SCHEME OF INSTRUCTION
BE (COMPUTER SCIENCE & ENGINEERING)
CSE: III - SEMESTER

S.No	Course Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	HS 301 MT	Humanities -_1 (Operations Research)	3	0	0	3	30	70	3
2	BS 302 MT	Mathematics – III (Probability & Statistics)	3	1	0	4	30	70	4
3	ES 301 EC	Basic Electronics Engineering	3	1	0	4	30	70	4
4	ES 302 CS	Logic and Switching Theory	3	0	0	3	30	70	3
5	PC 301 CS	Data Structures and Algorithms	3	0	0	3	30	70	3
Practicals									
6	ES 351 EC	Basic Electronics Lab	0	0	2	2	25	50	1
7	PC 351 CS	Data Structures Lab	0	0	2x2	4	25	50	2
8	PC 352 CS	IT Workshop (Python and MATLAB)	1	0	2x2	5	25	50	3
Total			**16**	**2**	**10**	**28**	**225**	**500**	**23**

L : Lectures

T : Tutorials

P : Practicals

CIE : Continuous Internal Evaluation

SEE : Semester End Examination

HS 301 MT OPERATIONS RESEARCH

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objective:

The objective of the course is to give an overview of different Optimization Techniques useful for problem solving and decision making.

Course Outcomes : Students can able to

i) Model Physical Problems in Engineering and Management in Mathematical Form.
ii) Solve decision making situation problem using the concept of linear programming techniques.
iii) Solve transport related problems of Industry.
iv) Solve the problems related to assignment of jobs or projects to the employees in IT and Management related, which minimizes the total assignment cost.

UNIT – I: Introduction

i. Introduction to OR- Origin, Nature, definitions, Managerial applications and limitations of OR.

ii. Linear Programming: Mathematical model, Formulation of LPP, assumptions underlying LPP, Solution by the Graph, Exceptional cases.

UNIT – II: Allocation Model - I

i. LPP - Simplex Method- Solution to LPP problems Maximisation and Minimisation cases Optimality conditions. Degeneracy.
ii. Dual - Formulation, Relationship between Primal - Dual, Solution of dual, Economic interpretation of dual.

UNIT – III: Allocation Model - II

Transportation Problem (TP) - Mathematical model, IBFS using northwest corner rule, Row and Column Minimum methods, Matrix minimum method(LCM) and Vogel's approximation method, Unbalanced TP, Degeneracy, Optimality Test and Managerial applications.

UNIT – IV: Allocation Model – III

i.Assignment Problem (AP): Mathematical model, Unbalanced AP, Restricted AP, method of obtaining solution- Hungarian method.
ii.Travelling salesman problem

UNIT – V: Competitive Strategy Models

Game Theory- concepts, saddle point, Dominance, Zero-sum game, two, three and more Persons games, analytical method of solving two person zero sum games, graphical solutions for (m x 2) and (2 x n) games

Suggested Readings:

1. J.K. Sharma, "Operations Research Theory and Applications 2009, 4th Ed. Macmillan.
2. S.D.Sharma, "Operations Research" , Publishing 2017, Latest Edition, Kedar Nath Ram Nath.
3. N.D. Vohra, "Quantitative Techniques in Management", 2010, 4th Ed.TMH.
4. Kasana, HS & Kumar, KD, "Introductory Operations Research theory and applications", 2008, Springer.
5. Chakravarty, P, "Quantitative Methods for Management and Economics", 2009, 1st Ed. HPH.
6. Barry Render, Ralph M. Stair, Jr. and Michael E. Hanna, "Quantitative analysis for Management", 2007, 9th Ed. Pearson.
7. Pannerselvam, R, "Operations Research", 2006, 3rd Ed. PHI.
8. Selvaraj, R, "Management Science Decision Modeling Approach", 2010, 1st Ed. Excel.
9. Ravindren, A, Don T. Phillips and James J. Solberg, 2000, "Operations Research Principles and Practice", 2nd Ed. John Wiley and Sons.
10. Hillier, Frederick S. & Lieberman, "Introduction to Operations Research Concepts and Cases", 2010, 8th Ed. TMH.
11. Prem Kumar Gupta & others, "Operations Research", 2010, S. Chand.

BS 302 MT **MATHEMATICS-III**
(PROBABILITY AND STATISTICS)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessional	30 Marks
Credits	4

Course objectives :

- To provide the knowledge of probability distributions , tests of significance, correlation and regression.

Course Outcomes :

At the end of the course students will be able to

- apply various probability distributions to solve practical problems, to estimate unknown parameters of populations and apply the tests of hypotheses
- perform a regression analysis and to compute and interpret the coefficient of correlation

UNIT-I : Measures of Central tendency, Moments, skewness and Kurtosis, Discrete random variables, Independent random variables, The multinomial distribution, Poisson approximation to the binomial distribution, Infinite sequences of Bernoulli trials, Sums of independent random variables, Expectation of Discrete Random Variables, Variance of a sum.

UNIT-II: Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and gamma densities.

UNIT-III: Probability distributions, Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions.

UNIT-IV: Curve fitting by the method of least squares , Fitting of straight lines, Second degree parabolas and more general curves, Correlation, Regression and Rank correlation.

UNIT-V : Test of significance, Large sample test for single proportion, Difference of proportions, Single mean, difference of means, and difference of standard deviations. Small Sample test for single mean, Difference of means and correlation coefficients, Test for ratio of variances , Chi-square test for goodness of fit and independence of attributes.

Suggested Reading:

1. R.K.Jain & S.R.K Iyengar, Advanced Engineering Mathematics, Narosa Publications, 4th Edition 2014.

2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publications, 43rd Edition.

3. S. Ross, "A First Course in Probability", Pearson Education India, 2002.

4. N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.

5. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.

6. S.C Gupta & Kapoor: Fundamentals of Mathematical statistics, Sultan chand & sons, New Delhi.

ES 301 EC BASIC ELECTRONICS ENGINEERING

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessional	30 Marks
Credits	4

Course Objectives:

- *To analyze the behavior of semiconductor diodes in Forward and Reverse bias.*
- *To design of Half wave and Full wave rectifiers with L,C, LC & CLC Filters.*
- *To explore V-I characteristics of Bipolar Junction Transistor in CB, CE & CC configurations.*
- *To explain feedback concept and different oscillators.*
- *To analyze Digital logic basics and Photo Electric devices.*

Course Outcomes:

Students will be

- *Able to learn about forward biased and reversed biased circuits.*
- *Able to plot the V-I Characteristics of diode and transmission.*
- *Able to design combinational logic circuits and PLDs.*

UNIT-I

Semi-Conductor Theory: Energy Levels, Intrinsic and Extrinsic Semiconductors, Mobility, Diffusion and Drift current. Hall Effect, Characteristics of P-N Junction diode, Parameters and Applications.

Rectifiers: Half wave and Full wave Rectifiers (Bridge, center tapped) with and without filters, ripple regulation and efficiency. Zener diode regulator.

UNIT-II

Bipolar Junction Transistor: BJT, Current components, CE, CB, CC configurations, characteristics, Transistor as amplifier. Analysis of CE, CB, CC Amplifiers (qualitative treatment only) .

JFET: Construction and working, parameters, CS, CG, CD Characteristics, CS amplifier.

UNIT-III

Feedback Concepts – Properties of Negative Feedback Amplifiers, Classification, Parameters. Oscillators – Barkhausen Criterion, LC Type and RC Type Oscillators and Crystal Oscillators. (Qualitative treatment only).

UNIT-IV

Operational Amplifiers – Introduction to OP Amp, characteristics and applications –Inverting and Non-inverting Amplifiers, Summer, Integrator, Differentiator, Instrumentation Amplifier.
Digital Systems: Basic Logic Gates, half, Full Adder and Subtractors.

UNIT-V

Data Acquisition Systems: Study of transducer (LVDT, Strain gauge, Temperature, and Force). Photo Electric Devices and Industrial Devices: Photo diode, Photo Transistor, LED, LCD, SCR, UJT Construction and Characteristics only.
Display Systems: Constructional details of C.R.O and Applications.

Suggested Readings:

1. Jocob Millman, Christos C. Halkias and Satyabrata Jit,*Electronics Devices and Circuits*,3rd Edition, McGraw Hill Education (India) Private Limited, 2010.
2. Rama Kanth A. Gaykward,*Op-AMPS and Linear Integrated Circuit*, 4thEdition PrenticeHall of India, 2000.
3. M. Morris Mano,*Digital Design*, 3rdEdition, Prentice Hall of India, 2002.
4. William D Cooper, and A.D. Helfrick,*Electronic Measurements and InstrumentationsTechniques*, 2ndEdition, Prentice Hall of India, 2008.
5. **5**. S. Shalivahan, N. Suresh Kumar, A. Vallava Raj,*Electronic Devices and Circuits*, 2ndEdition., McGraw Hill Education (India) Private Limited, 2007

ES 302 CS LOGIC AND SWITCHING THEORY

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

- To introduce concepts of Boolean logic, Postulates and Boolean Theorems.
- To understand the use of logic minimization methods and to solve the Boolean logic expressions
- To understand how to design the combinational and sequential circuits.
- To introduce and realize the adder circuits
- To understand the state reduction methods for sequential circuits.

Course Outcomes:

Students will be

- Able to apply the concepts of Boolean logic, Postulates and Boolean Theorems to solve the Boolean expressions.
- Able to solve the Complex Boolean logic expressions using Minimization methods.
- Able to design the combinational, sequential circuits and Various adder circuits.
- Able to apply state reduction methods to solve sequential circuits.

UNIT-I

Boolean Algebra: Axiomatic definition of Boolean Algebra Operators, Postulates and Theorems, Boolean Functions, Canonical Forms and Standard Forms, Simplification of Boolean Functions Using Theorems and Karnaugh Map Method.

UNIT-II

Minimization of Switching Functions: Quine-McCluskey Tabular Method, Determination of Prime Implicants and Essential Prime Implicants.

Combinational Logic Design: Single-Output and Multiple-Output Combinational Circuit Design, AND-OR, OR-AND and NAND/NOR Realizations, Exclusive-OR and Equivalence functions.

UNIT–III

Design of Combinational Logic Circuits: Gate Level design of Small Scale Integration (SSI) circuits, Modular Combinational Logic Elements- Decoders, Encoders, Priority encoders, Multiplexers and De-multiplexers.

Design of Integer Arithmetic Circuits using Combinational Logic: Integer Adders – Binary Adders, Subtractors, Ripple Carry Adder and Carry Look Ahead Adder, and Carry Save Adders.

UNIT-IV

Design of Combinational Circuits using Programmable Logic Devices (PLDs):
Programmable Read Only Memories (PROMs), Programmable Logic Arrays (PLAs), Programmable Array Logic (PAL) devices.

Introduction to Sequential Circuit Elements: Latch, Various types of Flip-Flops and their Excitation Tables.

UNIT -V
Models of Sequential Circuits: Moore Machine and Mealy Machine, Analysis of Sequential Circuits-State Table and State Transition Diagrams. Design of Sequential Circuits-Counters. Moore and Mealy State Graphs for Sequence Detection, Methods for Reduction of State Tables and State Assignments.

Suggested Reading:

1. M Morris Mano and Michael D Ciletti, *Digital Design*, Prentice Hall of India, Fourth Edition, 2008.
2. Zvi Kohavi, *Switching and Finite Automata Theory*, Tata McGraw Hill, 2nd Edition, 1979.

PC 301 CS DATA STRUCTURES AND ALGORITHMS

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

- To introduce the time and space complexities of algorithms.
- To discuss the linear and non-linear data structures and their applications.
- To introduce the creation, insertion and deletion operations on binary search trees and balanced binary search trees.
- To introduce various internal sorting techniques and their time complexities

Course Outcomes:
Students will be

- Able to analyze the time and space complexities of algorithms.
- Able to implement linear, non-linear data structures and balanced binary trees
- Able to analyse and implement various kinds of searching and sorting techniques.
- Able to find a suitable data structure and algorithm to solve a real world problem.

UNIT–I

Performance and Complexity Analysis: Space Complexity, Time Complexity, Asymptotic Notation (Big-Oh), Complexity Analysis Examples.
Linear List-Array Representation: Vector Representation, Multiple Lists Single Array.
Linear List-Linked Representation: Singly Linked Lists, Circular Lists, Doubly Linked Lists, Applications (Polynomial Arithmetic).
Arrays and Matrices: Row And Column Major Representations, Sparse Matrices.

UNIT –II

Stacks: Array Representation, Linked Representation, Applications (Recursive Calls, Infix to Postfix, Postfix Evaluation).
Queues: Array Representation, Linked Representation.
Skip Lists and Hashing: Skip Lists Representation, Hash Table Representation, Application- Text Compression.

UNIT- III

Trees: Definitions and Properties, Representation of Binary Trees, Operations, Binary Tree Traversal.
Binary Search Trees: Definitions, Operations on Binary Search Trees.
Balanced Search Trees: AVL Trees, and B-Trees.

UNIT –IV

Graphs: Definitions and Properties, Representation, Graph Search Methods (Depth First Search and Breadth First Search)
Application of Graphs: Shortest Path Algorithm (Dijkstra), Minimum Spanning Tree (Prim's and Kruskal's Algorithms).

UNIT –V

Searching : Linear Search and Binary Search Techniques and their complexity analysis.

Sorting and Complexity Analysis: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, and Heap Sort.

Suggested Reading:

1. Sartaj Sahni, *Data Structures--Algorithms and Applications in C++*, 2nd Edition, Universities Press (India) Pvt. Ltd., 2005.
2. Mark Allen Weiss, *Data Structures and Problem Solving using C++*, Pearson Education International, 2003.
3. Michael T. Goodrich, Roberto Tamassia, David M. Mount, *Data Structures and Algorithms in C++*, John Wiley & Sons, 2010.

PC 351 CS Basic Electronics Engineering Laboratory

Instruction	2 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	1

Course Objectives:

- *To understand the diode characteristics.*
- *To study the input and out characteristics of different Transistor configurations.*
- *To understand the design concepts of amplifier and Oscillator circuits.*
- *To understand the design concepts of feedback amplifiers.*

Course Outcomes:

Students will be

- *Able to design diode circuits.*
- *Able to understand the applications of Zener diode.*
- *Able to understand the operation of HWR & FWR circuits with & without filters.*
- *Able to analyze the characteristics of BJTs and FETs.*
- *Able to analyze the performance of operation amplifier.*
- *Able to operate laboratory equipment and analyze the results.*
- *Able to design logic gates using BJTs.*

List of Experiments:

1. CRO Applications.
2. Characteristics of semiconductor diodes (Ge, Si and Zener).
3. Static Characteristics of BJT (CE).
4. Static Characteristics of BJT (CB).
5. Ripple and Regulation characteristics of Half-wave rectifiers with and without filters.
6. Ripple and Regulation characteristics of Full-wave rectifiers with and without filters
7. Transistor as an amplifier.
8. Operational Amplifier Applications.
9. Emitter follower and source follower.
10. Static characteristics of CS configuration of FET.
11. BJT biasing.
12. Finding h-parameters for a two-port network (transistor in CB configuration).
13. Simulations of above experiments must also be carried using P-Spice Software.

Suggested Readings:

1. Maheshwari and Anand, *Laboratory Experiments and PSPICE Simulations in Analog Electronics*, 1st edition, Prentice Hall of India, 2006.
2. David Bell A., *Laboratory Manual for Electronic Devices and Circuits*, Prentice Hall of India, 2007

PC 351 CS DATA STRUCTURES LAB

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

1. Implement the following operations on singly linked list:
   i) Creation ii) Insertion iii) Deletion iv) Traversal
2. Implement the following operations on doubly linked list:
   i) Creation ii) Insertion iii) Deletion iv) Traversal
3. Implement the following operations on circular linked list:
   i) Creation ii) Insertion iii) Deletion iv) Traversal
4. Implementation of Stacks, Queues (using both arrays and linked lists).
5. Implementation of circular queue using arrays.
6. Implementation of double ended queue (de queue) using arrays.
7. Implement a program to evaluate a given postfix expression using stacks.
8. Implement a program to convert a given infix expression to postfix form using stacks.
9. Implementation of Polynomial arithmetic using linked list.
10. Implementation of recursive and non recursive functions to perform the following searching operations for a key value in a given list of integers:
    i) Linear search ii) Binary search
11. Implementation of hashing with (a) Separate Chaining and (b) Open addressing methods.
12. Implementation of recursive and iterative traversals on binary tree.
13. Implementation of operations on binary tree (delete entire tree, copy entire tree, mirror image, level order, search for a node etc.)
14. Implementation of the following operations on binary search tree (BST):
    (a) Minimum key (b) Maximum key (c) Search for a given key (d) Delete a node with given key

15. Implement the following sorting algorithms:
    a) Bubble sort b) Selection sort c) Insertion sort (d) Merge sort (e) Quick sort (f) Heap sort
16. Implement the following operations on AVL search tree: i) Insertion ii) Deletion
17. Implementation of graph traversals by applying: (a) BFS (b) DFS
18. Implement the following algorithms to find out a minimum spanning tree of a simple connected undirected graph: (a) Prim's algorithm (b) Kruskal's algorithm
19. Implement Dijkstra's algorithm for solving single source shortest path problem.
20. Implement the following operations on B-Trees:
    i) Creation ii) Insertion iii) Deletion iv) Traversal

PC 352 CS IT WORKSHOP

Instruction	5 Periods (1 L & 4 P) per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	3

SECTION 1 : MAT LAB / SCILAB PROGRAMS

1. Introduction to MATLAB/SCIlab Environment

2. Study of basic matrix operations

3. To solve linear equation

4. Solution of Linear equations for Underdetermined and Over determined cases.

5. Determination of Eigen values and Eigen vectors of a Square matrix.

6. Solution of Difference Equations.

7. Solution of Difference Equations using Euler Method.

8. Solution of differential equation using 4th order Runge- Kutta method.

9. Determination of roots of a polynomial.

10.Determination of polynomial using method of Least Square Curve Fitting.

11.Determination of polynomial fit, analyzing residuals, exponential fit and error bounds from the given data.

12.Determination of time response of an R-L-C circuit

SECTION 2 : Python Programs

1 Introduction to Python Programming:
   A. Running instructions in Interactive interpreter and a Python Script.
   B. Write a program to purposefully raise Indentation Error and Correct it
   C. Write a program to compute distance between two points taking input from the user
   D. Write a program add.py that takes 2 numbers as command line arguments and prints its sum.
   E. Program to display the following information: Your name, Full Address, Mobile Number, College Name, Course Subjects
   F. Write a Program for checking whether the given number is a even number or not.

2 Control Structures, Lists
   A. Program to find the largest three integers using if-else
   B. Program that receives a series of positive numbers and display the numbers in order and their sum
   C. Program to find the product of two matrices $[A]_{mxp}$ and $[B]_{pxr}$
   D. Program to display two random numbers that are to be added, the program should allow the student to enter the answer.
   E. If the answer is correct, a message of congratulations should be displayed.
   F. If the answer is incorrect, the correct answer should be displayed.
   G. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . 1/10.
   H. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

3 Functions and Recursion
   A. Write recursive and non-recursive functions for the following
   B. To find GCD of two integers
   C. To find the factorial of positive integer
   D. To print Fibonacci Sequence up to given number n
   E. To display prime number from 2 to n.
   F. Function that accepts two arguments: a list and a number n. It displays all of the numbers in the list that are greater than n
   G. Functions that accept a string as an argument and return the number of vowels and consonants that the string contains

4 Files, Exceptions, Lists, Sets, Random Numbers
   A. Program to write a series of random numbers in a file from 1 to n and display.
   B. Program to write the content in a file and display it with a line number followed by a colon
   C. Program to display a list of all unique words in a text file
   D. Program to analyse the two text files using set operations
   E. Write a program to print each line of a file in reverse order.
   F. Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?
   G. Write a program combine lists that combines these lists into a dictionary.

5 Object Oriented Programming
   A. Program to implement the inheritance
   B. Program to implement the polymorphism

6 GUI Programming
   A. Program that converts temperature from Celsius to Fahrenheit
   B. Program that displays your details when a button is clicked
   C. Write a GUI for an Expression Calculator using tk