DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Scheme of Instruction
and
Syllabi of

BE (ARTIFICIAL INTELLIGENCE &MACHINE LEARNING)
III & IV- SEMESTER

2022-2023

UNIVERSITY COLLEGE OF ENGINEERING

(AUTONOMOUS)

OSMANIA UNIVERSITY

HYDERABAD – 500 007, TELANGANA

SCHEME OF INSTRUCTION

BE (AI & ML) III–SEMESTER

Academic Year 2022-23

S.No	Course Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	PC 301 AI	Discrete Mathematics	3	1	0	4	30	70	3
2	BS 302 MT	Mathematics –III (Probability & Statistics)	3	1	0	4	30	70	3
3	ES 301 EC	Basic Electronics Engineering	3	1	0	4	30	70	3
4	ES 302 CS	Logic and Switching Theory	3	0	0	3	30	70	3
5	PC301 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	PC351 CS	Data Structures Lab	0	0	2x2	4	25	50	2
8	PC351 AI	IT Workshop (Python Lab)	0	0	2	2	25	50	1
Total			**15**	**3**	**8**	**26**	**225**	**500**	**19**

L : Lectures

T : Tutorials

P : Practicals

CIE : Continuous Internal Evaluation

SEE : Semester End Examination

PC 301 AI	**DISCRETE MATHEMATICS**					
Pre-requisites			**L**	**T**	**P**	**C**
			3	1	-	3
Evaluation	**SEE**	70 Marks	**CIE**		30 Marks	

Course Objectives :	
1	Use mathematically correct terminology and notation.
2	Construct correct direct and indirect proofs
3	Use division into cases in a proof.
4	Use counterexamples
5	Apply logical reasoning to solve a variety of problems

Course Outcomes *:*	
On completion of this course, the student will be able to	
CO-1	For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives
CO-2	For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference
CO-3	For a given a mathematical problem, classify its algebraic structure
CO-4	Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
CO-5	Develop the given problem as graph networks and solve with techniques of graph theory.

UNIT – I
Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. **Principles of Mathematical Induction**: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic

UNIT – II
Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination.

UNIT– III
Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. **Proof Techniques**: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

UNIT – IV
Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

UNIT –V
Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Euleri an and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

Suggested Reading:

1	Kenneth H. Rosen, Discrete Mathematics and its Applications, 7th edition, Tata McGraw –Hill, 2017
2	Susanna S. Epp, Discrete Mathematics with Applications, 4th edition, Wads worth Publishing Co. Inc, 2021.
3	CL Liu and DP Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw –Hill.
4	J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application to Computer Science", TMG Edition, TataMcgraw-Hill
5	Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson,
6	Discrete Mathematics, Tata McGraw - Hill

BS 302 MT	**MATHEMATICS-III**					
Pre-requisites			**L**	**T**	**P**	**C**
			3	1	-	3
Evaluation	**SEE**	70 Marks	**CIE**		30 Marks	

Course Objectives :	
1	To provide the knowledge of probability distributions , tests of significance, correlation and regression.

Course Outcomes *:*	
On completion of this course, the student will be able to	
CO-1	apply various probability distributions to solve practical problems, to estimate unknown parameters of populations and apply the tests of hypotheses
CO-2	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.KIyengar, 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, 8th Edition, 2002.
4	N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 10th Edition, 2010.
5	E. Kreyszig,"Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition, 2006.
6	S.C Gupta & Kapoor: Fundamentals of Mathematical statistics, Sultanchand & Sons, 11th Edition, New Delhi.

ES 301 EC	**BASIC ELECTRONICS ENGINEERING**					
Pre-requisites			**L**	**T**	**P**	**C**
			3	1	-	3
Evaluation	**SEE**	70 Marks	**CIE**		30 Marks	

Course Objectives :	
1	To analyze the behavior of semi conductor diodes in Forward and Reverse bias.
2	To design of Half wave and Full wave rectifiers with L, C, L C & CL C Filters.
3	To explore V I characteristics of Bipolar Junction Transistor in CB, CE & CC Configurations
4	To explain feedback concept and different oscillators.
5	To analyze Digital logic basics and Photo Electric devices.

Course Outcomes :	
On completion of this course, the student will be able to	
CO-1	Learn about forward biased and reversed biased circuits.
CO-2	Plot the V-I Characteristics of diode and transmission.
CO-3	Design combinational logic circuits and PLDs

UNIT – I
Semi-Conductor Theory: Energy Levels, Intrinsic and Extrinsic Semi conductors, Mobility, Diffusion and Drift current. Hall Effect, Characteristics of P-N Junction diode, Parameters and Applications.
Rectifiers: Half wave and Full wave Rectifiers (Bridge, centre 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 a simplifier. Analysis of CE, CB, CC Amplifiers (qualitative treatment only) .

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 Sub tractors.

UNIT –V
Data Acquisition Systems: Study of transducer (LVDT, Straingauge, 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 Reading:

1	Jocob Millman, Christos C. Halkiasand Satyabrata Jit, Electronics Devices and Circuits, 3rd Edition, McGraw Hill Education (India) Private Limited, 2010.
2	Rama Kanth A.Gaykward, Op-AMP Sand Linear Integrated Circuit, 4th Edition, Prentice Hall of India, 2000.
3	M. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India, 2002.
4	William D Cooper, and A.D. Helfrick, Electronic Measurements and Instrumentations Techniques, 2nd Edition, Prentice Hall of India, 2008.
5	S.Shalivahan, N.SureshKumar, A.VallavaRaj, Electronic Devices and Circuits, 2nd Edition., McGraw Hill Education (India) Private Limited, 2007

ES 302 CS	**LOGIC AND SWITCHING THEORY**					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	70 Marks	**CIE**		30 Marks	

Course Objectives :	
1	To introduce concepts of Boolean logic, Postulates and Boolean Theorems.
2	To understand the use of logic minimization methods and to solve the Boolean logic expressions
3	To understand how to design the combinational and sequential circuits.
4	To introduce and realize the adder circuits
5	To understand the state reduction methods for sequential circuits.

Course Outcomes :	
On completion of this course, the student will be able to	
CO-1	Apply the concepts of Boolean logic, Postulates and Boolean Theorems to solve the Boolean expressions
CO-2	Solve the Complex Boolean logic expressions using Minimization methods.
CO-3	Design the combinational, sequential circuits and various adder circuits.
CO-4	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-Mc Cluskey 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 A head 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, 4th Edition, 2008.
2	Zvi Kohavi, *Switching and Finite Automata Theory*, Tata Mc Graw Hill, 2nd Edition, 1979.

PC301CS	**DATA STRUCTURES AND ALGORITHMS**					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	70 Marks	**CIE**		30 Marks	

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

Course Outcomes :	
On completion of this course, the student will be able to	
CO-1	Analyze the time and space complexities of algorithms.
CO-2	Implement linear, non-linear data structures and balanced binary trees
CO-3	Analyse and implement various kinds of searching and sorting Techniques.
CO-4	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++*,2nd Edition, Pearson Education International, 2003.
3	Michael T.Goodrich, Roberto Tamassia, David M.Mount, *Data Structures and Algorithms in C++*, 2nd Edition, John Wiley & Sons, 2010.

ES 351 EC	**Basic Electronics Engineering Laboratory**					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	2	1
Evaluation	**SEE**	70 Marks	**CIE**		30 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	To understand the diode characteristics
2	To study the input and out characteristics of different Transistor configuration.
3	To understand the design concepts of amplifier and Oscillator circuits.
4	To understand the design concepts of feedback amplifiers.

Course Outcomes :	
On completion of this course, the student will be able to	
CO-1	Design diode circuits
CO-2	Understand the applications of Zener diode.
CO-3	Understand the operation of HWR & FWR circuits with & without filters.
CO-4	Analyze the characteristics of BJTs and FETs.
CO-5	Analyze the performance of operation amplifier.
CO-6	Operate laboratory equipment and analyze the results
CO-7	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 Reading:

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", 4th Edition,* Prentice Hall of India, 2007.

PC351 CS	**DATASTRUCTURESLAB**					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	4	2
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

List of Programs:

Implement the following operations on singly inked 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 (dequeue) using arrays.

7.Implement a program to evaluate a given post fix expression using stacks.

8.Implement a program to convert a given infix expression to post fix 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.Implementationof 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 anode 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 anode with given key

15.Implement the following sorting algorithms:

a) Bubble sort b) Selection sort c) Insertion sort (d)Merge sort (e) Quicksort (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

PC351 AI	**ITWORKSHOP (Python Lab)**					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	2	1
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

List of 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

SCHEME OF INSTRUCTION

BE(AI & ML) IV–SEMESTER

Academic Year 2022-23

S. No	Course Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1.	HS 401 MC	Management – I (Organizational Behavior / Finance & Accounting)	3	0	0	3	30	70	3
2.	MC101HS	Mandatory Course Environment Science	3	0	0	3	30	70	0
3.	PC401 AI	Principles of Programming Languages	3	1	0	4	30	70	3
4.	PC 402 CS	Computer Organization and Microprocessors	3	1	0	4	30	70	3
5	PC 403 CS	Object Oriented Programming using Java	3	0	0	3	30	70	3
6	PC 402 AI	Exploratory Data Analysis using Python	3	0	0	3	30	70	3
Practicals									
5	PC451 CS	Computer Organization and Microprocessor Lab	0	0	3	3	25	50	1.5
6	PC452 CS	Object Oriented Programming using Java Lab	0	0	2 x 2	4	25	50	2
7	PC451 AI	Exploratory Data Analysis using Python Lab	0	0	2X2	4	25	50	2
Total			**18**	**2**	**11**	**31**	**255**	**570**	**20.5**

L : Lectures T : Tutorials

P : Practicals CIE : Continuous Internal Evaluation

SEE : Semester End Examination

HS 401 MC	**ORGANIZATION BEHAVIOUR**					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	70 Marks	**CIE**		30 Marks	

Course Objectives :	
1	The objective of the course is to give an overview of management behavior, process of a organization. It highlights the organizational structure and also about leadership style which will be useful for problem solving and decision making.

Course Outcomes :	
On completion of this course, the student will be able to	
CO-1	Understand the levels of management and its role and process
CO-2	Creates awareness about the significance of planning which is a pre-requisite for decision making.
CO-3	Understand the phenomena of organization structure and importance of leadership styles to solve various managerial problems.
CO-4	Enriches the knowledge of communication and role of control system in an organizational structure

UNIT – I
Management –meaning, nature, and significance – Combination of art and science Management as a profession, Management Vs Administration -Levels of Management
Elements of managerial process –Styles and Roles of managers in organizations. Contributions of Taylor and Fayol. Human Relations and Behavioural School – Hawthorne studies.

UNIT – II
Planning –Nature and process of planning: Planning and Environmental uncertainties -Types of planning –Advantages and limitations of planning – Decision making –Stages in decision making.

UNIT– III
Nature and significance of organization – Authority and Responsibility relationships - Spanof control, Process of delegation – Barriers to delegation –Centralization and Decentralization, Concept of Line and Staff –Overcoming Line – staff conflict, Committees, Coordination. Organization structure, types, advantages and disadvantages

UNIT – IV
Staffing, motivation and leadership. Scope of staffing function. Theories of motivation – theory X, theory Y and theory Z. Maslow's need hierarchy. Leadership's styles.

UNIT –V
Communication and control – Process of communication – Verbal and Nonverbal. Barriers to communication. Types, process, and tools of Control. Characteristics of effective Control system – Human Reaction to control system.

Suggested Reading:

1	Harold Koontz & Heinz Weihrich, "Essentials of Management", Tata McGraw Hill, 7th Edition.
2	Curtis W. Cook and Phillip L. Hunsaker, *Management and Organisational Behaviour,* 3rdEdition, McGraw-Hill,2010.
3	Hellriegel, Jackson & Slocum, "Management", Thomson, 9th Edition.
4	Tripathi and Reddy, "Management".
5	Parag Divan "Management – Principles and Practices", Excel – 2008.
6	Stoner, "Management", 6th Edition, PHI, 2008.
7	Robbins, "Management",11th Edition, PHI, 2008.
8	T. Ramaswamy, "Principles of Management", I st Edition, Himalaya Publishing House, 2008.

MC101HS	**ENVIRONMENTALSCIENCES**					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	70 Marks	**CIE**		30 Marks	

Course Objectives :	
1	Comprehend the need of environmental science, ethics and issues
2	Illustrate the characteristics and functions of ecosystem
3	Understand the concepts of Biodiversity and its conservation needs
4	Study various environmental pollution effects, prevention and control acts

Course Outcomes :	
On completion of this course, the student will be able to	
CO-1	Application of awareness on environmental Issues for sustainable society.
CO-2	Acquaintance with utilization of various natural resources and ecosystems.
CO-3	Ability in conserving and protecting the biodiversity.
CO-4	Knowledge of social and environment related issues and their preventive measures

UNIT – I
Multidisciplinary nature of Environmental studies: Definition, scope and importance, Need for public awareness. Environmental ethics: issues and possible solutions. Population growth. Sustainable development and SDGs.
Current Environmental Issues: global warming and Climate change, acid rain, ozone layer depletion. Environment protection Acts. Environment and human health

UNIT – II
Natural Resources : Renewable and non renewable resources : Natural resources and associated problems Forestresources,Waterresources,MineralResources,Waterconservation, Food Resources Energy Resources.
Land Resources: Land as a resource, land degradation, soil erosion and desertification Role of individual linconservation of natural resources, Equitable use of resources for sustainable life styles.

UNIT– III
Ecosystems: Concept of an ecosystem Structure and function of an ecosystem, Producers, consumers, decomposers. Energy flow in the ecosystems. Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and functions: Terrestrial ecosystem, Forest ecosystem, Grassland ecosystem, Desert ecosystem. Aquatic ecosystems(ponds, streams, lakes, rivers, oceans, estuaries)

UNIT – IV
Biodiversity and its Conservation: Introduction-Definition: genetics, species and ecosystem diversity. Bio geographically classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, national and local level. India as a mega diversity nation.
Hot-spots of biodiversity, Threats to biodiversity: habitats loss, poaching of wildlife, man wild life conflicts. Endangered and endemics paces of India, Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity, Wildlife conservation and protection act, Forest conservation and protection act

UNIT –V
Environmental Pollution: Definition, Causes, effects and control measures-Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Air(prevention and control of pollution)Act, Water(prevention and control of pollution)Act Solid waste Management: Causes, effects and control measures of urban and industrial wastes Role of an individual's, communities and NGOs in prevention of pollution.

Suggested Reading:

1	Gilbert, M.Masters," Introduction to Environmental Engineering and Science" , 3rd Edition, Prentice-Hall of India Pvt. Ltd., New Delhi, 1995.
2	Erach Bharucha , Textbook of Environmental studies, 2nd Edition, UGC.
3	Hammer. M J. and Hammer. MJ. Jr., Water and Wastewater Technology. 7th Edition , Prentice-Hall of India Pvt. Ltd., New Delhi. 1998
4	D D Mishra, "Fundamental concepts in Environmental Studies" , Ist Edition, S Chand&Co Ltd.
5	SasiKumar,K. and Sanoop GopiKrishna., Solid waste Management, Ist Edition, Prentice-Hall of India Pvt. Ltd., New Delhi, 2009

PC401 AI	**PRINCIPLES OF PROGRAMMING LANGUAGES**					
Pre-requisites			**L**	**T**	**P**	**C**
			3	1	-	3
Evaluation	**SEE**	70 Marks	**CIE**		30 Marks	

Course Objectives :	
1	To introduce the major programming paradigms, and the principles and techniques involved in design and implementation of modern programming languages
2	To introduce notations to describe syntax and semantics of programming languages.
3	To analyze and explain behavior of simple programs in imperative languages using concepts such as binding, scope, control structures, subprograms and parameter passing mechanisms.
4	To introduce the concepts of ADT and object oriented programming for large scale software development.
5	To introduce the concepts of concurrency control and exception handling.

Course Outcomes :	
On completion of this course, the student will be able to	
CO-1	Understand the programming paradigms of modern programming languages
CO-2	Describe syntax and semantics of programming languages
CO-3	Analyze the behavior of simple programs in imperative languages.
CO-4	Understand the concepts of ADT and object oriented programming for large scale software development
CO-5	Understand the concepts of functional programming and logic programming

UNIT – I

Preliminary Concepts: Reasons for Studying Concepts of Programming Languages, Programming Domains, Language Evaluation Criteria, Influences on Language Design, Language Categories, Language Design Trade-offs, Implementation Methods, Programming Environments, Evolution of the Major Programming Languages.

Describing Syntax and Semantics: General Problem of Describing Syntax, Formal Methods of Describing Syntax, Attribute Grammars, Describing the Meaning of Programs.

UNIT – II

Names, Binding, Type Checking, and Scopes: Names, Variables, The Concept of Binding, Type Checking, Strong Typing, Type Compatibility, Scope, Scope and Lifetime, Referencing Environments, Named Constants.

Data Types: Primitive Data Types, Character String Types, User- Defined Ordinal Types, Array Types , Associative Arrays, Record Types, Union Types, Pointer and Reference Types, **optional types**

Expressions and Assignment Statements: Arithmetic Expressions, Overloaded Operators, Type Conversions, Relational and Boolean Expressions, Short-Circuit Evaluation, Assignment Statements, Mixed- Mode Assignment.

UNIT– III

Statement-Level Control Structures: Selection Statements, Iterative Statements, Unconditional Branching, Guarded Commands.

Subprograms: Fundamentals and Design Issues for Subprograms, Local Referencing Environments, Parameter –Passing Methods, Parameters That are Subprograms Names, Overloaded Subprograms, Generic Subprograms, Design Issues for Functions, User-Defined Overloaded Operators.

Implementing Subprograms: The General Semantics of Calls and Returns, Implementing "Simple" Subprograms, Implementing Subprograms with Stack-Dynamic Local Variables, Nested Subprograms, Blocks, Implementing Dynamic Scoping.

Abstract Data Types: The Concept of Abstraction, Introduction to Data Abstraction, Design Issues for Abstract Data Types, Language Examples, Parameterized ADT, Encapsulation Constructs, Naming Encapsulation.

UNIT – IV

Object Oriented Programming: Design Issues, Object Oriented Programming in Smalltalk, C++, Java, C#, Ada 95, Ruby, The Object Model of JavaScript, Implementation of Object Oriented Constructs.

Concurrency: Subprogram level Concurrency, Semaphores, Monitors, Massage Passing, Ada Support for Concurrency, Java Threads, C# Threads, Statement-Level Concurrency.

Exception Handling and Event Handling: Introduction to Exception Handling, Exception Handling in Ada, C++ and Java, Introduction to Event Handling, Event Handling with Java.

UNIT –V

Functional Programming Languages: Introduction, Mathematical Functions, Fundamentals of FPL, LISP, Introduction to Scheme, COMMON LISP,ML, Haskell, Application of Functional Programming Languages and A Comparison of Functional and Imperative Languages, Functional interfaces (Java 8.0)

Logic Programming Languages: Introduction to Predicate Calculus, Predicate Calculus and Proving Theorems, An Overview of Logic Programming. The Origins, Basic Elements and Deficiencies of Prolog, Applications of Logic Programming.

Scripting Languages: Common Characteristics, Data Types , Object Orientation Names and Scopes, String and Pattern Manipulation Problem Domains, Scripting the World Wide Web

Suggested Reading:

1	"Concepts of Programming Languages" Robert .W. Sebesta 12th Edition, Pearson Education, 2019
2	"Programming Language Pragmatics " Michal Scott 4th Edition Morgan Kaufmann Publishers, 2015
3	Java Precisely Pete r Sestoft 3rd Edition, MIT press 2016.
4	Programming Languages: Principles & Practices Kenneth A. Lambert and Kenneth C. Louden, 3rd Edition, Cencage Learning 2012
5	Programming languages –Watt, Wiley Dreamtech, Ist, 2004.

PC 402 CS	**COMPUTER ORGANIZATION AND MICROPROCESSOR**					
Pre-requisites			**L**	**T**	**P**	**C**
			3	1	-	3
Evaluation	**SEE**	70 Marks	**CIE**		30 Marks	

Course Objectives :	
1	To understand the Instruction Set Architecture: Instruction format, types, various addressing modes
2	To understand the basic components and design of the CPU: the ALU and control unit**.**
3	To understand the parallelism both in terms of a single processor and multiple processors.
4	To understand the8085and 8051 architecture
5	To learn the interfacing with I/O Organization, Interrupt-driven I/O, and DMA

Course Outcomes :	
On completion of this course, the student will be able to	
CO-1	Understand the Instruction Set Architecture: Instruction format, types, various addressing modes
CO-2	Understand the basic components and design of the CPU: the ALU and control unit write multithread deprograms with synchronization.
CO-3	Understand the parallelism both in terms of a single processor and multiple processors
CO-4	Understand the 8085 and8051 architectures
CO-5	Interfacing with I/O Organization, Interrupt-driven I/O, DMA

UNIT – I
Data representation : Fixed and Floating Point representations. **Overview of Computer Function and Interconnections** : Computer components, Inter connection structures, Bus interconnection, Bus structure, and Data transfer.
Register Transfer Microoperations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic, Logic and Shift microoperations, Arithmetic Logic Shift Unit.

UNIT – II
Basic Computer Organization and Design :Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory reference instruction, Input-Output and Interrupt. **Micro programmed Control: Control memory, Address Sequencing, Microprogram** example, Design of Control Unit.

UNIT– III
Central Processing Unit: General Register Organization, Stack Organization, Instruction formats, Addressing modes, Data Transfer and Manipulation, and Program control. Floating Point Arithmetic Operations. Pipeline Processing: Arithmetic, Instruction and RISC Pipelines. **Memory Organization**: Cache memory, Virtual memory, Memory Management hardware

UNIT – IV
8085 Architecture: Introduction to microprocessors and microcontrollers, 8085 Processor Architecture, Internal operations, Instructions and timings. Programming the 8085-Introduction to 8085 instructions, Addressing modes and Programming techniques with Additional instructions.
Input-Output Organization: Modes of Transfer, Priority Interrupt, Direct Memory Access(DMA), I/O Processor. Basic Interfacing concepts with8085, Programmable Interrupt Controller(8259A).Direct Memory Access(DMA)-DMA Controller(Intel 8257)

UNIT –V
Introduction to Microcontrollers, 8051–Architecture, Instruction set, Addressing modes and Programming techniques. Comparison of various families of 8-bit microcontrollers. System Design Techniques-Interfacing of LCD, ADC, Sensors, Stepper motor, Keyboard and DAC using microcontrollers. Communication Standards -Serial RS 232 and USB. Features of Multi-Core Processors architectures and Graphics Processing Units.

Suggested Reading:

1	Morris Mano M, "*Computer System Architecture*",3rd Edition, Pearson Education India,2007.
2	William Stallings, "*Computer Organization and Architecture*",PHI,7th Edition, 2008.
3	Ramesh S.Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition, Prentice Hall, 2002.
4	Myke Predko "Programming and Customizing the 8051 Microcontroller", Ist Edition, Tata McGraw Hill, 1994.

PC 403 CS	**OBJECT ORIENTED PROGRAMMING USING JAVA**					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	70 Marks	**CIE**		30 Marks	

Course Objectives :	
1	To introduce fundamental object oriented concepts of Java programming Language-such as classes, inheritance packages and interfaces.
2	To introduce concepts of exception handling and multithreading.
3	To use various classes and interfaces in java collection framework and utility classes.
4	To understand the concepts of GUI programming using AWT and Swing controls.
5	To introduce Java I/O streams and serialization.

Course Outcomes :	
On completion of this course, the student will be able to	
CO-1	Use object-oriented programming concepts to solve real world problems.
CO-2	Demonstrate the behaviour of programs involving constructs like string, arrays, garbage collection.
CO-3	Understand the impact of exception handling to avoid abnormal termination of program and able to solve multi-threaded programs with synchronization.
CO-4	implement real world applications using java collection frame work and I/O classes
CO-5	Write Event driven GUI programs using AWT/Swing

UNIT – I
Object Oriented System Development: understanding object oriented development, understanding object oriented concepts, benefits of object oriented development**.**
Java Programming Fundamentals: Introduction, overview of Java, data types, variables and arrays, operators, control statements, classes, methods, inheritance, packages and interfaces**.**

UNIT – II
Exceptional Handling, Multithreaded Programming, I/O Basics, Reading Console Input and Output, Reading and Writing Files, Print Writer Class, String Handling.

UNIT– III
Exploring Java. Lang, Collections Overview, Collection Interfaces, Collection Classes, Iterators, Random Access Interface, Maps, Comparators, Arrays, Legacy Classes and Interfaces, String Tokenizer, Bit set, Date, Calendar, Observable Timer.

UNIT – IV
GUI Programming & Event Handling: Event Handling Mechanisms, The Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces, Handling mouse and keyboard events, Adapter classes, Inner classes, Anonymous Inner classes, Introduction, AWT classes working with Graphics, Understanding Layout Managers, Flow Layout, Border Layout, Grid Layout, Card Layout, Grid Bag Layout.
Java Swing: Basics of Swing, Difference between AWT & Swing, MVC Architecture, Components and Container, Exploring Swing Controls-J Label and Image Icon, J Text Field, The Swing Buttons-J Button, J Toggle Button, J Check Box, J Radio Button, J Tabbed Pane, J Scroll Pane, J List, J Combo Box, Swing Menus, Dialogs.

UNIT –V
Java I/O Classes and Interfaces, Files, Stream and Byte Classes, Character Streams, Serialization.

Suggested Reading:

1	Herbert Schildt, "*The Complete Reference JAVA"*, Tata McGraw Hill,7th Edition,2005.
2	James M Slack, "*Programming and Problem Solving with JAVA"*, Ist Edition, Thomson Learning, 2002.
3	C.Thomas Wu, "*An Introduction to Object-Oriented Programming with Java"*, Tata McGrawHill, 5thEdition, 2005.

PC 402 AI	**EXPLORATORY DATA ANALYSIS USING PYTHON**					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	70 Marks	**CIE**		30 Marks	

Course Objectives :	
1	To gain the fundamentals of Exploratory data analysis and understand different stages of EDA process
2	To familiarize with NumPy and Pandas tool and also to change the dataset inorder to analyze them better.
3	To gain overview on essential linear algebra and statistical measures for gaining insights about data and their correlation.
4	To understand time series data and how to perform EDA on it.
5	To use EDA techniques on real datasets, prepare different types of models and evaluate them

Course Outcomes :	
On completion of this course, the student will be able to	
CO-1	Understand the fundamentals of Exploratory data analysis and its visual aids
CO-2	Preprocess raw data, cleaning the data and learn different methods of grouping dataset.
CO-3	Solve linear system of equations, descriptive statistics measures like measure of central tendency and measure of dispersion
CO-4	Perform data reduction and different methods of time series analysis
CO-5	Understand model evaluation and different types of machine learning algorithms

UNIT – I

Exploratory Data Analysis Fundamentals: Understanding data science, The significance of EDA, Steps in EDA, Making sense of data, Numerical data: discrete data, Continuous data. Categorical data. Measurement scales: Nominal, Ordinal, Interval, Ratio. Comparing EDA with classical and Bayesian analysis, Software tools available for EDA: NumPy ,Pandas , Matplotlib , IPython and Jupyter , SciPy ,Scikit-learn ,Statsmodels .(Ref-1, Chp-1) ,

Visual Aids for EDA : Line chart, Steps involved. Bar charts, Scatter plot, Bubble chart, Scatter plot using seaborn. Area plot and stacked plot, Pie chart, Table chart, Polar chart , Histogram, Lollipop chart, Choosing the best chart, Other libraries to explore. (Ref-1, Chp-2)

UNIT – II
Data loading: Loading the dataset, Data transformation Data cleansing ,Loading the CSV file, Reading and writing: CSV file with numpy, pandas, excel. Data analysis (Ref-1, Chp-2)
Data Cleaning: Exploring data **,** Filtering data to weed out the noise, Column-wise filtration, row-wise filtration. Handling outliers, Feature encoding techniques: one-hot encoding, Label encoding, ordinal encoder. (Ref-2,Chp-7)
Missing values, detecting missing values, example of detecting missing values, causes of missing values, types of missing values, diagnosis of missing values, dealing with missing values, dropping by rows, dropping by columns, mathematical operations with nan, errors, types of errors, dealing with errors (ref-3 chp-11)
Grouping Datasets: Understanding groupby(), groupby mechanics, selecting a subset of columns, max and min, mean, Data aggregation, group-wise operations , pivot tables, cross-tabulations.(ref-1, chp-6)

UNIT– III
linear algebra: Fitting to polynomials with numpy, determinant, finding the rank of a matrix, matrix inverse using numpy, solving linear equations using numpy, decomposing a matrix using svd, eignevectors and eigen values using numpy, generating random numbers, (ref-2, chp-4)
Descriptive Statistics: Understanding statistics, distribution functions uniform distribution, normal distribution, exponential distribution, binomial distribution. Cumulative distribution function, descriptive statistics. Measures of central tendency, mean/average, median , mode ,Measures of dispersion, standard deviation, variance, skewness, kurtosis, types of kurtosis. Quartiles, visualizing quartiles.(ref-1, chp-5)
Correlation: Introducing correlation, Types of analysis, Understanding univariate analysis, Understanding bivariate analysis, Understanding multivariate analysis. Discussing multivariate analysis using the Titanic dataset.(Ref-1. Chp-7)

UNIT – IV
Data reduction : distinction between data reduction and data redundancy, the objectives of data reduction, types of data reduction, performing numerosity data reduction, random sampling, stratified sampling, performing dimensionality data reduction, PCA (ref-3, chp-13)
Time Series Analysis: Understanding the time series dataset, fundamentals of tsa, univariate time series, characteristics of time series data, tsa with open power system data, visualizing time series.(ref-1, chp-8)

UNIT –V
Hypothesis Testing and Regression: Hypothesis testing, Hypothesis testing principle, statsmodels library, Average reading time, Types of hypothesis testing, T-test. Understanding regression, Types of regression, Simple linear regression, Multiple linear regression, Nonlinear regression, Constructing a linear regression model, Model evaluation, Computing accuracy, Understanding accuracy, implementing a multiple linear regression model.(Ref-1, Chp-9)
Machine learning : Types of machine learning, Understanding supervised learning, Regression, Classification Understanding unsupervised learning, Applications of unsupervised learning, Clustering using MiniBatch , K-means clustering. (ref-1, chp-10)

Suggested Reading:

1	Hands-On Exploratory Data Analysis with Python: Suresh Kumar Mukhiya, Usman Ahmed
2	Python Data Analysis: Perform data collection, data processing, wrangling, visualization, and model building using Python, 3rd Edition. by Avinash Navlani , Armando Fandango , Ivan Idris
3	Hands-On Data Preprocessing in Python Roy Jafari Packt Publishing
4	WesMcKinney"python for data analysis", first edition, publisher o'reilly media.
5	Ani Adhikari, John DeNero, David Wagner "computational and inferential thinking: The Foundation of Data Science" 2nd edition.

PC451 CS	COMPUTER ORGANIZATION AND MICROPROCESSORS LAB					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	3	1.5
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

List of programs:

PART A: Programs using VERILOG

1. Review of the different logic design ckts., a) Gates b) Flip/Flop(RS, JK, D, T),
2. Familiarity with state of art IC-chips, e.g. a) Multiplexer , b) Decoder, c) Encoder, d) Counter, e)Shift-Register, f)adder Truth Table verification and clarification from Data-book.
3. Design a BCD adder.
4. Design an Adder/Subtracter composite unit
5. Design a carry-look ahead Adder
6. Design a ripple counter and carry-look ahead counter.
7. Design ALU and 4-bit processor

PART B: 8085 Programming using Microprocessor Trainer Kit

1. Simple programming examples using 8085 instruction set. To understand the use of various instructions and addressing modes.
2. Interfacing and programming of 8255. (e.g.: traffic light controller)
3. Interfacing and programming of 8254.
4. Interfacing and programming of 8279.

PART C: 8051 Programming

1. Simple programming examples using 8051 Microcontroller
2. A/D and D/A Converter Interface
3. Stepper motor interface
4. Display interface

PC453 CS	**OBJECT ORIENTED PROGRAMMING USING JAVALAB**					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	4	2
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

Course Objectives :	
1	Ability to learn the concept of classes, inheritance and abstract classes
2	Learn to demonstrate multithreaded programs with synchronization
3	Demonstrate real world applications using java collection frame work and I/O classes.
4	Model Event driven GUI programs using AWT/Swing.

Course Outcomes :	
On completion of this course, the student will be able to	
CO-1	Understand the OOPS features
CO-2	Understand the usage of abstract classes and interfaces.
CO-3	Write multi threaded programs with synchronization.
CO-4	Implement real world applications using java collection frame work and I/O classes
CO-5	Write Event driven GUI programs using AWT/Swing

List of Programs:

1. A program to illustrate the concept of class with constructors, methods and overloading.

2.A program to illustrate the concept of Inheritance and Dynamic polymorphism.

3. A program to show the concept of packages.

4. A program to illustrate the usage of interfaces and Abstract class.

5. A program to illustrate exception handling keywords.

6. A program to illustrate user define exception using stack.

7. A program to illustrate user define exception for evaluating a post fix expression.

8. A program to illustrate to handle string in java using String and StringBuffer.

9. A program to illustrate manipulating array in java

10. A program to illustrate Multithreading.

11. A program to illustrate Thread synchronization.

12.A program to illustrate inter thread communication

13.A program using String tokenizer.

14. A program using Linked list class.

15. A program using Tree set class.

16. A program using Hash set and Iterator classes.

17. A program using Map classes.

18. A program using Enumeration and Comparator interfaces.

19. A program to illustrate Buffered I/O streams and Buffered reader.

20. Write a Java program to read text from file from a specify index or skipping byte using file Input stream.

21. Write a Java program to determine number of byte return to file using data output stream.

22. A program to illustrate Byte Array I/O Streams.

23. A program to illustrate the usage of Serialization.

24. An application involving GUI with different controls, menus and event handling.

25. A program to implement asimple calculator using grid layout manager.

26. A program to implement Recursive Fibonacci method using swing

27. A program to display digital clock using swing

28. A program to read from a file and write to a file using Applet

29. A program to display a calendar using JCombo box.

30. A program to illustrate event listener interfaces.

PC451 AI	**EXPLORATORY DATA ANALYSIS USING PYTHON LAB**					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	4	2
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

Course Outcomes :	
CO-1	Perform exploratory data analysis and apply analytical techniques to real-word datasets using libraries such as Pandas, Numpy and Scipy
CO-2	Develop Python code for cleaning and preparing data for analysis - including handling missing values, formatting.
CO-3	Manipulate data using data frames, summarize data, understand data distribution, perform correlation.
CO-4	Apply exploratory data analysis to some real data sets and provide interpretations via relevant visualization
CO-5	Build and evaluate regression models using machine learning scikit-learn library and use them for prediction and decision making

List of Programs:

1. (a) Install different libraries of python: NumPy ,Pandas , Matplotlib , Seaborn, IPython and Jupyter , SciPy ,Scikit-learn ,Statsmodels

   (b) Reading writing data from flat files, CSV files, Excel spread sheet using Numpy , and Pandas

2. Creation and manipulation of Numpy arrays: Element wise Array operations, sorting, copying, subsetting, sliciing, indexing, transposing, changing shape, adding/removing elements, combining arrays, splitting arrays, broadcasting arrays
3. Generate simple 2D plots for mathematical functions using Matplotlib
4. Visualize data with different types of plots in Matplotlib : Line chart, Bar charts, Scatter plot, Pie chart, Histogram, BoxPlot, Bubble Plot, Lollipop plot, Stacked area Plot, Table plot
5. Use Scipy.linalg / Numpy.linalg package practice different matrix functions, Creating a masked array
6. Use Scipy.linalg / Numpy.linalg package : Fitting to polynomials, Eigenvectors , Eigenvalues, Decomposing a matrix using SVD, Generating random numbers
7. (a)creating pandas Data frames, grouping and joining Data frames, Pandas series, Creating Pivot tables
   (b) Using vectorized string functions with Pandas data frames
8. Visualize data with different types of plots in Pandas
9. Use Seaborn for categorical plots and statistical data visualization

10. Use Email data: (Ref book2(Chap2))

a) Load personal email data from CSV files

(b)clean the data : converting the date, removing NaN values, dropping columns, refactoring time zones

(c)Data analysis: average emails, most frequently used words

11. Pandas dataframe and dataframe related operations on Toyota Corolla dataset

(Kaggle) Reading files Exploratory data analysis Data preparation and preprocessing

12. Data visualization on Toyoto Corolla dataset using matplotlib and seaborn libraries

13. Multivariate analysis with Titanic data set (Ref book1(Chap7))

14. Time series analysis with Open Power System data (Ref book1(Chap8))

15. Predicting price of pre-owned cars using Regression – kaggle data set

16. PCA on toy data set (ref 3 chap 13)

17. Wine quality data analysis: loading, applying descriptive statistics, finding correlated columns, analyzing columns, adding new attributes, grouping columns, concatenating data frames, univariate analysis, multivariate analysis. (Ref 1 chap 11)

Suggested Reading:

1	Hands-On Exploratory Data Analysis with Python: Suresh Kumar Mukhiya, Usman Ahmed
2	Python Data Analysis: Perform data collection, data processing, wrangling, visualization, and model building using Python, 3rd Edition. by Avinash Navlani , Armando Fandango , Ivan Idris
3	Hands-On Data Preprocessing in Python Roy Jafari Packt Publishing
4	WesMcKinney"python for data analysis", first edition, publisher o'reilly media.
5	Ani Adhikari, John DeNero, David Wagner "computational and inferential thinking: The Foundation of Data Science" 2nd edition.