET Amplifier (Common Source Amplifier)

Part – B

Simulate any 4 experiments using spice software

II Year –I Semester

Subject Code	Subject Name	L	T	P	C
R20ECE-PC2104	Signals and Systems Laboratory	0	0	3	1.5

Course Objective:

- Provide knowledge of the Fourier, Laplace and Z transform tools for analyzing the signals and systems in frequency domain.
- Generate and characterize various continuous and discrete time signals.
- Perform the basic operations on the signals.
- Analyze the spectral characteristics of signals using Fourier analysis.
- Analyze the systems using Laplace transform and Z-transform.

Course Outcomes:

At the end of this course the student will able to:

1. Apply basic techniques and functions for working with matrices in the MATLAB (L3)
2. Write a maintainable MATLAB code to generate continuous/discrete time signals and perform various operations on these signals (L3).
3. Analyze the spectral characteristics of signals by using Fourier analysis (L4).
4. Compute the Laplace & Z transforms and their inverse transforms of a signal (L3).
5. Simulate the response of an LTI system for various inputs such as impulse, step and sinusoidal signals and Analyze linear time-invariant (LTI) system and illustrate its pole-zero plot (L4) (L4).

Applications: The laboratory experiments are demonstrate the generation, basic operations of signals like shifting, scaling and convolution etc. The students are applied on the various types of signal to transform from time domain to frequency domain and vice-versa.

Prerequisites

- Signals and systems.
- MATLAB Basics.

List of Experiments

1. Basic Operations on Matrices.
2. Generation of Basic Continuous/Discrete Time Signals.
3. Operations on Continuous/Discrete Time Signals.
4. Convolution on Continuous/Discrete Time Signals.
5. Even & Odd parts and Real & Imaginary parts of a Signal.
6. Auto Correlation and Cross Correlationon Continuous/Discrete Time Signals.
7. Verification of Linearity and Time Invariance Properties of a Given System.
8. Computation of Unit Sample, Unit Step and Sinusoidal Responses of the Given LTI System.
9. Synthesis of Signals Using Fourier Series.
10. Fourier Series of a Given Signal and Plotting Its Magnitude and Phase Spectrum.
11. Fourier Transform of a Given Signal and Plotting Its Magnitude and Phase Spectrum.
12. Laplace Transform & Inverse Laplace Transform of Some Signals.
13. Z - Transform & Inverse Z Transform of Some Signals.
14. Verification of Sampling Theorem.
15. Finding and Plotting the Poles and Zeros in S-Plane and the Corresponding Magnitude and Phase responses for the Given Transfer Function.
16. Finding and Plotting the Poles and Zeros in Z-Plane and the Corresponding Magnitude and Phase responses for the Given Transfer Function.

II B.TECH I SEMESTER

Subject Code	Subject Name	L	T	P	C
R20ECE-SC2101	Printed Circuit Board Designing Lab (Skill Oriented Course)	1	0	2	2

Course Objectives :

- Introduce PCB Design tools and embedded systems design tools and hardware programmers.
- Understand the need for PCB Design and steps involved in PCB Design and Fabrication process.
- Familiarize the Concept of foot print and Assignment of Foot print to Different Active
- and Passive Components.
- Familiarize Schematic and layout design flow using Electronic Design Automation
- and Different Simulation Tools.
- Introduce Different Types of Soldering Techniques and Circuit Testing Techniques.

Course Outcomes:

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

1. Understand the necessity and evolution of PCB, types and classes of PCB.(L1)
2. Understand the steps involved in schematic, layout, fabrication and assembly process of PCB design. (L2)
3. Design (schematic and layout) PCB for analog circuits, digital circuits and mixed circuits. (L3)
4. Design (schematic and layout) and fabricate PCB for simple circuits. (L2)
5. Develop a Circuit on PCB using Soldering Techniques and testing methods. (L3).

List of Experiments:

Module-1(Simulation)

1. Simulation of Basic power supply circuit.
2. Simulation of Automatic Night lamp using LDR.
3. Simulation of Traffic lights using 555 timer IC.
4. Simulation of Water level Indicator
5. Simulation of Musical System with LEDs.
6. Simulation of Leakage current Funder circuit.
7. Simulation of Rain alarm Circuit
8. Simulation of Multi vibrators.
9. Simulation of oscillator
10. Simulation of Cell phone Detector circuit.

Module-2(Layout Designing)

1. Layout designing for Basic power supply circuit.
2. Layout designing for Automatic Night lamp using LDR.
3. Layout designing for Traffic lights using 555 timer IC.
4. Layout designing for Water level Indicator
5 . Layout designing for Musical System with LEDs.
6. Layout designing for Leakage current Funder circuit.
7. Layout designing for Rain alarm Circuit
8. Layout designing for Multi vibrators.
9. Layout designing for oscillator
10. Layout designing for Cell phone Detector circuit.

Module-3(Soldering)

1. Soldering and testing of Basic power supply circuit.
2. Soldering and testing of Layout designing for Automatic Night lamp using LDR.
3. Soldering and testing of Layout designing for Traffic lights using 555 timer IC.
4. Soldering and testing of Layout designing for Water level Indicator

5 . Soldering and testing of Layout designing for Musical System with LEDs.
6. Soldering and testing of Layout designing for Leakage current Funder circuit.
7. Soldering and testing of Layout designing for Rain alarm Circuit
8. Soldering and testing of Layout designing for Multi vibrators.
9. Soldering and testing of Layout designing for oscillator
10. Soldering and testing of Layout designing for Cell phone Detector circuit.

II B.TECH I SEMESTER

Subject Code	Subject Name	L	T	P	C
R20BSH-MC2102	Essentials of Indian Tradition Knowledge Common to ECE,EEE & MEC	2	0	0	0

Course Objectives:

- Facilitate students with the concepts and roots of traditional knowledge system.(L2)
- Importing thought process reasoning and inference sustainability of Indian traditional knowledge system (L2)
- Comprehend the legal framework, traditional knowledge, biological diversity act 2002. (L3)
- Focus on traditional food and modern food. (L2)
- Facilitate traditional knowledge in various sectors. (L3)

Course Outcomes:

After completion of the course students will be able to:

1. Knowledge about the concept of traditional knowledge(L2)
2. Apply significance of traditional knowledge protection(L3)
3. Analyze various enactments related to the protecting facets of traditional knowledge. (L2)
4. Evaluate the significance Traditional Knowledge and modern food. (L2)
5. Compare the traditional knowledge in various sectors(L2)

Unit-I:

Introduction to Traditional Knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, Indigenous Knowledge(IK),characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge vis-à-vis formal knowledge.

Learning Outcomes:

Atthe end ofthe unit thestudentwill ableto:

- Recognize the social change in traditional knowledge(L2)
- Contrast and compare characteristics importance kinds of traditional knowledge.(L2)
- Analyze physical and social contexts of traditional knowledge. (L3)

Applications: Compare and contrast the traditional knowledge with formal knowledge.

Unit-II:

Protection of Traditional Knowledge: Need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

Learning Outcomes:

At the end of the unit the student will able to:

- Identify the need of protecting traditional knowledge.(L2)
- Apply significance of TK protection.(L3)
- Analyze the value of TK in global economy. (L3)

Applications: Identify and implementation of traditional knowledge in present scenario.

Unit-III:

Legal framework and Traditional knowledge: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act,2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PVPFR Act), The Biological Diversity Act 2002and Rules 2004, Systems of traditional knowledge protection- Legal concepts for the protection of traditional knowledge-Certain non IPR mechanisms of traditional knowledge protection.

Learning Outcomes:

At the end of the unit the student will able to:

- Contrast and compare the Scheduled Tribes and other traditional forest dwellers. (L2)
- Analyze plant variant protections and evaluate farmers right act. (L4)
- Analyze legal concepts for the protection of Traditional Knowledge.(L4)

Applications: Case study to recognize legal concepts, protection of culture and Indian traditional knowledge.

Unit-IV:

Traditional knowledge in Food : Evolution of Indian cuisine,Importance of traditional food –Styles of traditional food- Modern Food-Harmful effects of modern food, Factors influencing food choice- Economic and Physical Determinants-Uniqueness of Culture in Food.

Learning Outcomes:

Atthe end ofthe unitthestudent will ableto:

- Recognizing the significance of Traditional food (L2)
- Awareness about the harmful effects of modern food.(L3)

Applications: Distinguish between nutrition levels of traditional and modern food items

Unit-V:

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture.

LearningOutcomes:

At the end ofthe unitthestudent will ableto:

- Compare traditional knowledge indifferent sectors. (L2)
- Apply traditional knowledge in engineering. (L3)

Applications: Comparative study of traditional knowledge with current practices in different sectors.

Text Books:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Knowledge Traditions and Practices of India "Kapil Kapoor, Michel Danino.

ReferenceBooks:

1. TraditionalKnowledgeSystemandTechnologyinIndiabyBasantaKumarMohantaandVipin Kumar Singh, Pratibha Prakashan 2012.
2. TraditionalKnowledgeSystem in India by Amit Jha Atlantic publishers, 2002

E-Resources:

1. https://www.utrechtjournal.org/articles/10.5334/ujiel.283/
2. https://en.wikipedia.org/wiki/Traditional_knowledge
3. https://www.scconline.com/blog/post/2018/04/23/protecting-traditional-knowledge-the-india-story-till-date/
4. https://sciencebusiness.net/news/72773/India-leads-the-way-in-protecting-traditional-knowledge

Subject Code	Subject Name	L	T	P	C
R20ECE-PC2201	Analog Communication	3	0	0	3

Course Objectives:

Students undergoing this course, are expected to

1. Familiarize with the various techniques for analog modulation and demodulation of signals
2. Develop the ability to classify and understand various functional blocks of radio transmitters and receivers
3. Familiarize the basic techniques for generating and demodulating various pulse modulated signals
4. Familiarize various angle modulation techniques and demodulating various angle modulated signals
5. Understand the concept of noise and different sources of noise.

Course Outcomes:

After undergoing the course, students will be able to

1. Differentiate various Analog modulation and demodulation schemes and their spectral characteristics (L1)
2. Examine the performance of Angle modulation and demodulation techniques.(L3)
3. Explain sampling and examine the performance of pulse modulation and demodulation(L2)
4. Demonstrate various functional blocks of radio transmitters and receivers(L2)
5. Evaluate the effect of noise in Analog modulation systems and comprehend the receiver operation(L4).

UNIT I

Amplitude Modulation-I: Need for modulation, Amplitude Modulation - Time and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves - Switching modulator, Detection of AM Waves - Envelope detector, DSBSC modulation - time and frequency domain description,

Applications:

1. Amplitude modulation is used in a variety of applications. Broadcast transmissions, Air band radio, single side band, quadrature amplitude modulation

Learning Outcomes:

At the end of this unit the student will be able to

1. Understand the need for modulation, time domain and frequency domain representation (L1).
2. Understand the different modulation techniques of AM, DSB-SC,SSB-SC,VSB-SC (L1)

UNIT-II

Amplitude Modulation-II

Generation of DSBSC Waves - Balanced Modulators, Coherent detection of DSB-SC Modulated waves, COSTAS Loop, SSB modulation - time and frequency domain description, frequency discrimination and Phase discrimination methods for generating SSB, Demodulation of SSB Waves, principle of Vestigial side band modulation

Applications:

2. Amplitude modulation is used in a variety of applications. Broadcast transmissions, Air band radio, single side band, quadrature amplitude modulation
3. In order to transmit 2 channel stereo signals, **DSB** signals are used in Television and FM broadcasting.
4. SSB-SC modulation techniques are used in mobile communication, telemetry, military communications, navigation and amateur radio

Learning Outcomes:
At the end of this unit the student will be able to
1. Understand the need for modulation, time domain and frequency domain representation (L1).
2. Understand the different modulation techniques of AM, DSB-SC,SSB-SC,VSB-SC (L1)

UNIT III

Angle Modulation: Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave using Bessel functions, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Signal- Armstrong Method, Detection of FM Signal: Balanced slope detector, Phase locked loop, Comparison of FM and AM., Concept of Pre-emphasis and de-emphasis. Noise Figure of the Receiver, Noise Performance of Continuous Wave Modulation, Figure of Merit

Applications:

1. Angle modulation is used in telecommunications transmission systems.
2. Frequency modulation is widely used for **FM** radio broadcasting, telemetry, radar, seismic prospecting, and monitoring newborns for seizures via EEG, two-way radio systems, sound synthesis, magnetic tape-recording systems and some video-transmission systems.
3. Phase modulation is widely used for transmitting radio waves and is an integral element of many digital transmission coding schemes that support an ample range of wireless technologies such as GSM, Satellite television, and Wi-Fi.

Learning Outcomes:
At the end of this unit the student will be able to
1. Understand the frequency and phase modulation and demodulation techniques(L1).
2. Able to calculate the figure of merit for different modulation techniques (L3).

UNIT IV

Transmitters & Receivers: Radio Transmitter - Classification of Transmitter, AM Transmitter, FM Transmitter, Radio Receiver - Receiver Types - Tuned radio frequency receiver, Super hetrodyne receiver, FM Receiver, Comparison with AM Receiver

PULSE MODULATION : Time Division Multiplexing, Types of Pulse modulation, PAM (Single polarity, double polarity) PWM: Generation & demodulation of PWM, PPM, Generation and demodulation of PPM, TDM Vs FDM

Applications:

1. FM transmitters are commonly used for playing portable audio devices on car radios They are also used to broadcast a stationary audio source, like a computer or a television, around a home.
2. Pulse modulation techniques are used in Ethernet communication, many micro-controllers for generating control signals.
3. These techniques are used in Photo-biology, an electronic driver for LED lighting.

Learning Outcomes:
At the end of this unit the student will be able to
1. Understand the concepts of different types of transmitters and receivers. (L1).
2. Understand pulse modulation techniques. (L1).

UNIT –V

NOISE: Noise sources, Thermal noise, Noise Figure and Noise Temperature, Average Noise Figure and Effective Noise Temperature of cascaded networks, Noise in communication Systems: Noise in AM System, Noise in DSB and SSB Systems, Noise in Angle Modulation Systems**.**

Learning Outcomes:
At the end of this unit, the student will be able to

1. Apply the noise theory on analog signals (L3)
2. Apply the noise theory on modulation techniques(L3)

Text Books:

1. Simon Haykin, "Communication Systems", John Wiley and Sons, 2nd Edition, 2010.
2. B.P. Lathi, "Communication Systems", BS Publication, 2006.
3. George Kennedy and Bernard Davis, "Electronics & Communication System", TMH, 1999

References:

1. John G. Proakis, Masond, Salehi, "Fundamentals of Communication Systems", PTR, 2004.

2. H Taub & D. Schilling, "Principles of Communication Systems", Gautam Sahe, TMH, 3rd Edition, 2007. 3. R.P. Singh, S.D. Sapre, "Communication Systems", 2nd Edition, TMH, 2007.

Subject Code	Subject Name	L	T	P	C
R20ECE-PC2202	Analog Circuits	3	0	0	3

Course Objectives:

The main objectives of this course are :

- The principle of working and operation of multistage amplifiers with BJT using low frequency analysis.
- The need of feedback and its significance is explained.
- Understand the operation of Oscillator circuits
- Calculate the efficiency of power amplifier
- The working of Tuned amplifiers are explained

Course Outcomes:

At the end of the course, student will be able to:

1. Design Multistage Amplifiers and perform their analysis using BJT(L6).
2. Classify different feedback amplifiers and derive its necessary equations (L2).
3. Explain the working principle of different types of oscillators and analyze the frequency response (L2).
4. Classify the different types of Power Amplifiers and perform their analysis(L2).
5. Analyze the operation of different types of Tuned Amplifiers(L4).

UNIT – I

Small Signal Model of Transistors, Implementation of Multi Stage Amplifiers: Two port networks, Transistor Hybrid model, Determination of h-parameters, , generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Concept of Multi Stage Amplifiers, Two Stage RC Coupled amplifier (CE configuration), n –Stage Cascaded Amplifiers, Equivalent Circuits, High Input Resistance Transistor Circuits: Cascode Transistor Configuration, CE-CC Amplifiers, Frequency response of RC Coupled Amplifiers using BJT, Gain Bandwidth Product.

Applications:

1. Multistage amplifiers commonly implemented on integrated circuits where large numbers of transistors with common (matched) parameters are available.
2. Multistage amplifiers are used to increase the voltage/current gain to required level.

Learning Outcomes:

At the end of this unit the student will be able to

1. Explain the need of Multistage amplifiers (L2)
2. Understand the different methods of coupling of amplifiers(L2)
3. Design high input resistance circuits.(L3)
4. Plot the frequency response of RC coupled amplifiers(L2)

UNIT – II

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

Applications:

1. Feedback amplifiers are used to change the input and output impedance in accordance with our required level.
2. The feedback mechanism is used in the Control System to stabilize the system performance

Learning Outcomes:

At the end of this unit the student will be able to

1. Understand the concept of feedback and feedback topologies(L2)
2. Study the characteristics of negative feedback amplifiers(L2)

3. Understand the methods of analysis of feedback amplifiers(L2)
4. Performance comparison of feedback amplifiers(L2)

UNIT – III

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

Applications:

1. Design the sine wave generators
2. Design the local oscillators (Mixers) in the communication receiver circuits.

Learning Outcomes:

At the end of this unit the student will be able to

1. Understand the principle operation of Oscillator Circuits(L2)
2. Design the RC Phase shift Oscillator circuits using BJT and FET(L3)
3. Design the Tank Circuit Oscillators(L3)
4. Study the Frequency and amplitude stability techniques of oscillator circuits(L2)

UNIT – IV

Power Amplifiers: Classification of amplifiers, Class A power Amplifiers and their analysis, Harmonic Distortions, Class B Push-pull amplifiers and their analysis, Complementary symmetry push pull amplifier, Class AB power amplifier, Class-C power amplifier, Thermal stability and Heat sinks, Distortion in amplifiers.

Applications:

1. The power amplifiers are used as the last stage of the multistage amplifiers in the public addressing systems.
2. Heat sink design is used to protect the power transistor from the thermal runway.

Learning Outcomes:

At the end of this unit the student will be able to

1. Study the importance of power amplifiers(L2)
2. Understand the Load line analysis of power amplifier (L2)
3. Design the Class A, B, AB and C power amplifier circuits and calculate their efficiencies.(L3)
4. Calculate the total harmonic Distortion in an amplifier output(L3)
5. Know the importance of Heat Sinks in a power amplifiers(L2)
6. Study the Frequency and amplitude stability techniques of oscillator circuits(L2)

UNIT – V

Tuned Amplifiers: Introduction, Q-Factor, small signal tuned amplifier, capacitance single tuned amplifier, double tuned amplifiers, effect of cascading single tuned amplifiers on band width, effect of cascading double tuned amplifiers on band width, staggered tuned amplifiers, stability of tuned amplifiers, wideband amplifiers.

Applications:

1. The tuned amplifier is used in UHF radio relay systems.
2. It is used as intermediate frequency (IF) amplifier in a super heterodyne receiver.
3. It is used as RF amplifiers in receivers.
4. It is used as wide band tuned amplifiers for video amplification.
5. It is used as very narrow-band IF amplifier in a spectrum analyzer.
6. It is used as IF amplifier in a satellite transponder.

Learning Outcomes:

At the end of this unit the student will be able to

1. Study the importance of Tuned Amplifiers(L2)
2. Understand the operation of single tuned and double tuned amplifiers (L2)
3. Find the effect of cascading double tuned amplifiers on band width.(L1)
4. Explain the staggered tuned amplifiers(L2)

5. Explain the operation of Wideband Amplifiers(L2)

Text Books:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2011.
2. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits", Pearson/Prentice Hall, 10th Edition, 2008.
3. Pulse, Digital and Switching Waveforms – J.Millman and H. Tabu, McGraw-Hill
4. Pulse and Digital Circuits – A. Anand Kumar, PHI, 2005
5. Shalivahana N. Suresh Kumar, A. Vallavaraj, "Electronic Devices and Circuits", Tata McGraw Hill (India), 3rd edition, 2007.

References:

1. T.F. Bogart Jr., J.S.Beasley and G.Rico, "Electronic Devices and Circuits", Pearson Education, 6th edition, 2004.
2. S.G.Burns and P.R.Bond, "Principles of Electronic Circuits", Galgotia Publications, 2nd Edn.,1998.
3. G. Streetman, and S. K. Banerjee, Solid State Electronic Devices, 7th Edition, Pearson, 2014.
4. S.Salivahanan, N.Suresh Kumar, A.Vallavaraj, "Electronic Devices and Circuits", 2nd Edition, TMH, 2007.
5. K. Lal Kishore, "Electronic Devices and Circuits", B.S. Publications, 2nd Edition, 2005

Subject Code	Subject Name	L	T	P	C
R20EEE-PC2203	Control Systems Common to ECE & EEE	3	0	0	3

Course objectives:

- Learn the fundamental concepts of Control systems, behaviour of the control systems and write down the transfer functions for different types of electrical and mechanical Systems.
- Study the characteristics and time response analysis for first and second order systems.
- Explain the absolute stability and relative stability of control system by RH criterion and Root-Locus techniques.
- Demonstrate the analysis of the system response in frequency domain using Bode, polar and Nyquist plots.
- Introduce state variable analysis, and concepts of controllability and observability.

Course outcomes:

1. Find the Transfer function of physical systems and reduction of overall transfer function using block diagram algebra, signal flow graph approach.(L1)
2. Apply the concepts of time response analysis on first and second order systems.(L3)
3. Analyze the absolute stability and relative stability of control system by RH criterion and root locus techniques (L3)
4. Apply various frequency domain techniques to assess the system performance and stability (L3)
5. Analyze State space models of LTI systems and apply the concepts of controllability and observability.(L4)

Unit -I

Introduction : Concepts of Control Systems - Open Loop and closed loop control systems and their differences -Different examples of control systems - Classification of control systems, Feedback Characteristics, Effects of feedback, Mathematical models –Differential equations, Impulse Response and transfer functions.

Transfer Function Representation: Block diagram representation of systems considering electrical systems as examples - Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

Applications: Closed loop control systems are used in traffic light control systems, home appliances

Learning Outcomes:

After completion of this unit student will be able to

- List the differences between open loop and closed loop control systems (L1).
- Understand different examples of control systems (L2).
- Calculate the transfer function of a given system by using block diagram representation and signal flow graph (L3).

Unit -II

Time Response Analysis: Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

Applications: Filters, errors in different control systems

Learning Outcomes:

After completion of this unit student will be able to

- Understand the time response of first order and second order systems(L2)
- Derive the different time domain specifications for second order systems(L2)

Unit III

Stability Analysis in S-Domain: The concept of stability – Routh's stability criterion – Qualitative stability andconditional stability – Limitations of Routh's stability.

Root Locus Technique: The root locus concept - Construction of root loci – Effects of adding poles and zeros to G(s) H(s) on the root loci.

Applications: Stability, root locus can be applied to determine the dynamic response of control systems

Learning Outcomes:

After completion of this unit student will be able to

- Finding out the stability of the given system by Routh's stability criterion (L1)
- Identify whether the system is stable or not by using root locus technique (L3)

Unit IV

Frequency Response Analysis: Introduction, Frequency domain specifications - Bode diagrams - Determination of frequency domain specifications and Phase margin and Gain margin - Stability analysis from Bode Plots - Polar Plots - Nyquist Plots.

Applications: Calculate the parameters which effects of the stability of the system

Learning Outcomes:

After completion of this unit student will be able to

- Derive the different frequency domain specifications for first order and second order systems (L2)
- Find the gain and phase margin from bode diagrams and nyquist plots and understand their implications in terms of robust stability (L2)

Unit V

State Space Analysis of Continuous Systems: Concepts of state, state variables and state model, derivation of state models from block diagrams, diagonalization - Solving the Time invariant state equations - State Transition Matrix and it's Properties – Concepts of Controllability and observability.

Applications: Feedback control systems, for any electrical system matrix will be designed by using state space analysis.

Learning Outcomes:

After completion of this unit student will be able to

- Understand the concepts of state, state variables and state model (L2)
- Determine response of the system by using state space analysis (L4)
- Understand the concepts of controllability and observability (L2)

Text Books

1. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International Limited Publishers, 2nd edition.
2. Automatic control system – B.C.Kuo , john wiley and son's 8th edition, 2003.

Reference Books

1. Modern control engineering – K.Ogata , prentice Hall of India Pvt. Ltd., 5th Edition.
2. Control system – N.K.Sinha, New Age International (p) Limited Publishers, 3rd Edition, 1998.
3. A.Nagoor kani, "Control Systems", RBA Publications, 2nd Edition, 2006.
4. Control systems- A.Anand kumar, PHI learning pvt.ltd., 2nd Edition.
5. Control systems – K.Alice mary, P.Ramana

II-II B.Tech(ECE) Syllabus

Subject Code	Subject Name	L	T	P	C
R20ECE-PC2203	Digital Logic Design	3	0	0	3

Course objectives:

- To teach significance of number systems, conversions, binary codes and functionality of logic gates
- To discuss different simplification methods for minimizing Boolean functions
- To outline procedures for the analysis and design of combinational circuits
- To outline procedures for the analysis and design of sequential logic circuits
- To introduce programmable logic devices

Course Outcomes:

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

1. Describe various number systems, error detecting and correcting binary codes (L2)
2. Apply Boolean laws, k-map & Q-M methods to minimize switching functions (L3)
3. Design the combinational circuits (L5)
4. Design the sequential logic circuits (L5)
5. Compare different types of Programmable Logic Devices (L5)

Unit- 1

Number Systems and Codes: Decimal, Binary, Octal, and Hexa-decimal number systems and their conversions, sign magnitude representation , r's Complement and (r-1)'s Complement, Arithmetic addition, Subtraction of Binary Numbers complements, BCD code, Excess -3 code, BCD addition, Excess- 3 addition, Gray code, Error detection and correction – Parity generators and checkers, two-input logic gates, Universal building blocks, EX-OR, EX-NOR - Gates

Applications

1. Binary systems are widely used for electronic gates in electricity circuits and digital encoding.
2. Logic Gates are used in arithmetic logic units, microprocessors, computer memory and registers.
3. Gates are used to build square wave oscillators, as temperature heaters, parity generation and checking circuits.

Learning Outcomes:

At the end of the unit, the student will be able to

1. Summarize advantages of using different number systems (L2)
2. Explain usefulness of different coding schemes and functionality of logic gates (L2)

Unit- 2

Boolean Algebra & Logic Gates: Boolean operations, Boolean functions, complements and dual of Boolean functions, min-terms and max-terms, sum-of-products and product-of-sum representations, NAND /NOR implementations.

Minimization of Boolean Functions: Karnaugh map, don't-care conditions, prime implicants, minimization of functions using Quine - McClusky method.

Applications

1. Boolean functions are used in designing Integrated circuits.
2. Karnaugh maps are used for easy generation of error correcting codes.

Learning Outcomes:

At the end of the unit, the student will be able to

1. Apply basic laws & De Morgan's theorems to simplify Boolean expressions (L3)
2. Compare K- Map & Q-M methods of minimizing logic functions (L5)

Unit -3

Combinational Circuits: Introduction, Analysis of combinational circuits, Design Procedure- Half Adder, Full Adder, Half Subtractor, Full Subtractor, Binary Adder - subtractor, Decimal Adder, Design of comparator, decoders, encoders, multiplexers,

demultiplexers.

Applications

1. Combination logic is used in circuits to perform Boolean algebra on input signals and on stored data.
2. Combinational circuits are used in ALU's, data transmission, home alarm, car parking slot systems, multiple access techniques.

Learning Outcomes:

At the end of the unit, the student will be able to

1. Apply Boolean algebra for describing combinational digital circuits (L3)
2. Analyze standard combinational circuits such as adders, subtractors, multipliers, comparators etc. (L4)
3. Design simple combinational logic circuits (L5)
4. Implement logic functions with decoders and multiplexers (L3)

Unit 4

Sequential Circuits: Introduction, Latches –RS latch and JK latch, Flip-flops-RS, JK, T and D flip flops, Master-slave flip flops.

Registers and Counters: Registers, Shift registers, ripple counters, synchronous counters, Modulus-n Counter, Ring counter, Johnson counter, Up-Down counter.

Analysis and Design of Synchronous Sequential Circuits: Moore and Mealy machine models, State Equations, State Table, State diagram, State reduction & assignment.

Applications:

1. Flip flops are used in multi vibrators, triggering circuits, frequency divider circuits, data storage and data transfer circuits.
2. Counters are used in Frequency counters, Digital clocks, Time measurement, A to D converters, Digital triangular wave generator.

Learning Outcomes:

At the end of the unit, the student will be able to

1. Describe behaviour of Flip-Flops and Latches (L2)
2. Compare Moore and Mealy machine models (L2)
3. Design synchronous sequential circuits using flip flops (L5)
4. Construct complex digital systems using components such as registers and counters (L3)

Unit -5

Programmable Logic Devices (PLDs): PROM, Programmable Array Logic (PAL) and Programmable Logic Array (PLA), Realization of switching functions using PLDs.

Applications:

1. Programmable Logic devices provide specific functions, including device-to-device interfacing, data communication, signal processing, data display, timing and control operations

Learning Outcomes:

At the end of the unit, the student will be able to

1. Compare different types of Programmable Logic Devices (L5)
2. Design simple digital systems using PLDs (L5)

Textbooks:

1. M. Morris Mano and Michael D. Ciletti, Digital Design, 4th Edition, Pearson Education, 2013.
2. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education (India Private Limited), 4th edition, 2012.

References:

1. Switching and Finite Automata Theory, Z. Kohavi, Tata McGraw Hill.
2. Wakerly J.F. "Digital Design: Principles and Practices," Pearson India, 2008, 4th Edition.
3. Charles H Roth (Jr), Larry L. Kinney, "Fundamentals of Logic Design", Cengage Learning India Edition, 5th Edition, 2010.
4. John. M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.

Subject Code	Subject Name	L	T	P	C
R20ECE-PC2204	Electro Magnetic Waves and Transmission Lines	3	0	0	3

Course Objectives:

- To introduce fundamentals of static and time varying electromagnetic fields.
- To teach problem solving in Electromagnetic fields using vector calculus.
- To demonstrate wave concept with the help of Maxwell's equations.
- To introduce concepts of polarization
- To teach reflection and refraction of electromagnetic waves
- Introduce the wave propagation in rectangular wave guide and application of Poynting Theorem

Course Outcomes:

At the end of the course student will be able to

1. Explain basic laws of electromagnetic fields and know the wave concept (L2)
2. Analyze electric and magnetic fields at the interface of different medias Along With Maxwell Equations (L4)
3. Analyze the properties of wave equations in different medias (L3)
4. Explain the basic properties of transmission lines (L5)
5. Analyze the transmission line with different wave length levels (L2)

Unit 1

Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.

Applications :

1. Gauss's Law can be used to solve complex electrostatic problems involving unique symmetries like cylindrical, spherical or planar symmetry
2. The uses and applicationsof Maxwell's equations are just too many to count.
3. By understanding electromagnetism we're able to create images of the body using MRI scanners in hospitals;
4. we've created magnetic tape, generated electricity, and built computers.

Learning Outcomes:

At the end of the unit the student will be able to:

- Understand basic laws of static electric field (L2)
- be Derive the Maxwell's equations for electrostatic fields (L3)
- At the end of the unit the student will be Solve problems applying laws of electrostatics (L3)

Unit 2

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

Faraday's Law and Transformer e.m.f, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's equations for time varying fields, Maxwell's Equations in Different Final Forms

and Word Statements. Boundary Conditions of Electromagnetic fields: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Illustrative Problems.

Applications:

1. Ampere's Law is true, and you can use Ampere's Law to determine the magnetic field in these magnets given a particular current and properties of the material used in the magnet
2. These *applications* demonstrate that our regularized Biot-Savart laws are indeed
3. RNA molecules and to study nucleic acid-protein interactions in *real time*
4. ATM cards and swiping machines are also the application of law of electro magnetic induction

Learning Outcomes:

At the end of the unit the student will be able to

- Understand basic laws of static magnetic field (L2)
- Derive the Maxwell's equations for magnetic fields (L3)
- Solve problems applying laws of magneto statics (L3).
- Derive the Maxwell's equations for electromagnetic fields (L3)
- Apply the boundary conditions of electromagnetic fields at the interface of different media (L3)

Unit 3

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations between E & H, Sinusoidal Variations, Wave Propagation in different mediums , Polarization, 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, introduction to Poynting Theorem – Applications, Illustrative Problems.

Applications:

1. Polarization (also polarization) is a property applying to transverse waves that specifies the geometrical orientation of the oscillations
2. We use waveforms in various types of applications such as wireless communication, Radar, **Space Exploration**, Marine, Radio navigation, Remote sensing etc
3. A microscope uses a mirror to reflect light to the specimen under the microscope
4. An astronomical reflecting telescope uses a large parabolic mirror to gather in daily life
5. Application of the Poynting theorem to a source and a nonlinear load

Learning Outcomes:

At the end of the unit the student will be able to

- Understand concept of wave propagation through the Maxwell's equations (L2)
- Derive wave equations for different media (L3)
- Explain concept of polarization of electromagnetic wave (L2)
- Understand principles of reflections and refraction for different incidences (L2)
- State concept of power flow using Pointing vector (L1)
- Calculate Brewster angle, power flow, surface impedance (L3)

Unit 4

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, Loading - Types of Loading. Illustrative Problems

Applications:

1. Power transmission line.
2. Telephone lines.
3. Antennas
4. For Design Stub Filtes
5. Impendence matching purpose

Learning Outcomes:

At the end of the unit the student will be able to

- Understand concept of transmission line equations (L2)
- Derive transmission line equations for different conditions (L3)
- Explain concept phase velocity and group velocity concepts (L2)

UNIT 5:

Transmission Lines – II : Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. Low loss radio frequency lines and UHF Transmission lines, UHF Lines as Circuit Elements; Impedance Transformations λ/4, λ /2, λ/8 Lines –. Smith Chart – Construction and Applications, Quarter wave transformer, Stub Matching-single & double, Illustrative Problems

Applications:

1. Power transmission line.
2. Telephone lines.
3. Traces on Printed Circuit Boards.
4. Traces on Multi-Chip Modules.
5. Impendence matching purpose

Learning Outcomes:

At the end of the unit the student will be able to

- Understand concept of Input Impedance Relations (L2)
- Analysis the properties of transmission line in different wave lengths level (L3)
- Explain concept smith chart concepts (L2)

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics", Oxford Univ. Press, 4th ed., 2008.
2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", TMH, 7th ed., 2006.
3. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
4. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall,India

References:

1. John D. Krauss, "Electromagnetics", McGraw- Hill publications.
2. Electromagnetics, Schaum's outline series, Second Edition, Tata McGraw-Hill publications, 2006.

Subject Code	Subject Name	L	T	P	C
R20ECE-PC2205	Analog Communication Laboratory	0	0	3	1.5

Course Objectives:

1. perform Various analog modulation and demodulation schemes
2. Construct Various associated circuits of analog modulation schemes
3. Verify sampling theorem
4. Analyze various modulated schemes by using spectrum analyze
5. Demonstrate the action of PLL for FM demodulation applications

Course Outcomes: At the end of the course the student will be able to

1. Design and verify AM and FM modulators and demodulators(L2)
2. Demonstrate the sampling theorem process in different conditions(L3)
3. Analyze various types of modulation schemes frequency spectrums using Spectrum analyzer(L4)
4. Demonstrate the characteristics of various functional blocks of Transmitter and Receiver (L3)
5. Evaluate the various types of pulse modulation and demodulation techniques (L5)

List of Experiments

1.Amplitude modulation and demodulation.
2. Frequency modulation and demodulation.
3. Balanced modulator and Synchronous Detector.
4. Generation of Intermediate frequency (IF) signal using mixer circuit
5. Pre-emphasis and de-emphasis.
6. SSB modulator and demodulation.
7. Spectral analysis of AM, DSB-SC, SSB-SC using spectrum analyzer.
8. Phase Locked Loop operation and verification of capture range and lock range
9. AGC characteristics.
10. Pulse Amplitude Modulation and demodulation.
11. Pulse Width & Pulse Position Modulation and demodulation.
12. Sampling Theorem – Verification.
13. Frequency Synthesizer – Multiplication and Division.

Note: Any ten of the following experiments are to be performed during the semester and any five experiments are to be completed by using MATLAB

Subject Code	Subject Name	L	T	P	C
R20ECE-PC2206	Analog Circuits Laboratory	0	0	3	1.5

COURSE OBJECTIVES:

- Demonstrate the working of multistage and feedback amplifier and plotting the frequency response.
- Design the high input resistance circuits
- Explain the design procedure for different oscillators.
- Describe the efficiency calculations of various power amplifiers.
- Calculate the bandwidth of tuned amplifiers

COURSE OUTCOMES:

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

1. Design Multistage Amplifiers and perform their analysis using BJT and FET(L6).
2. Familiarize with small signal high frequency transistor Hybrid – π model and relevant derivations of conductance and capacitances (L2).
3. Classify different feedback amplifiers and derive its necessary equations (L2).
4. Explain the working principle of different types of oscillators and analyze the frequency response (L2).
5. Classify the different types of Power Amplifiers & Tuned Amplifiers and perform their analysis (L2).

List of Experiments

1. Two –Stage RC Coupled Amplifier
2. Darlington Pair Amplifier
3. Bootstrapped Emitter Follower
4. Voltage Series Feed Back Amplifier
5. Current Shunt Feedback Amplifier
6. RC Phase Shift/Wien Bridge Oscillator
7. Hartley / Colpitt's Oscillator
8. Class A Series Fed Power Amplifier
9. Transformer Coupled Class A Power Amplifier
10. Class-B Push pull Power Amplifier
11. Complementary Symmetry Class B Push Pull Power Amplifier
12. Single Tuned Voltage Amplifier
13. Double Tuned Voltage Amplifier

Note: Conduct any 10 Experiments also simulate with using spice software

Subject Code	Subject Name	L	T	P	C
R20ECE-PC2207	Digital Logic Design Laboratory	0	0	3	1.5

Course Objectives

- To design and realize basic digital combinational and sequential circuits.
- To verify the functionality of basic digital combinational and sequential circuits

Course Outcomes:

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

1. Acquire the knowledge of numbering systems and logic gates (L2).
2. Design of logic gates using IC's (L3).
3. Design of combinational circuits using IC's (L3).
4. Design of Sequential circuits using IC's (L3).
5. Design of synchronous and asynchronous counters using flip-flops (L3).

List of Experiments:

1. Verify the Truth Tables of AND, OR, NOT, NAND, NOR EXOR Logic Gates
2. Realization of logic gates using Universal logic gates.
3. Realization of Boolean function using logic gates
4. Design and realization of Code conversion circuits- BCD to Excess-3 and vice-versa.
5. Design and verify the logic circuit of Half adder and subtractor using logic gates
6. Design and verify the logic circuit Full adder/ subtractor using two half adders
7. Design and implementation of encoder and decoder
8. Design and realization of 8x1 mux using two 4x1 mux.
9. Realization of Flip-Flops using logic gates
10. Design and implementation of shift register
11. Design and verification of 4 bit ripple counter and mod 10/mod 12 ripple counter Design
12. Design and implementation of 3 bit synchronous up/down counter

Subject Code	Subject Name	L	T	P	C
R20BSH-SC2202	Employability Skills -1 (Skill Oriented Course)	1	0	2	2

Course Objectives

- Aims to help learners develop their English language skills, particularly those planning to appear for Competitive Exams that test their English Language abilities.
- Gains the power of expression through rich Vocabulary.
- Imparts critical reading strategies for comprehension of complex texts
- Provides training and opportunities to develop fluency in English through participation in formal group discussions and Self Introductions.
- Demonstrates good writing skills for effective Paragraph Writing, Essay Writing and formal correspondence through Emails.
- Encourages use of a wide range of grammatical structures, Phrases, Clauses and Idioms in speech and writing.

Course Outcomes

1. Enable students to identify Parts of Speech and use them flawlessly, write Emails in formal correspondence effectively, participate confidently by introducing oneself in any formal discussion.
2. Attain Language Proficiency & Accuracy through Contextualized Vocabulary, Verb forms, Tense and subject verb agreement, produce coherent expressions for professional writing, introduce themselves unhesitatingly with Task-Based Activities.
3. Develop the fluency and accuracy to write Technical Reports and Emails for professional communication by using appropriate vocabulary and participate confidently in any formal discussion.
4. Assimilate lifelong reading habit to comprehend a passage for its gist. Avoid the errors in both Speech & Writing and write Letters and Emails for official communication.
5. Realise the technical communicative competence and attainment of grammatically correct structures for formal communication.

Unit 1

Vocabulary: How to talk about actions. **Grammar:U**sing and Identifying Parts of Speech accurately **. Writing:** Paragraph Writing and formal correspondence through Emails**. Speaking:**Background to Group discussions & Self-introductions.

Learning Outcomes

At the end of the module, the learner will be able to

- Acquire vocabulary and use it contextually(L2)
- identify parts of speech and use them flawlessly in both Speech and Writing (L3)
- write paragraphs and Emails in formal correspondence effectively (L3)
- participate confidently in any formal discussion and introduce themselves unhesitatingly (L3)

Unit 2

Vocabulary: How to talk about various speech habits.**Grammar**: Learning Verb forms, Tenses and Subject-verb agreement and using them accurately in both Speaking and Writing contexts. **Writing :**Essay Writing and formal correspondence through Emails. **Speaking:**Four major areas -Subject Knowledge, Oral Communication Skills, Leadership Skills and Team Management-of GD;Real time GDs for Evaluation.

Learning Outcomes

- At the end of the module, the learner will be able to
- Acquire vocabulary and use it contextually (L2)
- use Verb forms,Tense and subject verb agreement for effective speaking and writing (L3)

- produce coherent expressions for professional writing (L4)

participate confidently in any formal discussion and introduce themselves unhesitatingly (L3)

Unit 3

Vocabulary: How to insult your enemies**. Grammar:** Sentence Analysis & Synthesis - Voice, Degrees of Comparison, Reported Speech and Types & Forms of sentences. **Writing:** Report writing and Emails for formal correspondence**. Speaking:** Roles in structured GDs; real time GDs for practicing the above roles.

Learning Outcomes

- At the end of the module, the learner will be able to
- Acquire vocabulary and use it contextually(L2)
- identify the complexity in the structure of a sentence (L2)
- write technical reports and emails for professional communication (L3)
- participate confidently in any formal discussion and introduce themselves unhesitatingly (L3)

Unit 4

Vocabulary: How to flatter your friends**. Grammar**: Common errors and Correction of Sentences **Reading:**Reading Comprehension passages through Skimming and Scanning and understanding the gist or the specific purpose of them.. **Writing:** Letter writing and Emails. **Speaking:**Advantages of GDs for hiring process ; real time GDs for evaluating.

Learning Outcomes

At the end of the module, the learner will be able to

- Acquire vocabulary and use it contextually(L2)
- comprehend a passage and know its gist(L3)
- avoid the errors in both Speech and Writing (L2)
- write letters and emails for official communication(L3)
- participate confidently in any formal discussion and introduce themselves unhesitatingly (L3)

Unit 5

Vocabulary & Grammar: High-frequency words for all competitive exams, Clause ,Phrase & Idioms**. Reading:** Reading for Comprehending **Writing:**Business Letters and Emails **Speaking:**Group Discussions for Evaluation

Learning Outcomes

At the end of the module, the learner will be able to

- Acquire vocabulary and use it contextually(L2)
- use grammatically correct structures for formal communication (L3)
- write Business Letters effectively (L3)
- participate confidently in any formal discussion and introduce themselves unhesitatingly (L3)

Reference Books

- Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
- Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
- Skilful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
- Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012. (Student Book, Teacher Resource Book, CD & DVD)
- Word Power Made Easy by Norman Lewis

Subject Code	Subject Name	L	T	P	C
R20ECE-MC2201	Pulse and Digital Circuits	3	0	0	0

Course Objectives:

- Understand the concepts of linear wave shaping circuits.
- Analyze the Switching Characteristics of diode and transistor.
- Interpret the working of logic gates and sampling gates using diode and transistors.
- Develop Multivibrators for various applications.
- Illustrate the functioning of different types of voltage time base generators.

Course Outcomes: The student can able to

1. Understand and analyze the responses of first order RC low pass and high pass filters for standard inputs.
2. Demonstrate the concept of switching characteristics of diodes and transistors
3. Design & analyze various Multivibrators
4. Comprehend the concepts of Voltage and Current time base generators
5. Realize the Logic Gates using Diodes and Transistors

UNIT – 1

Linear Waveshaping: High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square, ramp and exponential inputs. RC network as differentiator and integrator, Attenuators, its applications in CRO probe, RL and RLC circuits and their response for step input, Ringing circuit.

Applications:

1. Used as Integrator and Differentiator.
2. Used as Wave modifications.
3. Used as voltage magnification.

Learning Outcomes: At the end of this unit the student will be able to

1. Understand different types of signals and their behavior when applied to linear wave shaping circuits.
2. Understand different types of circuits and its designing methods.
3. Analyze the response of linear wave shaping circuits for different signals

UNIT – 2

Switching Characteristics of Devices: Diode as a switch, piecewise linear diode characteristics, Design and analysis of Transistor as a switch, Break down voltage consideration of transistor, saturation parameters of Transistor and their variation with temperature, Design of transistor switch, transistor-switching times.

Applications:

1. Switching mode power supplies

Learning Outcomes: At the end of this unit the student will be able to

1. understand the behaviour of diode and Transistor.
2. Design of various analog and digital electronic systems.

UNIT – 3

Multivibrators:

Astable Multivibrator: Analysis and Design of Collector Coupled Astable Multivibrator, Application of Astable Multivibrator as a Voltage to Frequency Converter. **Monostable Multivibrator**: Analysis and Design of Collector Coupled Monostable Multi vibrator, Triggering of Monostable Multivibrator, Applications of Monostable Multivibrator. **Bistable Multivibrator**: Analysis and Design of Fixed Bias, Self Bias Bistable Multi Vibrator, Collector Catching Diodes, Commutating Capacitors, Triggering of Binary Circuits, Emitter Coupled Bistable Multivibrator (Schmitt Trigger).

Applications:

1. Used as a Frequency dividers.

2. Used as a Saw tooth generators.
3.Used in Radar and T.V circuits.

Learning Outcomes: At the end of this unit the student will be able to

1. Understand the behaviour of bistable multivibrator circuits.
2. Understand the behaviour of monostable and astable multivibrator circuits.

UNIT – 4

Voltage Time Base Generators: General features of a time base signal, Methods of generating time base waveform Exponential Sweep Circuits, Negative Resistance Switches, basic principles in Miller and Bootstrap time base generators, Transistor Miller time base generator, Transistor Bootstrap time base generator.

Applications:

1. Used in CROs
2. Used in Televisions, Radar Display
3. Used in Precise Time Measurement systems.

Learning Outcomes: At the end of this unit the student will be able to

1. Understand the basic Knowledge of various voltage time base generator.

UNIT – 5

Logic Families & Sampling Gates: Logic Families: Diode Logic, Transistor Logic, Diode-Transistor Logic, Transistor-Transistor Logic, Emitter Coupled Logic, AOI Logic, Comparison of Logic Families. SAMPLING GATES: Basic Operating Principles of Sampling Gates, Diode Unidirectional Sampling Gate and Two-Diode Bi-Directional Sampling Gate, Four-Diode gates, Six-Diode Gates, Reduction of Pedestal in Sampling Gates, Applications of Sampling Gates.

Applications:

1. Used in Sampling Scopes
2.Used in sample and hold circuits.
3.Digital to Analog converters.

Learning Outcomes: At the end of this unit the student will be able to

1. Understand the knowledge of diode and transistor based logic gates and sampling gates.
2.Understand designing process of sampling gates.
3. Design the Logic functions using logic gates

Text Books:

1. Jacob Millman, Herbert Taub, Mothiki S. Prakash Rao (2008), Pulse, Digital and Switching Waveforms, 3rd edition, Tata McGraw Hill, New Delhi.
2. Anand Kumar (2005), Pulse and Digital Circuits, Prentice Hall of India, India

Reference Books:

1. David A. Bell (2002), Solid state pulse circuits, 4th edition, Prentice Hall of India, New Delhi, India.
2. Mothiki S. Prakash Rao (2006), Pulse and Digital Circuits, Tata McGraw Hill, India.