COURSE STRUCTURE(R19)
AND
DETAILED SYLLABUS
(II YEAR)

ELECTRONICS & COMMUNICATION ENGINEERING

For
B.Tech., Four Year Degree Course
(Applicable for the batches admitted from 2019-20)

LENDI INSTITUTE OF ENGINEERING AND TECHNOLOGY
An Autonomous Institution
Approved by AICTE & Permanently Affiliated to JNTUK, Kakinada
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II YEAR –I SEMESTER							
S.No.	**Course Code**	**Course**	**Category**	**L**	**T**	**P**	**Credits**
1	R19ECE-PC2101	Electronics Devices and Circuits	PC	3	0	0	3
2	R19ECE-PC2102	Switching Theory and Logic Design	PC	3	0	0	3
3	R19ECE-PC2103	Signals and Systems	PC	3	0	0	3
4	R19CSE-ES2101	Data structure with C Programming	ES	3	0	0	3
5	R19BSH-MA2101	Computational Methods using MAT LAB	BS	1	0	2	2
6	R19BSH-HM2101	Managerial Economics & Financial Analysis	HM	3	0	0	3
7	R19ECE-PC2104	Electronics Devices and Circuits-Lab	PC	0	0	3	1.5
8	R19ECE-PC2105	Switching Theory and Logic Design- Lab	PC	0	0	3	1.5
9	R19CSE-ES2102	Data structure with C Programming-Lab	ES	0	0	2	1
10	R19BSH-MC2101	Essential of Indian Traditional Knowledge	MC	2	0	0	0
11	R19BSH-MC2102	Industrial Psychology	MC	3	0	0	0
12	R19ECE-MC2103	MOOCS-1	MC	2	0	0	0
Total				**23**	**0**	**10**	**21**

II YEAR –II SEMESTER							
S.No	**Course Code**	**Course**	**Category**	**L**	**T**	**P**	**Credits**
1	R19ECE-PC2201	Electronics Circuit Analysis	PC	3	0	0	3
2	R19EEE-PC2202	Control Systems	PC	3	0	0	3
3	R19ECE-PC2203	Electromagnetic Waves and Transmission Lines	PC	3	0	0	3
4	R19ECE-PC2204	Random Variable and Stochastic Process	PC	3	0	0	3
5	R19CSE-ES2201	Computer Architecture and Organization	ES	3	0	0	3
6	R19BSH-HM2201	Management and Organizational Behavior	HM	3	0	0	3
7	R19ECE-PC2205	Electronics Circuit Analysis - Lab	PC	0	0	3	1.5
8	R19ECE-PC2206	Signal and systems-Lab	PC	0	0	3	1.5
9	R19CSE-SD2201	Python Programming-Lab	SD	2	0	2	1
10	R19ECE-SI2201	Summer Internship-I	SI	0	0	0	0
11	R19BSH-MC2201	Employability Skills (English)	MC	1	0	2	0
12	R19ECE-MC2202	MOOCS-2	MC	2	0	0	0
Total				**23**	**0**	**10**	**22**

II Year –I Semester Syllabus

Subject Code	Subject Name	L	T	P	C
R19ECE-PC2101	Electronic devices and Circuits	3	0	0	3

Course Objectives:

The main objectives of this course are:

1. Study the physical phenomena such as conduction, transport mechanism and V-I characteristics of different diodes.
2. To learn and understand the application of diodes as rectifiers with their operation and characteristics are discussed.
3. Understand the switching characteristics of diode and its application in non linear wave shaping circuits.
4. Acquire knowledge about the principle of working and operation of Bipolar Junction Transistor and Field Effect Transistor and their characteristics.
5. To learn and understand the purpose of transistor biasing and its significance.

Course Outcomes:

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

1. Understand the formation of p-n junction and how it can be used as a p-n junction diode in different modes of operation (L2)
2. Understand the basic applications of Diodes as rectifier with and without filters (L2).
3. Implement the non linear wave shaping circuits using diodes (L3)
4. Understand the construction, principle of operation of BJT and FET and compare their V-I characteristics in different configurations (L2).
5. Examine the various stability parameters of a Bipolar Junction Transistor in different biasing methods (L4)

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, Breakdown mechanisms, and its applications, Tunnel Diode, LED.

Applications: 1.Detection signals in digital networks.
2. Lighting systems in various display boards
3. As switches in logic circuits
4. Diodes in Voltage Multiplier Circuits
5. Diodes in Reverse Current Protection based on their PIV.
6. Diodes in Voltage Spike Suppression

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(Series inductor), Capacitor filter (Stunt inductor) $\pi Filter$, comparison of various filter circuits in terms of ripple factors.

Applications: 1 .power supplies for radio, television and computer equipment
2. Rectifying voltage like turning Ac and Dc.
3. Isolating signals from a supply.
4. Used to controlling the size the signal based on circuit requirement.

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, Clamping Operation, Clamping Circuits using diodes with different inputs, Clamping circuit theorem,

Applications:

1. Noise elimination in TV receivers.
2. In the case of generating new waveforms and/or shaping the existing older waveforms.
3. Clippers can be used as freewheeling diodes in protecting the transistors from transient effects by connecting the diodes in parallel with the inductive
4. In the separation of synchronizing signals existing from the composite color picture signal
5. Frequently used in FM transmitters for removing the excess ripples in the signals above a certain noise level
6. Clampers are widely used in test equipments and other sonar systems.
7. For improving the reverse recovery time, clampers are used.

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 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: 1 Amplifiers and oscillators1. Transistors are used in digital and analog circuits as a switch.
2. Uses in signal amplifier devices
3. Cellular phones would be one of the most widely used applications of transistors. Every cell phone uses a transistor amplifier.
4. Uses in power regulator and controllers
5. In modern electronics IC uses in almost every electronics applications. Transistors are used in building some of the integrated circuits (IC).
6. FET uses in analog switches, sample and hold circuits.

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: 1.Gain controller devices in communication systems.
2. Thermal stability for practical circuits.
3. Can do load line analysis for classify the power amplifiers.
4. Based on biasing techniques can calculate distortion in amplifiers.

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. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, Second Edition.
2. Integrated Electronics- Jacob Millman, C. Halkies, C.D.Parikh, Tata Mc-Graw Hill, 2009.
References:
1. Electronic Devices and Circuits-K. Satya Prasad, VGS Book Links.
2. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, Tata Mc-Graw Hill, Second Edition
3. Electronic Devices and Circuits – Bell, Oxford.

II Year –I Semester

Subject Code	Subject Name	L	T	P	Credits
R19ECE-PC2102	Switching Theory and Logic Design	3	0	3	3

Course objectives:

1. To study different number system based on radix and error coding techniques
2. Theorems and functions of Boolean algebra and behavior of logic gates to optimize logic gates for digital circuits using various techniques.
3. To understand concepts of combinational circuits and their realization.
4. To understand and design of sequential logic circuits
5. To Implement the PLDs and Synchronous sequential circuits.

Course Outcomes:

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

1. Understand 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. Analyze the procedure to design combinational logic circuits (L4)
4. Analyze the procedure to design sequential logic circuits (L4)
5. Design of PLDs and synchronous sequential circuits (L6)

Unit 1

Number Systems and Codes: Representation of numbers of different radix, conversation from one radix to another radix, r-1's compliments and r's compliments of signed members. Arithmetic addition, Subtraction of Binary Numbers complements, Gray code ,4 bit codes; BCD, Excess-3, 2421, 8421 code etc. Error detection & correction codes: parity checking, even parity, odd parity, hamming code.

Applications

1. Binary systems are widely used for electronic gates in electricity circuits and digital encoding.
2. Detect the error in digital transmission and to correct them
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 (L2)

Unit 2

Boolean Algebra & Logic Gates: Boolean theorems, Boolean operations, Boolean functions, principle of complementation & duality, De-Morgan theorems. Logic operations; Basic logic operations -NOT, OR, AND, Universal Logic operations, EX-OR, EXNOR operations. Min-terms and Max-terms, Standard SOP and POS forms, NAND-NAND and NOR-NOR realizations, Realization of three level logic circuits.

Minimization of Boolean Functions: Minimization and realization of switching functions using Boolean theorems, K-Map (up to 6 variables) and tabular method (Quine-McCluskey method) with only four variables and single function. Karnaugh map, don't-care conditions.

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 Logic Circuits: Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders; 4-bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit and carry look-a-head adder circuit, Design code converts using Karnaugh method and draw the complete circuit diagrams. Design of encoder, decoder, Multiplexer and De-multiplexers, Implementation of higher order circuits using lower order circuits. Realization of Boolean functions using decoders and multiplexers. Design of priority encoder, 4-bit digital comparator and seven segment decoder.

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 routing applications like home alarm, car parking slot systems etc..

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. Implement logic functions with decoders and multiplexers (L3)

Unit 4

Sequential Circuits: Classification of sequential circuits (synchronous and asynchronous) , operation of NAND & NOR Latches and Flip-flops ; truth tables and excitation tables of RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals. Conversion from one flip-flop to another flip-flop, Master-slave flips flops.

Registers and Counters: Registers, Shift registers, Buffer register, control buffer register, bi-directional shift register, universal shift, register, Design of ripple counters, synchronous counters, Modulus-n Counter, Ring counter, Johnson counter, Up-Down counter.

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. 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. Programming table.

Analysis and Design of Synchronous Sequential Circuits: Finite state machine, State diagram, State Table, Reduction of State Tables, State Equations, Analysis of clocked sequential circuits Mealy to Moore conversion and vice-versa, Realization of sequence generator , Design of Clocked Sequential Circuit to detect the given sequence (with overlapping or without overlapping).

Applications:

1. Programmable Logic devices provide specific functions, including device-to-device interfacing, data communication, signal processing, data display, and 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 synchronous sequential circuits using flip flops (L5)
3. Compare Moore and Mealy machine models (L2)

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.

II Year –I Semester

Subject Code	Subject Name	L	T	P	C
R19ECE-PC2103	Signals and Systems	3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are given below:

1. Explain the basic properties of signals and systems and identify the systems based on their properties
2. Develop expertise in time domain and frequency domain approaches to the analysis of continuous and discrete systems through Fourier series and Fourier transform tools.
3. Analyze the process of sampling and the effect of under sampling.
4. Development of mathematical skills to solve problems involving convolution and correlation.
5. Apply the Laplace transform as mathematical tool to convert time domain signals in to s-domain signals.
6. 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 properties (L4).
2. Apply the Fourier series and Fourier transform to obtain the spectral characteristics of continuous time periodic and aperiodic signals (L3).
3. Determine the Nyquist rates of low pass and band pass signals by using sampling theorem (L3).
4. Analyze the linear time invariant systems by applying the concepts of convolution and correlation (L4).
5. Use Laplace transform and Z - transform to obtain pole-zero plot with ROC for continuous time discrete time signals (L3).

UNIT- I: INTRODUCTION TO SIGNALS & SYSTEMS AND FOURIER SERIES: 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, 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, inevitability 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. Determine the Nyquist sampling rate for a continuous-time signal by applying sampling theorem (L3).
6. Explain the importance of sampling theorem for both low pass and 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. Solution of partial differential equations
2. Analysis of linear discrete system
3. 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- Anand Kumar PHI 3rd Edn

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. Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition,2008.
4. Signals and Systems – T K Rawat , Oxford University press, 2011

II Year –I Semester

Subject Code	Subject Name	L	T	P	C
R19CSE-ES2101	Data Structures with C Programming	3	0	0	3

Course Objectives:

1. Describe to searching and sorting techniques.
2. Applying stack and queue techniques for logical operations
3. Describe to list representation models in various types of applications
4. Design and Implementation of trees in various forms
5. Describe of orientation on graphs, graph traversals, spanning trees

Course Outcomes:

1. Analyze different searching and sorting Techniques.
2. Apply concepts of stacks and queues in different mathematical evaluations
3. Apply concepts of linked lists and implementation of different Linked Lists
4. Understanding of non linear data structures like trees and binary search trees their operations
5. Evaluating concepts of graphs and their applications.

UNIT I: ARRAYS AND INTRODUCTION TO DATA STRUCTURE

Data structure Definition, types of data structures, The Array as an Abstract Data Type, The Polynomial Abstract Data type- Polynomial Representation- Polynomial Addition, Sparse matrices

Searching: List Searches using Linear Search, Binary Search

Sorting Techniques: Basic concepts, Sorting by: insertion (Insertion sort), exchange (bubble sort, quick sort), distribution (radix sort), merging (merge sort) Algorithms and selection heap sort.

Application: Evaluating the Complex Mathematical applications

Learning Outcomes:

After completion of this unit, student will be able to

1. Understand and remember algorithms and its analysis procedure (L2).
2. Analysis procedure of search (L4).
3. Analyze sorting techniques (L4).

UNIT-II: STACKS AND QUEUES

The Stack Abstract Data Type, Implementation of stack operations , Expression-Infix, prefix, Postfix Notations, Conversions- Infix to Postfix, Infix to Prefix, Evaluation of postfix Expressions.

The Queue Abstract Data Type, Representation of Queue, Implementation of Queue operations, Circular queues, Application

Application: Evaluating the Complex Mathematical Expressions

Learning Outcomes:

After completion of this unit, student will be able to

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

UNIT-III: LINKED LISTS

Introduction to Linked List, difference between Arrays and Linked List, singly linked lists – creation, insertion, deletion, search and Traversal operations, Representation of stack, queue, polynomial and Sparse Matrix using single linked list, circular lists ,doubly linked lists- insertion, deletion and traversal operations.

Application: Data Storage Representations

Learning Outcomes:

After completion of this unit student will be able to

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

UNIT IV: TREES:

Basic tree concepts, Binary Trees: Properties, Representation of Binary Trees using arrays and linked lists, operations on a Binary tree , Binary Tree Traversals (Inorder, Preorder, Postorder), Binary search tree: Basic concepts, Binary search tree operations: insertion, deletion, Threaded Binary Trees. Heap: Basic concept, operations of max Heap.

Application: Computer Networks, Routing Protocols

Learning Outcomes:

After completion of this unit student will be able to

1. Create Binary Tree using linked list and Arrays (L6)..
2. Understanding different types of Binary tree Traversals (L2).
3. Analyze different Operation of Binary Search Tree operations (L4)..

UNIT-V: GRAPHS

Introduction, Definition, The Graph Abstract Data Type, Graph Representation, Depth First Search and Traversal, Breadth First Search and traversal, Connected , Biconnected Components , Spanning Trees, Minimum Cost Spanning Trees: Prim' s Algorithm , Kruskal's Algorithm. Single Source shortest Path: Dijkstra's Algorithm

Application: Communication networks, Routing Algorithms, Shortest Path, Network topologies

Learning Outcomes:

After completion of this unit student will be able to

1. Create the spanning tree from graphs (L6).
2. Create minimal spanning tree by using different algorithms (L6)

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 ed, 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 Press

II Year –I Semester

Subject Code	Subject Name	L	T	P	C
R19BSH-MA2101	**Computational Methods using MATLAB (ECE)**	1	0	2	2

Course Objectives:

1. To familiarize the numerical techniques.
2. To impart knowledge in basic concepts and programming using MATLAB in relation to the engineering applications.

Course Outcomes:

At the end of the course students will be able to

1. Solve non-linear equations using numerical methods.(L2)
2. Construct interpolation polynomials for a given function using Lagrange's and Newton's interpolation formulae for a given set of points.(L2)
3. Apply numerical methods to find derivatives, integrations and solutions of ordinary differential equations. (L3)
4. Use MATLAB as calculator for simple calculations of Algebraic problems.(L2)
5. Carry out computational experiments for numerical methods using MATLAB.(L3)

PART-A (Numerical Methods)

Unit I: Solution of Algebraic and Transcendental Equations: (10 hours)

Intermediate value theorem (statement only), Geometrical representation of a solution of an equation, Bisection method, Regula-Falsi method, Iterative Method, Newton-Raphson method for one variable and two variables.

Learning Outcomes:

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

1. find approximate roots of an equation by using different numerical methods. (L3)

Unit II: Interpolation (8 hours)

Finite differences, symbolic relations between operators, interpolation using Newton's forward, backward formulae, Gauss central difference formulae, Interpolation with unequal intervals using Newton's divided difference and Lagrange's formulae.

Learning Outcomes:

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

1. explain various discrete operators and find the relation among operators. (L2)
2. apply forward and backward interpolation formulas for equal intervals to find interpolating polynomial/values. (L3)
3. apply Newton's divided difference and Lagrange's formulas for unequal intervals to find interpolating polynomial/values. (L3)

Unit III: Numerical differentiation, Integration and solutions of Ordinary differential equations: (10 hours)

Numerical differentiation &Integration: Derivatives using forward difference formula and backward difference formula. Trapezoidal rule and Simpson's $1/3^{rd}$and $3/8^{th}$rules.

Solutions of Ordinary differential equations: Taylor's series method, Picard's method of successive approximation, Euler's method, modified Euler's method and Runge-Kutta method of fourth order for solving first order differential equations.

Learning Outcomes:

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

1. find derivatives and integration of a function by using different numerical methods. (L2)
2. solve ordinary differential equations by using different numerical schemes. (L3)

PART-B (MATLAB)

Unit IV: MATLAB Basics: (10 hours)

Input and Output operations, arithmetical operations, Matlab as Calculator, algebraic or symbolic computation, substituting in symbolic expressions, symbolic expressions, variable Precision, and exact arithmetic, vectors and matrices, suppress and output functions, built-in functions, user-defined functions.

Learning Outcomes:

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

3. use MATLAB to perform algebraic computations. (L2)
4. apply arithmetical, vector and matrix functions to mathematical problems.(L3)

Unit V: MATLAB Programming: (10 hours)

Writing scripts and functions, loops (for & while), conditional statements (If, if...else, switch, break, continue).

MATLAB Programming for Numerical Methods: Root finding, interpolation, numerical differentiation, numerical integration, numerical solutions of ordinary differential equations (Topics covered in Unit 1, 2 and 3).

List of MATLAB Programs:

1. Find a real root of the given equation using Newton-Raphson Method.
2. Find a real root of the given equation using Regular Falsi Method.
3. Find a real root of the given equation using Bisection Method.
4. Find a real root of the given equation using Iterative methods.
5. Find the unknown values of the given data using Newton forward and backward interpolation formula
6. Find the unknown values of the given data using Newton divided difference interpolation formula
7. Find the unknown values of the given data using Lagrange's interpolation formula
8. Find the first order derivatives of the given data.
9. Find the integral of the given data using trapezoidal rule and Simpson's 1/3rd and 3/8 rules.
10. Solve the differential equation using Euler methods.
11. Solve the differential equation using modified Euler's methods.
12. Solve the differential equation using Runge-Kutta method of fourth order.
13. Solve linear equation systems using Gaussian elimination.
14. Solve linear equation systems using Gauss-Seidel and Jacobi's iteration method.

Learning Outcomes:

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

1. understand the concepts of functions and loops. (L2)
2. construct a MATLAB program using the concepts of functions and loops. (L3)
3. construct MATLAB program to find root of an equation. (L3)
4. construct MATLAB program to find interpolation values for a given data. (L3)
5. construct MATLAB program to find differentiation for a given data. (L3)
6. construct MATLAB program to find integration for a given data. (L3)
7. construct MATLAB program to find numerical solutions of a given differential equation. (L3)

Evaluation Method:

1. **Internal Evaluation:** The weightage of internal marks for 30 consists of Descriptive examination and internal Laboratory examination. The Descriptive examination (Theory) (i.e) Mid-I examination is based on unit number 1,2 and 3 and internal Laboratory examination (i.e) Mid-II examination is based on unit number 4,5. The marks distribution is as follows: 10 marks for Mid-I examinations (theory), 6 marks for Assignment on unit 1,2,3(each 2 marks), 4 marks for lab record and 10 marks for Mid-II (internal Laboratory examination).

2. **Semester end examination:** The Semester end examination will be conducted on the topics of all units for 70 marks. The semester end examination will be Descriptive examination only .No external lab examination will be conducted.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43/e, 2010.
2. B.S. Grewal, Numerical Methods in Engineering & Science, Khanna Publishers, 2014.
3. Steven Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists-McGraw-Hill Higher Education (2006).

References:

1. Erwin kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2/e, Reprint 2012.
3. Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg, A guide to MATLAB for beginners and experienced users, Cambridge University Press (2006).
4. Sastry, S.S, Introductory Methods of Numerical Analysis, 5^{th} edition, Prentice Hall, 2017.
5. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
6. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018.
7. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
8. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
9. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
10. Misza Kalechman, Practical MATLAB Basics For Engineers, Crc Press (2008).

II Year –I Semester

Subject Code	Subject Name	L	T	P	C
R19BSH-HM2101	**Managerial Economics & Financial Analysis**	**3**	**0**	**0**	**3**

Course Objectives:

1. Inculcate the basic knowledge about concepts of Economics , Demand and current business environment.(L2)
2. Analyze various factors of production with proposed theories in relation to cost - volume profit analysis.(L4)
3. 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)
4. Provide fundamental skills about accounting and the process of preparing accounting statements and analysis of financial statements. (L3)
5. 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 market 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:

Definition, Nature and scope of Managerial Economics, Demand Analysis- Concept, Determinants , Law of Demand and its exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Methods of Demand Forecasting

Learning Outcomes:

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

Applications: Analyze the demand of a product by applying methods of the elasticity of demand.

UNIT – II: PRODUCTION AND COST ANALYSIS:

Production Function – Law of variable proportion - Least Cost Combination, Isoquants and Isocosts, MRTS, Cobb-Douglas production function, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts, cost behavior and cost types- Fixed Cost ,Variable Cost Opportunity Cost, Out of Pocket Costs vs. Imputed Costs, Explicit cost Vs

Implicit cost, Breakeven Analysis (BEA) - Determination of Breakeven Point (simple problems), Managerial Significance and limitations of BEA.

Learning Outcomes:

1. Examine various issues involved in production decision analysis (L1)
2. Construct how production function is carried out to achieve least cost combination of inputs(L3)
3. Apply Break Even Analysis and its importance in managerial decision making(L4)

Applications: Compute contribution, revenue, cost comparison, Margin of safety for making accurate decisions related to profitability of particular enterprise.

UNIT – III: MARKET STRUCTURES, PRICING &BUSINESS ENVIRONMENT:

Market structures: Types of Competition, Features of Perfect Competition, Monopoly and Monopolistic Competition, Price- Output determination in Perfect Competition and Monopoly. Pricing - Objectives and Methods of Pricing – Cost based Pricing, Demand based Pricing, Competition based Pricing, Other Pricing methods-Forms of Business Organizations and their features- Sole Proprietorship- Partnership – Joint Stock Companies- Business cycles.

Learning Outcomes:

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

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

UNIT – IV: INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS: Accounting Concepts and Conventions- Double entry book keeping- Accounting cycle, Journal, Ledger, and Trial Balance, Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Analysis and Interpretation of financial statements.

Learning Outcomes:

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

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

UNIT – V:

CAPITAL AND CAPITAL BUDGETING: Capital and its significance, Types and sources of Shot term and Long term Capital, Components of Fixed and Working Capital. Nature and scope of Capital Budgeting, Time value of money, Methods of Capital Budgeting Projects-Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method(NPV), Internal Rate of Return(IRR) (simple problems).

Learning Outcomes:

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

Application: Assess long term investments and funds required in small organization**.**

TEXT BOOKS:

1. Aryasri, Managerial Economics and Financial Analysis, TMH, 2012.

2. Varshney&Maheshwari, Managerial Economics, Sultan Chand& Sons, 2014.

3. S.A. Siddiqui and A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age International Publishers, Hyderabad, 2013

REFERENCE BOOKS :

1. Raghunatha Reddy &Narasimhachary, Managerial Economics & Financial Analysis, Scitech, 2009.
2. V. Rajasekarn& R. Lalitha, Financial Accounting, Pearson Education, New Delhi, 2010.
3. Domnick Salvatore, Managerial Economics in a Global Economy, 4th Edition, Cengage, 2009.
4. Subhash Sharma & M. P. Vittal, Financial Accounting for Management, Text & Cases, Machmillan, 2012.
5. S. N. Maheshwari& S. K. Maheshwari, Financial Accounting, Vikas 2012.
6. Truet and Truet, Managerial Economics; Analysis, Problems and Cases, Wiley, 2012.
7. Dwivedi, Managerial Economics, Vikas 2012.
8. M. Kasi Reddy and S.Saraswathi, Managerial Economics and Financial Accounting, PHI, 2012.
9. Erich A. Helfert, Techniques of Financial Analysis, Jalco, 2007.

WEBLINKS

1. Managerial economics and financial analysis notes
2. https://www.smartzworld.com/notes/managerial-economics-and-financial-analysis-mefa/
3. Production and cost analysis- https://slideplayer.com/slide/5708722/
4. Accounting analysis - https://www.readyratios.com/reference/accounting/accounting_analysis.html

II Year –I Semester

Subject Code	Subject Name	L	T	P	C
R19ECE-PC2104	ELECTRONIC DEVICES & CIRCUITS LAB	0	0	3	1.5

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

1. Understand the switching characteristics of Diodes and Transistors applications (L1).
2. Analyze the working principle of BJT and FET in different configurations (L4).
3. Analyze the response of linear wave shaping circuits for different signals (L4).
4. Sketch the response of non linear wave shaping circuits using non linear elements (L3).
5. Compare the transistor parameters in different amplifier configurations (L4).

Part – A

1. PN Diode operation. P-N Junction Diode Characteristics Part A: Germanium Diode (Forward bias& Reverse bias) Part B: Silicon Diode (Forward Bias only)
2. Zener Diode Characteristics Part A: V-I Characteristics Part B: Zener Diode as Voltage Regulator
3. Rectifiers (without and with-filter) Part A: Half-wave Rectifier Part B: Full-wave Rectifier
4. Linear Wave Shaping (LPF, HPF)
5. Non Linear Wave Shaping Clippers
6. Non Linear Wave Shaping Clampers
7. BJT Characteristics (CE Configuration) Part A: Input Characteristics Part B: Output Characteristics.
8. FET Characteristics(CS Configuration) Part A: Drain Characteristics Part B: Transfer Characteristics
9. Transistor as a Switch
10. UJT Characteristics
11. BJT-CE Amplifier
12. Emitter Follower-CC Amplifiers
13. 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	CREDITS
R19ECE-PC2105	Switching Theory and Logic Design- Lab	0	0	3	1.5

Course Objectives

1. To design and realize basic digital combinational and sequential circuits.
2. 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:

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

1. Verification of truth tables of Logic gates Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive OR (vi) Exclusive NOR

2. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit

3. Verification of functional table of 3 to 8 line Decoder /De-multiplexer

4. 4 variable logic function verification using 8 to 1multiplexer.

5. Design full adder circuit and verify its functional table.

6. Verification of functional tables of (i) J K Edge triggered Flip –Flop (ii) J K Master Slave Flip – Flop (iii)D Flip -Flop

7. Design a four bit ring counter using D Flip – Flops / JK Flip Flop and verify output

8. Design a four bit Johnson's counter using D Flip-Flops / JK Flip Flops and verify output

9. Verify the operation of 4-bit Universal Shift Register for different Modes of operation.

10. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip Flops and Test it with a low frequency clock and Sketch the output waveforms.

11. Design MOD – 8 synchronous counter using T Flip-Flop and verify the result and Sketch the output waveforms.

12. (a) Draw the circuit diagram of a single bit comparator and test the output (b) Construct 7 Segment Display Circuit Using Decoder and 7 Segment LED and test it.

II Year –I Semester

Subject Code	Subject Name	L	T	P	C
R19CSE-ES2102	Data Structures with C Programming -Lab	0	0	3	1.5

OBJECTIVES:

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

COURSE OUTCOMES:

1. Analyzing different searching and sorting Techniques
2. Apply logical ability to solve the problems related Linked List.
3. Apply logical ability to solve the problems of Stack and queue applications.
4. Implementation of trees and their operations
5. Evaluate Binary search tree Operations
6. Analyzing different Graph Operations.

LIST OF PROGRAMS:

1. Write C programs to implement the following search algorithms:
   i) Linear Search ii) Binary Search
2. Write C programs to implement the following sorting algorithms:
   i) Bubble Sort ii) Insertion Sort iii) Selection Sort.
3. Write a C programs to implement the following sorting algorithms
   i) Merge Sort ii) Quick Sort.
4. Write a C programs that implement the following data structures using arrays:
   i) Stack ii) Queue.
5. Write C programs to Implement of Circular Queue using Arrays
6. Write C programs to evaluate of postfix expression.
7. Write a C programs to implement the following types of Lists
   i) Singly linked list iii) Doubly linked list.
8. 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
9. Write C programs for the implementation of BFS for a given graph.
10. Write C programs for the implementation of DFS for a given graph.
11. Write a C program for the implementation of Prim's algorithm to obtain the minimum cost spanning tree from a connected undirected graph.
12. Write a C program to implement Dijkstra's algorithm for the single source shortest path problem.

II Year –I Semester

Subject Code	Subject Name	L	T	P	C
R19BSH-MC2101	Essential of Indian Traditional Knowledge	2	0	0	0

COURSE OBJECTIVES:

1. Facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of knowledge system.(L2)
2. Importing basic principle of thought process reasoning and inference sustainability of Indian traditional knowledge system(L2)
3. Comprehend the legal framework, traditional knowledge, biological diversity act 2002 and geographical indication act 2003.(L3)
4. Focus on traditional knowledge and intellectual property mechanism
5. Analyze 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 and analyze social context(L2)
2. Apply significance of traditional knowledge protection (L3)
3. Analyze various enactments related to the protection of plant varieties. (L4)
4. Evaluate desired concepts of Intellectual property to protect the traditional knowledge(L4)
5. Compare the traditional knowledge in various sectors (L4)

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, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

Learning Outcomes:

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

1. Recognize the social change in traditional knowledge(L4)
2. Contrast and compare characteristics importance kinds of traditional knowledge. (L2)
3. Analyze physical and social contexts of traditional knowledge. (L4)

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

Unit-II: Protection of traditional knowledge: The 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:

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

4. Evaluate the role of government in harnessing Traditional Knowledge. (L4)

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

Unit-III: **Legal framework and Traditional knowledge in Food:** 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);B:The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Importance of food – Styles of food-traditional food- Modern Food- Factors influencing food choice- Economic and Physical Determinants- Uniqueness of Culture in Food.

Learning Outcomes:

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

1. Contrast and compare the Scheduled Tribes and other traditional forest dwellers(L2)
2. Analyze plant variant protections and evaluate farmers right act(L4)
3. Evaluate food security and protection of TK in the country(L5)Applications: Establish an effective system for the protection of plant varieties and observe nutrition levels of traditional and modern food items

Unit-IV: Traditional knowledge and intellectual property: Systems of traditional knowledge protection- Legal concepts for the protection of traditional knowledge- Certain non IPR mechanisms of traditional knowledge protection- Patents and traditional knowledge- Strategies to increase protection of traditional knowledge- global legal FORA for increasing protection of Indian Traditional Knowledge.

Learning Outcomes:

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

1. Evaluate strategies to increase the protection of traditional knowledge and Intellectual Property Rights (L4)
2. Apply systems of traditional knowledge protection. (L3)
3. 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-V: Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture,

Learning Outcomes:

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

1. Compare traditional knowledge in different sectors. (L2)
2. Apply traditional knowledge in engineering. (L3)

Applications: Generate the report on Traditional and current methods of cultivation and observe yield levels

Reference Books:

1. Traditional Knowledge System in India, by AmitJha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, PratibhaPrakashan 2012.
3. Traditional Knowledge System in India by AmitJha Atlantic publishers, 2002

4. "Knowledge Traditions and Practices of India" KapilKapoor, Michel Danino

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

II Year –I Semester

Subject Code	Subject Name	L	T	P	C
R19BSH-MC2102	**Industrial Psychology**	3	0	0	0

COURSE OBJECTIVES:

1. Ability to develop interpersonal skills among employees in work Environment.(L3)
2. Develop and validate the different specifications in job selection.(L3)
3. Equip skills for evaluation of a job in industry.(L2)
4. Impart knowledge relevant to appraisal system.(L2)

COURSE OUTCOMES:

1. State the essentials of psychology at workplace and gain insights about work place behavior. (L2)
2. Analyze key concepts and theoretical perspectives in industrial psychology. (L2)
3. Study the job amenities and their impact on work environment. (L3)
4. Examine the performance and behavior of consumer. (L4)
5. Estimate the various causes and consequences of stress.(L5)

UNIT I: INTRODUCTION TO INDUSTRIAL PSYCHOLOGY: Nature and meaning of Industrial Psychology- Role of the psychologist in industry- Occupation field of Psychology - Study of behavior in work situation and applications – Psychological principles of selection, Placement, Counseling and training.

Learning Outcomes:
At the end of this unit students will be able to:
1. Apply the elements of psychology in interpersonal relationships at work place (L3)
2. Work out the applications of psychological principles in work situation. (L5)
3. Motivate the people by counseling and training.(L4)

Applications: Psychological principles to solve problems in Wipro Spectrum to improve the quality of life.

UNIT II: DESIGN OF WORK ENVIRONMENTS: Human Ergonomics and physical environment techniques of job analysis, Social environment- Group dynamics in Industry Personal psychology –attitude, perception, personality, values - training, placement, promotion, counseling, job motivations, job satisfaction.

Learning Outcomes:
At the end of this unit students will be able to:
1. Validate and develop a job specific selection design. (L5)
2. Learn Group dynamics in Industry. (L1)
3. Know the Human Engineering at physical environment. (L2)

Applications: Compare and contrast work environment in an Industry, Business, Organization and firm like MSME, MNCs and public sector.

UNIT III: WORK METHODS: Efficiency at work-Features of work curve - characteristics - Work methods- hours of work, nature of work, fatigue and boredom, rest pauses. Personal

factors- age, abilities, interest. Working environment - noise, illumination, atmospheric conditions

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

1. Comprehend how to design, develop and evaluate job. (L2)
2. Describe Work Methods.(L2)
3. Demonstration on personal factors. (L2)

Applications: Analyze working environment in RINL & HPCL.

UNIT IV: EMPLOYEE PERFORMANCE AND CONSUMER PSYCHOLOGY: Identify environmental and cultural limitations. Methods of Appraisal- select the best appraisal method to accomplish goals-. Study of Consumer Behavior - Purchasing Decision making process- Determinants of Consumer Behavior & Motivation

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

1. Analyze the physical and psychological aspects related to workplace in terms of environmental conditions.(L4)
2. Knowledge about motivational factors of consumer. (L3)
3. Demonstrate and utilize the knowledge gained through the concepts of consumer psychology (L2)
4. Determine methods of evaluating employee performance.(L5)

Applications: Evaluate latest performance management methods in industries through case studies.

UNIT V: STRESS MANAGEMENT: Concept of Stress - Consequences and managing stress- Stress reduction interventions related to Life/Work issues- Measuring stress- workplace violence- repetitive stress injuries - preventing of Stress.

Learning Outcomes:

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

1. Estimate various consequences of stress management.(L2)
2. Evaluate the techniques which relieves stress in engineer's life.(L5)

Applications: Encourage physical activities like meditation, yoga and games in order to obtain stress free environment.

TEXT BOOKS:

1. Wickens, C. D.; Lee, J. D., Liu, Y. & Gordon Becker, S. E. (2015). An Introduction to Human Factors Engineering. 2nd Edition. Pearson Education: New Delhi.
2. Aamodt, M.G. (2013). Industrial Psychology. Cengage Learning: Delhi.
3. Schultz, D. & Schultz, S. E. (2013). Psychology and Work Today: An Introduction to Industrial and Organizational Psychology. 7th Edition. Pearson Education: New Delhi.
4. Matthewman, L., Rose, A. & Hetherington, A. (2009). Work Psychology. Oxford University Press: India.

REFERENCES:

1. Miner J.B. (1992) Industrial/Organizational Psychology. N Y : McGraw Hill.
2. Blum & Naylor (1982) Industrial Psychology. Its Theoretical & Social Foundations CBS Publication.
3. Aamodt, M.G. (2007) Industrial/Organizational Psychology : An Applied Approach (5th edition) Wadsworth/Thompson : Belmont, C.A.
4. Aswathappa K. (2008). Human Resource Management (fifth edition) New Delhi : Tata McGraw Hill.

E-Resources:

1. https://en.wikipedia.org/wiki/Industrial_and_organizational_psychology
2. https://en.wikipedia.org/wiki/Bachelor_of_Arts_in_Organizational_Psychology
3. https://link.springer.com/chapter/10.1057/9781137327734_14
4. https://www.verywellmind.com/what-is-industrial-organizational-psychology-2795302

II Year –II Semester Curriculum

Subject Code	Subject Name	L	T	P	C
R19ECE-PC2201	Electronic circuit Analysis	3	0	0	3

Course Objectives:

The main objectives of this course are:

1. The principle of working and operation of multistage amplifiers with BJT using low freq analysis.
2. The need of feedback and its significance is explained.
3. Understand the operation of Oscillator circuits
4. Calculate the efficiency of power amplifier
5. 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 – 1 : 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 – 2 : 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 – 3: OSCILLATORS:

Oscillator principle, condition for oscillations, types of oscillators, RC-phase shift and WeinBridge 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 – 4: 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 – 5: 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.

II Year –II Semester

Course Code	Course Title	L	T	P	C
R19EEE-PC2202	Control Systems (Common to EEE&ECE)	3	0	0	3

Course Objectives:

1. To learn the fundamental concepts of control systems and write down the transfer functions for different types of electrical and mechanical Systems.
2. To study the characteristics and time response analysis for first and second order systems.
3. To explain the absolute stability and relative stability of control system by RH criterion and Root locus techniques.
4. To demonstrate the analysis of the system response in frequency domain using bode, polar and Nyquist plots.
5. To introduce state variable analysis, concepts of controllability and observability.

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

1. Develop the transfer function of physical systems using block diagram algebra and signal flow graphs (L3)
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 (L4)
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

Mathematical Modelling of Control System

Classification of control systems-open loop and closed loop control systems and their differences-feedback characteristics-transfer function of linear systems-differential equations of electrical and mechanical systems-transfer function of AC and DC servo motors-synchro transmitter and receiver - block diagram algebra – representation by signal flow graph - reduction using mason's gain formula.

Unit outcomes: The students are able to

1. Explain the open loop and closed loop systems (L2)
2. Calculate the transfer function of a given system by using block diagram algebra and signal flow graph method (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 and proportional integral systems.

Unit outcomes: The students are able to

1. Understand the time response of first order and second order systems (L2)

2. Derive the different time domain specifications for second order systems (L2)
3. Determine time response specifications and steady state error for the second order system (L3)

UNIT-III: Stability Analysis in S-Domain

Stability Analysis: Concept of stability–absolute and relative stability analysis-Routh-Hurwitz criteria.

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.

Unit Outcomes: The students are able to

1. Find the stability of the given system by Routh's stability criterion (L1)
2. Identify whether the system is stable or not by using root locus technique (L3)

UNIT–IV

Frequency Response Analysis: Frequency domain specifications -relationship between time and frequency response -bode diagrams- transfer function from the bode diagrams-phase margin and gain margin-stability analysis from bode plots, polar plots and nyquist plots- lag and lead compensators.

Unit outcomes: The students are able to

1. Identify the stability of linear time invariant systems using frequency response methods (L3)
2. Derive the different frequency domain specifications for second order systems (L2)
3. Find the gain and phase margin from bode diagrams and Nyquist plots for understanding their implications in terms of stability (L2)
4. Explain the concepts of lag and lead compensators (L2)

UNIT-V

State Space Analysis: 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.

Unit outcomes: The students are able to

1. Analyze State space models of linear time invariant systems (L4)
2. Determine state space model for the given system (L3)
3. Understand the concepts of controllability and Observability (L2)

Textbooks:

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.
6. M. Gopal, “Control Systems: Principles and Design”, McGraw Hill Education, 1997.

Web Links:

1. https://nptel.ac.in/courses/108101037/
2. https://www.electrical4u.com/electrical-engineering-articles/control-system/
3. https://www.tutorialspoint.com/control_systems/control_systems_quick_guide.htm

II Year –II Semester

Subject Code	Subject Name	L	T	P	C
R19ECE-PC2203	Electromagnetic Waves and Transmission Lines	3	0	0	3

Course Objectives:

1. To introduce fundamentals of static and time varying electromagnetic fields.
2. To teach problem solving in Electromagnetic fields using vector calculus.
3. To demonstrate wave concept with the help of Maxwell's equations.
4. To introduce concepts of polarization
5. To teach reflection and refraction of electromagnetic waves
6. 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 applications of 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. weve created magnetic tape, generated electricity, and built computers.

Learning Outcomes:

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

1. Understand basic laws of static electric field (L2)
2. be Derive the Maxwell's equations for electrostatic fields (L3)
3. 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 electromagnetic induction

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

1. Understand basic laws of static magnetic field (L2)
2. Derive the Maxwell's equations for magnetic fields (L3)
3. Solve problems applying laws of magneto statics (L3).
4. Derive the Maxwell's equations for electromagnetic fields (L3)
5. 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

1. Understand concept of wave propagation through the Maxwell's equations (L2)
2. Derive wave equations for different media (L3)
3. Explain concept of polarization of electromagnetic wave (L2)
4. Understand principles of reflections and refraction for different incidences (L2)
5. State concept of power flow using Pointing vector (L1)
6. 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 Filters
5. Impendence matching purpose

Learning Outcomes:

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

1. Understand concept of transmission line equations (L2)
2. Derive transmission line equations for different conditions (L3)
3. 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

1. Understand concept of Input Impedance Relations (L2)
2. Analysis the properties of transmission line in different wave lengths level (L3)
3. 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.

II Year –II Semester

Subject Code	Subject Name	L	T	P	C
R19ECE-PC2204	Random Variable and Stochastic Process	3	0	0	3

Course Objectives:

1. To give students an introduction to elementary probability theory, in preparation for courses on statistical analysis, random variables and stochastic processes.
2. To mathematically model the random phenomena with the help of probability theory concepts
3. To introduce the important concepts of random variables and stochastic processes.
4. To analyze the LTI systems with stationary random process as input.
5. To introduce the types of noise and modeling noise sources.

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

1. Understand the concept of random phenomena and solve simple probabilistic problems.(L2)
2. Identify different types of random variables and compute statistical averages of these random variables.(L2)
3. Characterize the random processes in the time and frequency domains. (L4)
4. Analyze the LTI systems with random inputs. (L4)
5. Apply these techniques to analyze the systems in the presence of different types of noise(L3)

UNIT I THE RANDOM VARIABLE : Introduction, Review of Probability Theory, 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.

OPERATION ON ONE RANDOM VARIABLE – EXPECTATIONS : Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Nonmonotonic Transformations of Continuous Random Variable.

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

1. Differentiate the properties in discrete and continuous probability distribution (L3)

2. Evaluate the expectations and moments for discrete and continuous probability distributions (L2)

Applications:

1. To find load on a specific point in a beam we can use discrete functions to find loading at each point on a beam.

2.To find number of semiconductor wafers that need to be analyzed in order to detect a large particle of contamination in p-type or n-type material or in doping material we use random variables or discrete random variable.

3.To record the length of time for a chemical reaction to take place, once again the

Possible time intervals making up our sample space are infinite in number and uncountable.

UNIT II MULTIPLE RANDOM VARIABLES : 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

1. Differentiate the properties in discrete and continuous probability distribution for multiple random variables (L3)
2. Evaluate the expectations and moments for discrete and continuous probability distributions distribution for multiple random variables (L2)

Applications:

1. Number of airplanes taking off and landing during a given time in an airport

2.The range of the amount of current which can pass through a certain wire. We can find expected phase angle of AC circuit using continues random variable and also we can find how the phase angle varies from original value which gives the quality of our circuit which helps electrical engineers working in quality control firms

UNIT III RANDOM PROCESSES – TEMPORAL CHARACTERISTICS: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-

Order Stationary Processes, Second-order and Wide-Sense Stationarity, Nth-order and Strict-Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

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

1. Apply Gaussian random and Poisson random process to electronics and communicating engineering problems. (L3)
2. Interpret the concepts power spectrum and cross-power density spectrum (L2)

Applications:

1. Stock market and exchange rate fluctuations
2. speech Signals
3. Audio and video Signals
4. Medical data such as a patient's EKG, EEG, blood pressure or temperature
5. Robotics, automotive technology
6. Semiconductor manufacturing

UNIT IV RANDOM PROCESSES – SPECTRAL CHARACTERISTICS: The Power Density Spectrum: Properties, Relationship between Power Density Spectrum and Autocorrelation Function, the Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Density Spectrum and Cross-Correlation Function.

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

1. Analyze the LTI systems with random inputs.(L4)
2. Apply these techniques to analyze the systems in the presence of different types of noise.(L3)

Applications :

1. High level requirement and link budget analysis
2. Noise in wireless receiver circuits
3. Low noise amplifier design

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS : Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, Autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectra of Input and Output, Band pass, Band-Limited and Narrowband Processes, Properties, Modeling of Noise Sources: Resistive (Thermal) Noise Source, Arbitrary

Noise Sources, Effective Noise Temperature, Average Noise Figure, Average Noise Figure of cascaded networks

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

1. Apply the estimation theory on signal processing (L3)
2. Apply the decision theory on statistics, philosophy and psychology(L3)

Applications:

1. digital communications
2. Radar communication
3. Sonar: enemy submarine
4. Image processing: detect an aircraft from infrared images
5. Biomedicine: cardiac arrhythmia from heartbeat sound wave

TEXT BOOKS: 1. Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles, TMH, 4th Edition, 2001.

2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S.Unnikrisha, PHI, 4th Edition, 2002.

REFERENCE BOOKS:

1. Probability and Random Processes with Applications to Signal Processing, Henry Stark and John W. Woods, Pearson Education, 3rd Edition.

2. Schaum's Outline of Probability, Random Variables, and Random Processes.

3. An Introduction to Random Signals and Communication Theory, B.P. Lathi, International Textbook, 1968.

4. Random Process – Ludeman , John Wiley

II Year –II Semester

Subject Code	Subject Name	L	T	P	C
R19CSE-ES2201	Computer Architecture and Organization	3	0	0	3

Course objectives:

1. To understand the architecture of a modern computer with its various processing units. Also the Performance measurement of the computer system.
2. To understand the memory management system of computer.
3. To Understand the various instructions, addressing modes
4. To Understand the concept of I/O organization

Course Outcomes:

Students can understand the architecture of modern computer.

1. They can analyze the Performance of a computer using performance equation [L3]
2. Understanding of different instruction types. [L2]
3. Students can calculate the effective address of an operand by addressing modes. [L3]
4. They can understand how computer stores positive and negative numbers. [L2]
5. Understand the concepts of I/O Organization and Memory systems. [L2]

UNIT -I: Basic Structure Of Computers: Functional unit, Basic Operational concepts, Bus structures, System Software, Performance, The history of computer development. Machine Instruction and Programs: Instruction and Instruction Sequencing: Register Transfer Notation, Assembly Language Notation, Basic Instruction Types.

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

1. Understand design of the various functional units and components of computers. [L2]
2. Analyse some of the design issues in terms of speed, technology, cost, performance. [L3]
3. Understand concepts of register transfer notation. [L2]
4. Understand the basic instructions used in the computers. [L2]

Applications:

1. Strong basics in hardware components of a computer

UNIT -II: Addressing Modes: Basic Input/output Operations, The role of Stacks and Queues in computer programming equation. Component of Instructions: Logic Instructions, shift and Rotate Instructions Type of Instructions: Arithmetic and Logic Instructions, Branch Instructions, Addressing Modes, Input/output Operations

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

1. Explain different types of addressing modes. [L1]
2. Discuss different types of computer arithmetic and logic operations. [L1]
3. Understand the structure, function and type of instructions used in performing computer arithmetic. [L2]

Application:

1. Addressing modes, Arithmetic and logic instructions are used in the design of central processing unit (CPU) .
2 .To study and design arithmetic logic unit (ALU).

UNIT -III: INPUT/OUTPUT ORGANIZATION: Accessing I/O Devices, Interrupts: Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access, Buses: Synchronous Bus, Asynchronous Bus, Interface Circuits, Standard I/O Interface: Peripheral Component Interconnect (PCI) Bus, Universal Serial Bus (USB).

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

1. Understand the input / output and Memory related concepts. [L2]
2. Discuss different types of busses inside computer organisation. [L1]
3. Understand the structure and function of peripheral interface used in Input /Output organisation. [L2]

Application:

1. PCI bus in high speed I/O systems applications.
2.USB (Universal Serial Bus) is the most popular connection used to connect a computer to devices such as digital cameras, printers, scanners, and external hard drives.

UNIT -IV: The MEMORY SYSTEMS: Basic memory circuits, Memory System Consideration, Read Only Memory: ROM, PROM, EPROM, EEPROM, Flash Memory, Cache Memories: Mapping Functions, INTERLEAVING Secondary Storage: Magnetic Hard Disks, Optical Disks.

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

1. Discuss the concept of memory organization [L1]
2. Summarize the types of memory [L1]
3. Understand the design and working of secondary storage elements. [L2]
4. Explain the use of cache memory and virtual memory . [L1]

Applications:

1. RAM allows your computer to perform many of its everyday tasks, such as loading applications, browsing the internet, editing a spreadsheet, or experiencing the latest game.
2.ROM is the memory that is pre-written to hold the instructions for booting-up the computer.

UNIT -V: Processing Unit: Fundamental Concepts: Register Transfers, Performing an Arithmetic Or Logic Operation, Fetching A Word From Memory Execution of Complete Instruction, Hardwired Control, Micro programmed Control: Microinstructions, Micro program Sequencing, Wide Branch Addressing Microinstructions with next –Address Field

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

1. Understand concepts of Hardwired control and micro programmed control. [L2]
2. Understand the architecture and functionality of central processing unit . [L2]
3. Summarize the Instruction execution stages. [L1]
4. Summarize the types of micro operations. [L1]

Applications:

1. A cell phone or mobile device executes game instructions by use of processing unit.
2. VCRs, televisions and gaming platforms also contain processing unit for executing complex instructions and tasks.

TEXTBOOKS:

1. Computer Organization, Carl Hamacher, ZvonksVranesic, SafeaZaky, 5thEdition, McGrawHill,2011.
2. Computer Architecture and Organization, John P. Hayes ,3rdEdition, McGrawHill,2002.

REFERENCE BOOKS:

1. Computer Organization and Architecture – William Stallings SixthEdition,Pearson/PHI
2. Structured Computer Organization – Andrew S. Tanenbaum, 4th EditionPHI/Pearson, 2012.
3. Fundamentals or Computer Organization and Design, - SivaraamaDandamudiSpringer Int.Edition,2003.
4. “Computer Organization and Design: The Hardware/Software Interface” by DavidA. Patterson and John L.Hennessy, 1998.
5. J .P. Hayes, "Computer Architecture and Organization",McGraw-Hill,1998.

II Year –II Semester

Subject Code	Subject Name	L	T	P	C
R19BSH-HM2201	Management and Organizational Behavior	3	0	0	3

COURSE OBJECTIVES:

1. Provide fundamental knowledge on Management, Administration, Organization methodologies.
2. Equip with knowledge of Production, Materials, Inventory and Quality control.
3. Identify the conflict management skills related to Organization behavior.
4. Analyses the PERT/CPM techniques for better Project Management.
5. Comprehend the marketing mix for new product development.

COURSE OUTCOMES:

1. Apply concepts & principles of management & designs of organization in practical world. (L3)
2. Apply principles of Work-study, Quality Control techniques and Inventory control in industry(L3)
3. Develop PERT/CPM Charts for projects of enterprise and estimate time & cost of project.(L4)
4. Realize concepts of individual behavior in organization. (L3)
5. Ascertain functional management challenges with changes of levels in organization(L4)

Unit I:

INTRODUCTION TO MANAGEMENT: Management-Concept -Nature-Functions-Evolution of Management Thought -Motivational theories- Principles of Organization-Features and types organizational structures- Decision making Process-Leadership styles.

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

1. Acquire the techniques, skills and modern engineering tools necessary for engineering practice.(L3)
2. Apply concepts & principles of management & structures of organization in a practical world(L3)
3. Evaluate management aspects and its implementation in aim of achieving organizational goals(L5)

Applications:

Divide the class into two teams' old employees and new joiners and motivate the work environment with respect to excellent management and the supportive.

UNIT II:

OPERATIONS MANAGEMENT: Principles and types of operations management-Work Study- Statistical Quality Control: X-bar chart, R chart, Cchart and P chart, (simple Problems) Deming's contribution to Quality. Inventory Management: Objectives-Functions, Inventory Controlling Techniques-EOQ-ABC Analysis.

Learning Outcomes:

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

1. Equip with the concepts of operations & their technical relationships(L2)
2. Utilization of techniques in Statistical Quality Control .(L3)
3. Estimate qualitative and quantitative methods of inventory management.(L5)

Applications:

Study the Inventory control employed in Big Bazaar and frames the basic inventory models which represent the inventory management.

UNIT III:

INTRODUCTION TO ORGANIZATIONAL BEHAVIOUR: Concept of Organizational Behaviour (OB)- Importance, Elements of organizational behaviour - Organization culture, Managing cultural diversity-Conflict-Definition, Types- Conflict Management Approaches**.**

Learning outcome

1. Acquire the various challenges employee faces in an organizations..(L2)
2. Analyze different rational decisions seen in the organization..(L3)
3. Educate general history on management theory and practices.(L2)

Application:

Predict different approaches of cultural diversity and challenges seen in RINL and list out all the approaches to solve the problems.

UNIT IV:

PROJECT MANAGEMENT: Project planning and control- Development of network- Difference between Program Evaluation Review Technique and Critical Path Method- Identifying critical path- probability - project crashing (simple problems).

Learning Outcomes:

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

1. Analyze methods of reducing the time and cost of the project.(L2)
2. Visualize Project handling and control the techniques for optimum utilization of resources(L2)
3. Develop PERT/CPM networks for projects of an enterprise and estimate time & cost of project(L6)

Application:

Estimation of the cost and time of the High way Corridor of the Visakhapatnam Metro Tram Project.

UNIT V:

FUNCTIONAL MANAGEMENT: HRM- Definition – Nature-Managerial and Operative functions- Difference between Personnel Management and Human Resource Management-Job Evaluation and merit rating. Introduction of Marketing- Marketing mix-New product development- Product life cycle.

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

1. Understand the importance of human resources power in the main functional areas (L2)
2. Study the latest methods involved in Human Resource Planning.(L3)
3. Analyze the organization through SWOT analysis(L4)

Applications:
Generate a self study report of the variety of technical advancements and factors governing the in Wipro Technologies in Global level.

Text Books:

1. Management Science by Aryasri; Publisher: Tata McGraw Hill, 2009
2. Management by James Arthur, Finch Stoner, R. Edward Freeman, and Daniel R. Gilbert 6th Ed; Publisher: Pearson Education/Prentice Hall.
3. Robbins, Stephen & S. Sanghi, Organizational Behaviour, Pearson Education. 2010. 2.

References Books:

1. Principles of Marketing: A South Asian Perspective by Kotler Philip, Gary Armstrong, Prafulla Y. Agnihotri, and EshanulHaque , 2010, 13th Edition, Publisher: Pearson Education/ Prentice Hall of India.

2. A Handbook of Human Resource Management Practice by Michael Armstrong, 2010; Publisher: Kogan Page Publishers.
3. Quantitative Techniques in Management by N.D. Vohra, 4th edition, 2010; Publisher: Tata McGraw Hill.
4. Parikh, M. & Gupta, R, OrganisationalBehaviour, Tata McGraw-Hill, 2010
5. Operations Management: Theory and Practice by B. Mahadevan, 2010; Publisher: Pearson Education.

Web links:

1. www.managementstudyguide.com
2. www.citehr.com
3. www.nptel.ac.in/courses/122106032
4. www.btechguru.com/courses--nptel--basic-course

II Year –II Semester

Subject Code	Subject Name	L	T	P	C
R19ECE-PC2205	Electronics Circuit Analysis - Lab	0	0	3	1.5

COURSE OBJECTIVES:

1. Demonstrate the working of multistage and feedback amplifier and plotting the frequency response.
2. Design the high input resistance circuits
3. Explain the design procedure for different oscillators.
4. Describe the efficiency calculations of various power amplifiers.
5. 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).

Part – A Conduct any 10 Experiments also simulate with using Spice Software

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

II Year –II Semester

Subject Code	Subject Name	L	T	P	C
R19ECE-PC2206	Signal and systems-Lab	0	0	3	1.5

Course Objective:

1. Provide knowledge of the Fourier, Laplace and Z transform tools for analyzing the signals and systems in frequency domain.
2. Generate and characterize various continuous and discrete time signals.
3. Perform the basic operations on the signals.
4. Analyze the spectral characteristics of signals using Fourier analysis.
5. 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 (L4).
6. Analyze linear time-invariant (LTI) system and illustrate its pole-zero plot (L4).

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 Correlation on 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 Year –II Semester

Subject Code	Subject Name	L	T	P	C
R19CSE-SD2201	Python Programming-Lab	2	0	2	1

COURSE OBJECTIVES:

1. To write, test, and debug simple Python programs.
2. To implement Python programs with Conditionals and Loops
3. Learn Syntax and Semantics and create Functions in Python
4. Represent compound data using Python Lists, Tuples, and Dictionaries.
5. Implement Object Oriented Programming concepts in Python

COURSE OUTCOMES:

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

1. Understand the working environment of Python and its program structure.
2. Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
3. Implement Conditionals and Loops for Python Programs.
4. Use Python Lists, Tuples and Dictionaries for representing compound data.
5. Interpret the concepts of Object-Oriented Programming as used in Python

Experiment 1:

- **a.** Demonstrate the python script Working of 'id' and 'type' functions
- **b.** Write a python script to read using input() and display using print() functions.

Experiment 2:

- **a.** Write a program to compute Square root of a number (Newton's method).
- **b.** Write a program to compute distance between two points taking input from the user (Pythagorean Theorem)

Experiment 3:

- **a.** Write a program to take input as integer N and Check if a number is odd or even.
- **b.** Write a python script to print Prime pairs within a given range of numbers. (Hint N=20, then (3,5) (5,7) (11,13) (17,19) are prime pairs)

Experiment 4:

- **a.** Write a python script for GCD of two numbers.
- **b.** Write a python script to find the maximum from a list of numbers.

Experiment 5:

- **a.** Write a program to take input as String S and print frequency of each character in S using List data structure.
- **b.** Write a program to take input as String S contains combination of uppercase, lowercase, numbers and special symbols, then print Uppercase followed by Lowercase followed by numbers followed by special symbols.

Experiment 6:

- **a.** Write a python script to take input as String sentence S and print each word count using dictionary.
- **b.** Using Slice operator, write a python script to take input as String S and check whether string is palindrome or not.

Experiment 7:

14. Write a program to Perform Linear Search and Binary Search.

15. Write a program to Perform selection sort and insertion sort.

Experiment 8:

a. Write a program to demonstrate use of List & related functions.

b. Write a program to find mean, median, mode for the given set of numbers in a list.

Experiment 9:

a. Write a python script to demonstrate use Tuple, Set & related functions.

b. Write a python script to read and write from a file.

Experiment 10:

a. Create a module named "Lendi" and create functions addStudent, removeStudent, searchStudent. Access the above module using import statement.

Experiment 11:

a. Install packages using PIP.

b. Write a script that uses the random module for generating random numbers.

Experiment 12:

a. Using Python OOPS, create a class, constructor, method, __str__ and __repr__ for:
i. Employee
ii. Student

Experiment 13:

a. Write a python script to implement Decorators for methods in a class.

b. Write a program to implement Python duck Typing.

Experiment 14:

a. Using NumPy, implement different matrix operations in python.

b. Using SciPy, implement polynomials and linear algebra expressions.

c. Using pandas, read the data from CSV and JSON files.

Experiment 15:

a. Using MatPlotlib library, plot the graph with all different plot types.(Pie Chart, Area Plot, Scatter Plot, Histogram and Bar Graph)

APPLICATIONS:

1. Web Application Development and Scraping
2. Designing Games
3. Machine Learning and AI based applications
4. Embedded Systems and IoT Applications
5. Data Science and Visualization
6. Embedded and CAD Applications