Osmania University

Faculty of Informatics

Two years MCA Program

Master of Computer Applications 2022-23

Syllabi for Semesters – I and II

With Effect from Academic Year 2022 – 2023

Osmania University
Hyderabad

SCHEME OF INSTRUCTION
MASTER OF COMPUTER APPLICATIONS (MCA)
SEMESTER- I

SNo	Course Code	Course Title	Hours/ Week			Scheme of Examination				No of Credits
						Max Marks			Duration (hrs)	
THEORY			L	T	P	CIE	SEE	Total Marks	SEE	
1	PCC101	Discrete Mathematics	4	-	-	30	70	100	3	4
2	PCC102	Data Structures using C	4	-	-	30	70	100	3	4
3	PCC103	Object Oriented Programming using Java	3	1	-	30	70	100	3	4
4	PCC104	Computer Architecture	3		-	30	70	100	3	3
5	PCC105	Probability & Statistics	3	1	-	30	70	100	3	4
6	MGC106	Managerial Economics and Accountancy	3		-	30	70	100	3	3
PRACTICALS										
7	LCC151	Data Structures using C Lab	-	-	3	25	50	75	3	1.5
8	LCC152	Java Programming Lab	-	-	3	25	50	75	3	1.5
9	HSC153	Soft Skills Lab	-	-	2	25	50	75	3	1
			20	2	8	255	570	825	27	26

Abbreviation	Full Form	Abbreviation	Full Form
PCC	Professional Core Course	CIE	Continuous Internal Evaluation
PEC	Professional Elective Course	SEE	Semester End Evaluation
MGC	Management Course	L	Lecture
LCC	Laboratory Core Course	P	Practical

Note : Each lab should be made with 30 students for batch

SCHEME OF INSTRUCTION
MASTER OF COMPUTER APPLICATIONS (MCA)
SEMESTER – II

SNo	Course Code	Course Title	Hours/ Week			Scheme of Examination				No of Credits
						Max Marks			Duration (hrs)	
THEORY			**L**	**T**	**P**	**CIE**	**SEE**	**Total Marks**	**SEE**	**Cr**
1	PCC 201	Operating Systems	4		-	30	70	100	3	4
2	PCC 202	Database Management System	4	-	-	30	70	100	3	4
3	PCC 203	Design and Analysis of Algorithms	3	1	-	30	70	100	3	4
4 *	PCC 204	Data Engineering with Python	4	-	-	30	70	100	3	4
5	PCC 205	Machine Learning	3	-	-	30	70	100	3	3
6	MGC 206	Operations Research	3		-	30	70	100	3	3
PRACTICALS										
7	LCC 251	Operating Systems Lab	-	-	3	25	50	75	3	1.5
8 *	LCC 252	Data Engineering with Python	-	-	3	25	50	75	3	1.5
9	LCC 253	Database Management Systems Lab	-	-	3	25	50	75	3	1.5
10	SIP 321	Summer Internship/ Mini Project*	-	-	-	-	-		-	-
			21	1	9	255	570	825	27	26.5

***Summer Internship/ Mini Project** : After second semester, the students are expected to do summer internship/ Mini Project and Its grade will be credited in the third semester memo after evaluation.

Abbreviation	Full Form	Abb	Full Form
PCC	Professional Core Course	CIE	Continuous Internal Evaluation
PEC	Professional Elective Course	SEE	Semester End Evaluation
HSC	Humanities and Social Science Course	L	Lecture
LCC	Laboratory Core Course	P	Practical

Note : Each lab should be made with 30 students for batch

SCHEME OF INSTRUCTION
MASTER OF COMPUTER APPLICATIONS (MCA)
SEMESTER- III

SNo	Course Code	Course Title	Hours/ Week			Scheme of Examination			No of Credits
						Max Marks		Duration (hrs)	
THEORY			**L**	**T**	**P**	**CIE**	**SEE**	**SEE**	**Cr**
1	PCC301	Software Engineering	**4**	**-**	**-**	**30**	**70**	**3**	**4**
2	PCC302	Computer Networks	**4**	**-**	**-**	**30**	**70**	**3**	**4**
3	PCC303	Data Science	**3**	**1**	**-**	**30**	**70**	**3**	**4**
4	PCC304	Web Technologies	**3**		**-**	**30**	**70**	**3**	**3**
5	**PEC****	**Professional Elective–I**	**3**	**-**	**-**	**30**	**70**	**3**	**3**
6	**PEC****	**Professional Elective–II**	**3**	**-**	**-**	**30**	**70**	**3**	**3**
PRACTICALS									
7	LCC351	Computer Networks Lab	**-**	**-**	**3**	**25**	**50**	**3**	**1.5**
8	LCC352	Software Engineering Lab	**-**	**-**	**3**	**25**	**50**	**3**	**1.5**
9	LCC353	Data science Lab	**-**	**-**	**3**	**25**	**50**	**3**	**1.5**
10	**SIP321**	Summer Internship/ Mini Project	**-**	**-**	**-**	**50**		**-**	**2**
			20	**1**	**9**	**305**	**570**	**27**	**27.5**

Professional Electives	**Course Code-PEC****	**Professional Elective -1**
	PEC311	Information Security
	PEC312	Distributed Systems
	PEC313	Internet of Things
	PEC314	Information Retrieval System
Professional Electives	**Course Code-PEC****	**Professional Elective – II**
	PEC321	Network Security
	PEC322	Software Quality Testing
	PEC323	Image Processing
	PEC324	Natural Language Processing

Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
PCC	Professional Core Course	CIE	Continuous Internal Evaluation
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SCHEME OF INSTRUCTION

MASTER OF COMPUTER APPLICATIONS (MCA)

SEMESTER- IV

SNo	Course Code	Course Title	Hours/ Week		Scheme of Examination			No of Credits
					Max Marks		Duration (hrs)	
THEORY			**L**	**P**	**CIE**	**SEE**	**SEE**	**Cr**
1	**PEC****	**Professional Elective –III**	**3**	**-**	**30**	**70**	**3**	**3**
2	**PEC****	**Professional Elective –IV**	**3**	**-**	**30**	**70**	**3**	**3**
3	**OE****	**Open Elective**	**2**	**-**	**30**	**70**	**3**	**2**
PRACTICALS								
4	Proj401	Project Work	**-**	**24**	**50**	**100**	**3**	**12**
		Total	**8**	**24**	**140**	**310**	**12**	**20**

Professional Electives

Course Code-PEC**	**Professional Elective – III**
PEC411	Block Chain Technologies
PEC412	Big Data Analytics
PEC413	Cloud Computing
PEC413	Deep Learning

Course Code-PEC**	**Professional Elective – IV**
PEC421	Cyber Security
PEC422	Digital Forensics
PEC423	Optimization Techniques
PEC424	Enterprise Architecture

Course Code-OE**	**Open Elective**
OE 431	Professional Ethics
OE 432	Constitution of India
OE 433	Disaster Management
OE 434	Organization Behaviour
OE 435	Intellectual Property & Cyber Law
OE 436	Environmental Science

PCC 101 DISCRETE MATHEMATICS

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

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:

1. For a given logic sentence express it in terms of predicates, quantifiers, and logicalconnectives
2. For a given a problem, derive the solution using deductive logic and prove the solutionbased on logical inference
3. For a given a mathematical problem, classify its algebraic structure
4. Evaluate Boolean functions and simplify expressions using the properties of Booleanalgebra
5. Develop the given problem as graph networks and solve with techniques of graphtheory.

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, permutationand 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, Eulerian 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 readings :

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, TataMcGraw – Hill
2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co. Inc
3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer OrientedApproach, 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, Tata Mcgraw-Hill
5. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press.Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson.

PCC102 Data Structures using C

Credits : 4

Instruction	4L hrs per week	Duration of SEE	3 hours
CIE	30 marks	SEE	70 marks

Course Objectives

1. To learn the features of C
2. To learn the linear and non-linear data structures
3. To explore the applications of linear and non-linear data structures
4. To learn to represent data using graph data structure
5. To learn the basic sorting and searching algorithms

Course Outcomes - Upon completion of the course, students will be able to:

1. Implement linear and non-linear data structure operations using C
2. Suggest appropriate linear / non-linear data structure for any given data set.
3. Apply hashing concepts for a given problem
4. Modify or suggest new data structure for an application
5. Appropriately choose the sorting algorithm for an application

UNIT I - C PROGRAMMING BASICS

Structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and Two-dimensional arrays. Strings- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT II - FUNCTIONS, POINTERS, STRUCTURES AND UNIONS

Functions – Pass by value – Pass by reference – Recursion – Pointers – Definition – Initialization – Pointers arithmetic. Structures and unions – definition – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives.

UNIT III - LINEAR DATA STRUCTURES

Arrays and its representations
Stacks and Queues – Applications
Linked lists – Single, circular and doubly Linked list-Application

UNIT IV - NON-LINEAR DATA STRUCTURES

Trees – Binary Trees – Binary tree representation and traversals , – Applications of trees.
Binary Search Trees , AVL trees.
Graph and its representations – Graph Traversals.

UNIT V - SEARCHING AND SORTING ALGORITHMS

Linear Search – Binary Search.
Sorting: Selection Sort, Bubble Sort, Insertion sort , Merge sort , Quick Sort
Hashing, Types of Hashing. Collision resolution techniques

Suggested Readings:

1. Brian W. Kernighan / Dennis Ritchie ,The C Programming Language ,Second Edition , Pearson 2015
2. Pradip Dey and Manas Ghosh, ―Programming in C, Second Edition, Oxford University Press, 2011.
3. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, ―Fundamentals of Data Structures in C, Second Edition, University Press, 2008.
4. Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 1996
5. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, ―Data Structures and Algorithms, Pearson Education, 1983.

PCC103 Object Oriented Programming using Java

Credits : 4

Instruction	3L hrs per week	Duration of SEE	3 hours
CIE	30 marks	SEE	70 marks

Course Objectives

1. Learn the basics of object oriented programming
2. Study Java I/O mechanisms
3. Explore Java API
4. Develop graphics based Java programs
5. Learn swing framework

Course Outcomes

1. Explain OOPs features and concepts
2. Write basic Java programs
3. Write I/O programs in Java
4. Use various built-in Java classes and methods
5. Create window based Java programs

UNIT-I

Object Oriented System Development: Understanding Object Oriented Development, Understanding Object Concepts, Benefits of Object Oriented Development.

Java Programming Fundamentals: Introduction, Overview of Java, Data Type, Variables and Arrays, Operators, Control statements, Classes, Methods, Inheritance, Packages and Interfaces, Inner Classes.

UNIT-II

I/O basics, Stream and Byte classes, Character Streams, Reading Console input and output, Print Writer Class, String Handling, Exceptions Handling, Multithreaded Programming.

UNIT-III

Exploring Java Language, Collections Overview, Collections Interfaces, Collections Classes, Iterators, Random Access Interface, Maps, Comparators, Arrays, Legacy classes and interfaces, Sting Tokenizer, BitSet, Date, Calendar, Timer.

UNIT-IV

Introducing AWT working With Graphics: AWT Classes, Working with Graphics.

Event Handling: Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces.

AWT Controls: Control Fundamentals, Labels, Using Buttons, Applying Check Boxes, CheckboxGroup, Choice Controls, Using Lists, Managing Scroll Bars, Using TextField, Using TextArea, Understanding Layout Managers, Menu bars and Menus, Dialog Boxes, FileDialog, Handling events by Extending AWT Components, Exploring the controls, Menus and Layout Managers.

UNIT-V

Introduction to Swing Package, Java I/O classes and interfaces, Reading and Writing Files, Serialization, Introduction to Java Network Programming, Object Class, Exploring Image package.

Suggested Readings:

1. Herbert Schildt, **The Complete Reference Java**, 9th Edition, Tata McGraw Hill, 2005.
2. Bruce Eckel, **Thinking in Java**, 4th Edition, Pearson Education
3. Dietel and Dietel, **Java: How to Program,** 5th Edition, Prentice Hall
4. James M Slack, **Programming and Problem solving with JAVA**, Thomson Learning, 2002
5. C Thomas Wu, **An Introduction to Object Oriented programming with Java**, Tata McGraw Hill, 2005.
6. Kathy Sierra, Bert Bates ,**Head First Java**, 2nd Edition, **A Brain-Friendly Guide**, Publisher: O'Reilly Media, February 2005.

PCC104 Computer Architecture

Credits : 3

Instruction	3 hrs per hrs weeks..	Duration of SEE	3 hours
CIE	30 marks	SEE	70 marks

Course Objectives

1. Learn the basics of data representation
2. Study register transfer micro operations
3. Explore CPU
4. Comprehend computer arithmetic algorithms
5. Learn I/O organization

Course Outcomes

1. Apply data representation methods
2. Write logic diagrams for microoperations
3. Write general register organization diagrams
4. Analyze computer arithmetic algorithms.
5. Explain I/O organization

UNIT -I

Data Representation: Data types, Complements, Fixed and Floating Point representations, and Binary codes.

Overview of Computer Function and Interconnections: Computer components, Interconnection structures, Bus interconnection, Bus structure, and Data transfer.

UNIT-II

Register Transfer Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic, Logic and Shift micro operations, Arithmetic Logic Shift Unit. **Basic Computer Organization and Design:** Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory reference instruction, Input-Output and Interrupt.

UNIT-III

Micro programmed Control: Control memory, Address Sequencing, Micro program example, Design of Control Unit.

Central Processing Unit: General Register Organization, Stack Organization, Instruction formats, Addressing modes, Data Transfer and Manipulation, and Program control.

Computer Arithmetic: Addition and Subtraction, Multiplication, Division, and Floating Point Arithmetic Operations.

UNIT-IV

Memory Organization: Memory Hierarchy, Main Memory, RAM and ROM, Auxiliary memory, Associative memory, Cache memory, Virtual memory, Memory Management hardware.

UNIT–V

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), I/O Processor, Serial Communication.

Pipeline Processing: Arithmetic, Instruction and RISC Pipelines.

Assessing and Understanding Performance: CPU performance and its factors, Evaluating performance.

Suggested Readings

1. Morris Mano M, **Computer System Architecture**, Pearson Education India, 3rd Edition, 2007.
2. William Stallings, **Computer Organization and Architecture**, PHI, 7th Edition, 2008.
3. David A Patterson, John L Hennessy, **Computer Organization and Design**, Morgan Kaufmann, 5th Edition, 2013.
4. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, **Computer Organization,** Tata McGraw-Hill Education, 5th Edition, 2002

PCC105 Probability & Statistics

Credits : 4

Instruction	3L hrs per week	Duration of SEE	3 hours
CIE	30 marks	SEE	70 marks

Course Objectives

1. Understand the Linear Algebra concepts through vector spaces.
2. Basic concepts of probability and concepts of various discrete and continuous probability distributions.
3. Learning sampling procedure and various kinds of estimate techniques.
4. Learning hypotheses testing and acquiring knowledge of basic statistical Inference and its applications.
5. The concept of association between two variables and forecast future values by regression equations.

Course Outcomes

1. Understanding of Linear Algebra will boost the ability to understand and apply various data science algorithms.
2. Calculate probabilities by applying probability laws and theoretical results, knowledge of important discrete and continuous distributions, their inter relations with real time applications.
3. Understanding the use of sample statistics to estimate unknown parameters.
4. Become proficient in learning to interpret outcomes.
5. Compute and interpret Correlation Analysis, regression lines and multiple regression analysis with applications.

UNIT-I

Vector Spaces - Vector Spaces and Subspaces -Null Spaces, Column Spaces and Linear Transformations. Linearly Independent Sets - Bases - Coordinate Systems.

UNIT-II

Probability - Basic terminology, Three types of probability, Probability rules, Statistical independence, statistical dependency, Bayes' theorem.

Probability Distributions - Random variables, expected values, binomial distribution, Poisson distribution, normal distribution, choosing correct distribution.

UNIT-III

Sampling and Sampling Distributions - Random sampling, Non-Random Sampling distributions, operational considerations in sampling.

Estimation - Point estimates, interval estimates, confidence intervals, calculating interval estimates of the mean and proportion, t-distribution, determination of sample size in estimation.

UNIT-IV

Testing Hypothesis - one sample tests - Hypothesis testing of mean when the population standard deviation is known, powers of hypotheses test, hypotheses testing of proportions, hypotheses testing of means when standard deviation is not known.

Testing Hypotheses - Two sample tests - Tests for difference between means - large sample, small sample, with dependent samples, testing for difference between proportions – Large sample.

UNIT-V

Chi-square and Analysis of Variance - chi-square as test of independence, chi-square as a test of goodness of fit, analysis of variance, inferences about a population variance, inferences about two population variances.

Regression and Correlation – Simple Regression - Estimation using regression line, correlation analysis, making inferences about population parameters, limitations, errors and caveats in regression and correlation analysis. Multiple Regression and correlation analysis. Finding multiple regression equations and making inferences about population parameters.

Suggested Reading

1. David C Lay, Linear Algebra and its Applications 4e
2. Richard I Levin, David S Rubin - Statistics for Management, Seventh Edition, PHI - 1997
3. R D Sharma " Theory and Problems of Linear Algebra", International Publishing House Pvt. Limited, 2011.
4. A K Sharma, " Linear Algebra", Discovery Publishing House Ltd., 2019.
5. Gilbert Strang, Linear Algebra and its Applications, 2010
6. S. C. Gupta and V. K. Kapoor , Fundamentals of Mathematical Statistics Sultan Chand & Sons, New Delhi.

PCC106 Managerial Economics and Accountancy

Credits : 3

Instruction	3 hrs per week	Duration of SEE	3 hours
CIE	30 marks	SEE	70 marks

Course Objectives

1. To learn important concepts of Managerial Economics and apply them to evaluate business decisions.
2. To understand various parameters that determine the consumers' behavior.
3. To evaluate the factors that affect production
4. To understand the concepts of capital budgeting and payback period.
5. To study the concepts of various book-keeping methods.

Course Outcomes

1. Apply the fundamental concepts of managerial economics to evaluate business decisions Understand types of Demand and factors related to it.
2. Identify different types of markets and determine price –output under perfect competition.
3. Determine working capital requirement and payback
4. Analyze and interpret financial statements through ratios

UNIT – I

Meaning and Nature of Managerial Economics: Managerial Economics and its usefulness to Engineers, Fundamental Concepts of Managerial Economics-Scarcity, Marginalism, Equi-marginalism, Opportunity costs, Discounting, Time Perspective, Risk and Uncertainty, Profits, Case study method.

UNIT – II

Law of Demand and Supply: Law of Demand, Determinants, Types of Demand; Elasticity of Demand (Price, Income and Cross-Elasticity); Demand Forecasting, Law of Supply and Concept of Equilibrium. (Theory questions and small numerical problem can be asked)

UNIT – III

Theory of Production and Markets: Production Function, Law of Variable Proportion, ISO quants, Economics of Scale, Cost of Production (Types and their measurement), Concept of Opportunity Cost, Concept of Revenue, Cost-Output relationship, Break-Even Analysis, Price - Output determination under Perfect Competition and Monopoly (theory and problems can be asked)

UNIT – IV

Working Capital Management and Capital Budgeting: Concepts, Significance, determination and estimation of fixed and **variable**, working capital requirements, sources of capital.

Introduction to capital budgeting, methods – traditional and modern methods with problems.

(Theory questions and numerical problems on estimating working capital requirements and evaluation of capital budgeting opportunities can be asked)

UNIT – V

Accounting: Meaning-Significance-Principles of double entry book keeping, Journal, Ledger accounts , Subsidiary books, , Trial Balance, preparation of Final Accounts with simple adjustments, Analysis and interpretation of Financial Statements through Ratios.
(Theory questions and numerical problems on preparation of final accounts, cash book, petty cash book, bank reconciliation statement, calculation of some ratios)

Suggested Readings:

1. Mehta P.L., Managerial Economics —Analysis, Problems and Cases , Sultan Chand & Sons Educational Publishers, 2011
2. Maheswari S.N., Introduction to Accountancy , Vikas Publishing House, 2005
3. Pandey I.M., Financial Management , Vikas Publishing House, 2009
4. S P Jain and K L Narang, "Financial Accounting" , Kalyan Publishers, 2018
5. M Hanif and A Mukherjee "Modern Accountancy", McGraw Hill, 3rd Edition, 2018.

LCC151 Data Structures using C Lab

Credits : 1.5

Instruction	3P hrs per week	Duration of SEE	3 hours
CIE	25 marks	SEE	50 marks

Course Objectives

1. To understand and implement basic data structures using C
2. To apply linear and non-linear data structures in problem solving.
3. To learn to implement functions and recursive functions by means of data structures
4. To implement searching and sorting algorithms

Course Outcomes - Upon completion of the course, the students will be able to:

1. Write basic and advanced programs in C
2. Implement functions and recursive functions in C
3. Implement data structures using C
4. Choose appropriate sorting algorithm for an application and implement it in a modularized way

Programs

1. Basic C Programs – looping, data manipulations, arrays
2. Programs using strings – string function implementation
3. Programs using structures and pointers
4. Programs involving dynamic memory allocations
5. Array implementation of stacks and queues
6. Linked list implementation of stacks and queues
7. Application of Stacks and Queues
8. Implementation of Trees, Tree Traversals
9. Implementation of Binary Search trees
10. Implementation of Linear search and binary search
11. Implementation Insertion sort, Bubble sort, Quick sort and Merge Sort
12. Implementation Hash functions, Collision resolution techniques

LCC152 Java Programming Lab

Credits : 1.5

Instruction	3P hrs per week	Duration of SEE	3 hours
CIE	25 marks	SEE	50 marks

Course Objectives

1. Learn how to write simple java programs
2. Learn how to write multithreaded programs
3. Learn how to write I/O programs
4. Learn how to write serialization programs
5. Learn how to write program using URL class

Course Outcomes

1. Be able to write simple java programs
2. Be able to write multithreaded programs
3. Be able to write I/O programs
4. Be able to write serialization programs
5. Be able to write URL class program

Programs

1. Write a program to calculate salary of n employees using concept of classes with constructors and methods.
2. Write a program to demonstrate e-commerce website using inheritance, abstract class and dynamic polymorphism.
3. Write a program to demonstrate various arithmetic calculations using packages.
4. Write a program to demonstrate client-server environment using multithreading.
5. Write a program to demonstrate mutual exclusion using thread synchronization.
6. Write a program to demonstrate Linked list class.
7. Write a program to demonstrate Hash set and Iterator classes.
8. Write a program to demonstrate Enumeration and Comparator interfaces.
9. Write a program to accept data and display output in key, value pair.
10. Write a program to create a registration form with different controls, menus and demonstrate event handling.
11. Write a program to copy data from one file to another file.
12. Write a program to merge contents of two files and display output on console.
13. Write a program to illustrate Serialization.
14. Write a program to retrieve web page using URL class.
15. Write a program to load and display image and perform gray scale.

HSC153 Soft Skills Lab

Credits : 1

Instruction	2P hrs per week	Duration of SEE	3 hours
CIE	25 marks	SEE	50 marks

Course Objectives

1. Learn conversational skills
2. Learn reading strategies
3. Learn time management
4. Learn stress management
5. Learn career planning

Course Outcomes

1. Express conversational skills
2. Specify reading strategies
3. Perform time management
4. Perform stress management
5. Explore career planning

Activities

1. Conversation skills, Listening dialogues from TV/radio/Ted talk/Podcast
2. Group discussion
3. Interview skills, Making presentation
4. Listening to Lectures and News Programmes, Listening to Talk show
5. Watching videos on interesting events on Youtube,
6. Reading different genres of tests ranging from newspapers to philosophical treatises
7. Reading strategies – graphic organizers, Reading strategies – summarizing
8. Reading strategies – interpretation, Reports
9. Cover letter, Resume,
10. Writing for publications, Letters, Memos, Emails and blogs
11. Civil Service (Language related), Verbal ability
12. Motivation, Self image
13. Goal setting, Managing changes
14. Time management, Stress management
15. Leadership traits
16. Team work
17. Career and life planning.
18. Multiple intelligences
19. Emotional intelligence
20. Spiritual quotient (ethics)
21. Intercultural communication
22. Creative and critical thinking
23. Learning styles and strategies

Suggested Readings:

1. Business English Certificate Materials, Cambridge University Press.
2. Graded Examinations in Spoken English and Spoken English for Work downloadable

materials from Trinity College, London.
3. International English Language Testing System Practice Tests, Cambridge University Press.
4. Interactive Multimedia Programs on Managing Time and Stress.
5. Personality Development (CD-ROM), Times Multimedia, Mumbai
6. Robert M Sherfield "Developing Soft Skills" 4th Edition, Pearson Education, 2009.

Web Sources

http://www.slideshare.net/rohitjsh/presentation-on-group-discussion
http://www.washington.edu/doit/TeamN/present_tips.html
http://www.oxforddictionaries.com/words/writing-job-applications
http://www.kent.ac.uk/careers/cv/coveringletters.htm
http://www.mindtools.com/pages/article/newCDV_34.htm

SCHEME OF INSTRUCTION
MASTER OF COMPUTER APPLICATIONS (MCA)
SEMESTER – II

SNo	Course Code	Course Title	Hours/ Week			Scheme of Examination				No of Credits
						Max Marks			Duration (hrs)	
THEORY			L	T	P	CIE	SEE	Total Marks	SEE	Cr
1	PCC 201	Operating Systems	4	-	-	30	70	100	3	4
2	PCC 202	Database Management System	4	-	-	30	70	100	3	4
3	PCC 203	Design and Analysis of Algorithms	3	1	-	30	70	100	3	4
4 *	PCC 204	Data Engineering with Python	4	-	-	30	70	100	3	4
5	PCC 205	Machine Learning	3	-	-	30	70	100	3	3
6	MGC 206	Operations Research	3	-	-	30	70	100	3	3
PRACTICALS										
7	LCC 251	Operating Systems Lab	-	-	3	25	50	75	3	1.5
8 *	LCC 252	Data Engineering with Pytl	-	-	3	25	50	75	3	1.5
9	LCC 253	Database Management Systems Lab	-	-	3	25	50	75	3	1.5
10	SIP 321	Summer Internship/ Mini Project*	-	-	-	-	-	-	-	-
			20	3	9	255	570	825	-	26.5

***Summer Internship**: After second semester, the students are expected to do summer internship/ Mini Project and Its grade will be credited in the third semester memo after evaluation.

Abbreviation	Full Form	Abbreviation	Full Form
PCC	Professional Core Course	CIE	Continuous Internal Evaluation
PEC	Professional Elective Course	SEE	Semester End Evaluation
HSC	Humanities and Social Science Course	L	Lecture
LCC	Laboratory Core Course	P	Practical

Note : Each lab should be made with 30 students for batch

PCC201 Operating Systems

Credits : 4

Instruction	4 L hrs per week	Duration of SEE	3 hours
CIE	30 marks	SEE	70 marks

Course Objectives

1. To gain the understanding of operating system and unix operating system in specific
2. To comprehend the details of process.
3. To learn the types and architecture of computer memory
4. To study file system and its implementation
5. To realize the operating system concepts into case studies.

Course Outcomes – Learners on completion of the course, be able to

1. Explain operating systems and Unix OS, illustrate the workings of various OS components.
2. Analyze the process, its states and process scheduling algorithms.
3. Demonstrate paging, demand paging, page replacement and segmentation with illustrations.
4. Elaborate the file access and allocation methods and mass storage structures.
5. Describe concrete implementations of Linux system and Windows 7.

UNIT-I

Unix: Introduction, commands, file system, security and file permission, regular expression and grep, shell programming, awk.
Introduction to Operating Systems: OS structure and strategies, Process concepts, Multithreaded Programming, Process scheduling, Process synchronization, Deadlocks.

UNIT-II

Memory management strategies with example architectures: Swapping, Contiguous allocation, Paging, Segmentation, Segmentation with paging, Virtual memory management : Demand paging, Page replacement, Thrashing.

UNIT-III

File System Interface: File concepts, Access methods and protection. File system implementation: File system structure, Allocation methods, Directory implementation of file systems, Mass storage structures, I/O systems

UNIT-IV

System Protection : Principles and Domain, Access Matrix and implementation, Access control and access rights, Capability based systems, Language based Protection,
System Security: Problem, Program threats, cryptography, user authentication, implementing security defenses, Firewalling, Computer security Classification

UNIT-V

Case Studies: The Linux System–Design principles, Kernel modules, Process management, Scheduling, Memory management, File systems, Input and Output, Inter process

communication. Windows 7 –Design principles, System components, Terminal services and fast user switching File systems, Networking, Programmer interface.

Suggested Readings:

1. Abraham Silberschatz, Peter B Galvin, Operating System Concepts, 9th edition, Wiley, 2016
2. William Stallings, Operating Systems-Internals and Design Principles, 8th edition, Pearson, 2014
3. Andrew S Tanenbaum, Modern Operating Systems, 4th edition, Pearson, 2016.

PCC202 Database Management System

Credits : 4

Instruction	4L hrs per week	Duration of SEE	3 hours
CIE	30 marks	SEE	70 marks

Course Objectives

1. Introduce database concepts along with ER modelling
2. Learn about relational databases and SQL query language
3. Define advanced SQL
4. Study DB transactions and explore concurrency concepts
5. Introduce NoSQL

Course Outcomes

1. Explain the DB concepts and model requirements as ER-model
2. Suggest relational algebra queries from text specification
3. Write SQL queries for the given questions
4. Elaborate indexing and hashing and describe concurrency control concepts
5. Comprehend NoSQL technology

UNIT – I

Introduction: Database System Applications, Purpose of Database Systems, View of Values, Nested Sub-queries, Complex Queries, Views, Modification of the Database, Joined Relations Data, Database Languages, Relational Databases, Database Design, Object–based and Semi-structured Databases, Data Storage and Querying, Transaction Management, Data Mining and Analysis, Database Architecture, Database Users and Administrators. Database Design and the **E-R Model**: Overview of the Design Process, The Entity- Relationship Model, Constraints, Entity-Relationship Diagrams, Entity – Relationship Design Issues, Weak Entity Sets, Extended E-R Features, Database Design for Banking Enterprise, Reduction to Relational Schemas, Other Aspects of Database Design

UNIT – II

Relational Model: Structure of Relational Databases, Fundamental Relational-Algebra Operations, Additional Relational – Algebra Operations, Extended Relational - Algebra Operations, Null Values, Modification of the Databases. Structured Query Language: Data Definition, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null

UNIT – III

Advanced SQL: SQL Data Types and Schemas, Integrity Constraints, Authorization, Embedded SQL, Dynamic SQL, Functions and Procedural Constructs, Recursive Queries, Advanced SQL Features. Relational Database Design: Features of Good Relational Design, Atomic Domains and First Normal Form, Functional-Dependency Theory, Decomposition using Functional Dependencies.

UNIT – IV

Indexing and Hashing: Basic Concepts, Ordered Indices, B+-tree Index Files, B-tree Index Files, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices. Index Definition in SQL Transactions: Transaction Concepts, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability

UNIT – V

Concurrency Control: Lock-based Protocols, Timestamp-based Protocols, Validation-based Protocols, Multiple Granularity, Multi-version Schemes, Deadlock Handling, Insert and Delete Operations, Weak Levels of Consistency, Concurrency of Index Structures. Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, Advanced Recovery Techniques, Remote Backup Systems

NoSQL: Need for NoSQL, aggregate data models, more details on data models, distribution models, consistency, version stamps, map-reduce, key-value databases, document databases, column-family stores, graph databases, Schema Migrations

Suggested Readings

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, Database System Concepts, McGraw-Hill International Edition, 6th Edition, 2010.
2. Ramakrishnan, Gehrke, Database Management Systems, McGraw-Hill International Edition, 3rd Edition, 2003.
3. Elmasri, Navathe, Somayajulu, Fundamentals of Database Systems, Pearson Education,4thEdition,2004.
4. Shashank Tiwari, “Professional NoSQL”, 1st Edition , Wiley publishers, 2011.

PCC203 Design and Analysis of Algorithms

Credits : 4

Instruction	4(3L+1T) hrs per week	Duration of SEE	3 hours
CIE	30 marks	SEE	70 marks

Course Objectives

1. Learn algorithms time complexity
2. Learn divide and conquer approach
3. Learn greedy method
4. Learn dynamic programming
5. Learn backtracking

Course Outcomes

1. Carry out algorithms time complexity
2. Explain divide and conquer approach
3. Illustrate greedy method
4. Elaborate dynamic programming
5. Explore backtracking

Unit I

Introduction to Algorithms: Algorithm Specification, Performance Analysis, Randomized Algorithms. **Elementary Data Structures**: Stacks and Queues, Trees, Dictionaries, Priority Queues, Sets and Disjoint Set Union, Graphs.

Unit II

Divide and Conquer: Binary Search, Finding the Maximum and Minimum, Merge Sort; Quick Sort, Selection sort, Strassen's Matrix Multiplication, Convex Hull.

The Greedy Method: Knapsack Problem, Tree Vertex Splitting, Job Sequencing with Deadlines, Minimum-Cost Spanning Trees, Single Source Shortest Paths.

Unit III

Dynamic Programming: General Method, Multistage Graphs, All-Pairs Shortest Paths, Single-Source Shortest Paths, Optimal Binary Search Trees, 0/1 Knapsack, The Traveling Salesperson Problem.

Basic Traversal and Search Techniques: Techniques for Binary Trees, Techniques for Graphs, Connected Components and Spanning Trees, Biconnected Components and DFS.

Unit IV

Back Tracking: General Method, 8-Queens Problem, Sum of Subsets, Graph Coloring, Hamiltonian Cycles, Knapsack Problem. **Branch-Bound**: The Method, 0/1 Knapsack Problem, Traveling Sales Person.

Unit V

NP-Hard and NP-Complete Problems: Basic Concepts, Cook's Theorem, NP-Hard. Graph Problems, NP-Hard Scheduling Problems, NP-Hard Code Generation, Some Simplified NP-Hard Problems.

Suggested Readings

1. E Horowitz, S Sahni, S Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Universities Press, 2007.
2. R. Pannerselvam, "Design and Analysis of Algorithms", PHI, 2007.
3. Hari Mohan Pandey, "Design, Analysis and Algorithm", University Science Press, 2009.
2. TH Cormen, CE Leiserson, RL Rivert, C Stein, "Introduction to Algorithms", Third Edition, PHI, 2010.

PCC 204 # Data Engineering with Python

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

Course Objectives: The main objectives of this course are to teach

- how to extract raw data,
- clean the data,
- perform transformations on data,
- load data and visualize the data

Outcomes:

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

- Understand the basics of Python Programming Language
- Handle different types of files and work with text data
- Use regular expression operations
- Use relational databases via SQL
- Use tabular numeric data
- Use the data structures: data series and frames
- Use PyPlot for visualization
- Use Python for basic Machine Learning

Unit – I

Introduction, Parts of Python Programming Language, Control Flow Statements, Functions, Strings [Reference 2 – Chapter 1 to Chapter 5]

Unit- II

Lists, Dictionaries, Tuples and sets, Files, Regular expressions [Reference 2- Chapter 6 to Chapter 10]

Unit-III

Introduction to Data Science [Reference 2- Chapter 12] **, Data Science**: Data Analysis Sequence, Data Acquisition Pipeline, Report Structure [Reference 1(Chapter 1-Unit1 to Unit 3)]]
Files and Working with Text Data: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Python os and os.pathModules. [Reference 2, Chapter 9)]
Working with Text Data: JSON and XML in Python[Reference 2, Section12.2]

Working with Text Data: Processing HTML Files, Processing Texts in Natural Languages [Reference 1(Chapter3 –Unit 13, and Unit16)

Regular Expression Operations: Using Special Characters, Regular Expression Methods, Named Groups in Python Regular Expressions, Regular Expression with *glob* Module [Reference 2-Chapter 10]

Unit – IV

Working with Databases: Setting Up a MySQL Database, Using a MySQL Database: Command Line, Using a MySQL Database, Taming Document Stores: MongoDB [Reference 1 (Chapter4-Unit17toUnit20)]

Working with Data Series and Frames: Pandas Data Structures, Reshaping Data, Handling Missing Data, Combining Data, Ordering and Describing Data, Transforming Data, Taming Pandas File I/O [Reference 1 (Chapter 6-Unit 31 to Unit 37)]

Plotting: Basic Plotting with PyPlot, Getting to Know Other Plot Types, Mastering Embellishments, Plotting with Pandas [Reference 1 (Chapter8-Unit 41 to Unit 44)]

Unit – V

Probability and Statistics: Reviewing Probability Distributions, Recollecting Statistical measures, Doing Stats the Python way [Reference 1 (Chapter9-Unit 45 to Unit 47)]

Machine Learning: Designing a Predictive Experiment, Fitting a linear regression, Grouping Data with K- means Clustering. Surviving in Random Decision Forests. [Reference 1(Chapter 10 - Unit 48 to Unit-51)]

Suggested Reading

1. Data Science Essentials in Python: Collect, Organize, Explore, Predict, Value. Dmitry Zinoriev, The Pragmatic Programmers LLC, 2016
2. Introduction to Python Programming**.** Gowrishankar S., Veena A. CRC Press, Taylor & Francis Group, 2019
3. Python for Everybody: Exploring Data Using Python 3. Charles R Severance, 2016
4. Python Data Analytics – Data Analysis and Science using Pandas, matplotlib and the Python Programming Language. Fabio Nelli, Apress, 2015
5. Website Scraping with Python. Using BeautifulSoup and Scrapy. GáborLászlóHajba, Apress, 2018
6. Machine Learning with Python Cookbook:.Practical Solutions from Preprocessing to Deep Learning. Chris Albon, O'Reilly 2018

PCC205 Machine Learning

Credits : 3

Instruction	3L hrs per week	Duration of SEE	3 hours
CIE	30 marks	SEE	70 marks

Course Objectives

1. Learn regression techniques
2. Learn dimensionality reduction methods
3. Learn classification schemes
4. Learn clustering mechanisms
5. Learn evaluation metrics

Course Outcomes

1. Solve regression problems
2. Apply dimensionality reduction methods
3. Analyze classification schemes
4. Explore clustering mechanisms
5. Explain evaluation metrics

Unit I

Basic Maths: Probability, Linear Algebra, Convex Optimization **Background**: Statistical Decision Theory, Bayesian Learning (ML, MAP, Bayes estimates, Conjugate priors)

Unit II

Regression: Linear Regression, Ridge Regression, Lasso **Dimensionality Reduction**: Principal Component Analysis, Partial Least Squares

Unit III

Classification: Linear Classification, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Perceptron, Support Vector Machines + Kernels, Artificial Neural Networks + Back Propagation, Decision Trees, Bayes Optimal Classifier, Naive Bayes.

Unit IV

Evaluation measures: Hypothesis testing, Ensemble Methods, Bagging, Adaboost Gradient Boosting, Clustering, K-means, K-medoids, Density-based Hierarchical, Spectral

Unit V

Miscellaneous topics: Expectation Maximization, GMMs, Learning theory

Introduction to Reinforcement Learning **Graphical Models**: Bayesian Networks.
Use Cases of various ML Algorithms in Manufacturing, Retail, Transport, Healthcare, weather, insurance sectors.

Suggested Readings

1. Ethem Alpaydin. Introduction to Machine Learning 3e(Adaptive Computation and Machine Learning Series). The MIT Press, 2004.
2. Tom M. Mitchell, Machine Learning McGraw Hill Education, 2013

MGC206 Operations Research

Credits : 3

Instruction	3L hrs per week...	Duration of SEE	3 hours
CIE	30 marks	SEE	70 marks

Course Objectives

1. Learn linear programming
2. Learn transportation problem
3. Learn assignment problem
4. Learn dynamic programming
5. Learn gaming theory

Course Outcomes

1. Solve linear problems
2. Apply transportation problems
3. Analyze assignment problems
4. Explore dynamic programming
5. Explain gaming theory

UNIT I

Linear Programming: Introduction, Concept of Linear Programming Model, Development of LP models, Graphical Method, Linear Programming Methods, Special cases of Linear Programming, Duality, Sensitivity Analysis.

UNIT II

Transportation Problem: Introduction, Mathematical Model for 'Transportation Problem, Types of Transportation Problem, Methods to solve Transportation Problem, Transshipment Model.

UNIT III

Assignment Problem: Introduction, Zero-One Programming Model, Types of Assignment Problem, Hungarian Method, Branch-and-Bound Technique for Assignment Problem.

Integer Programming: Introduction, Integer Programming Formulations, The Cutting-Plane Algorithm, Branch-and-Bound Technique, Zero-One Implicit Enumeration Algorithm.

UNIT IV

Dynamic Programming: Introduction, Applications of Dynamic Programming, Solution of Linear Programming Problem through Dynamic Programming.
Basics of Queuing theory.

UNIT V

Game Theory: Introduction, Game with Pure Strategies, Game with Mixed Strategies, Dominance Property, Graphical Method for 2 x n or m x 2 Games, Linear Programming Approach for Game Theory.

Suggested Reading:

1. Pannarselvam, "*Operations Research*", 3rd Edition, PHI, 2009.
2. Prem Kumar Gupta, DS Hira, "*Problems in Operations Research*", S. Chand, 2010.
3. Rathindra P Sen, "*Operations Research - Algorithm and Application*", PHI, 2010.
4. J K Sharma, "*Operations Research*", Fourth Edition, MacMillan, 2009.

LCC251 Operating Systems Lab

Credits : 1.5

Instruction	3P hrs per week	Duration of SEE	3 hours
CIE	25 marks	SEE	50 marks

Course Objectives

1. Learn shell commands and scripting
2. Learn CPU scheduling algorithms
3. Learn memory management algorithms
4. Learn synchronization problems
5. Explore file allocation strategies and disk scheduling algorithms

Course Outcomes

1. Be able to execute shell commands and write shell scripts
2. Be able to write programs on CPU scheduling
3. Be able to create memory management algorithms
4. Be able to execute programs to demonstrate synchronization problems
5. Be able to implement file allocation methods and be able to create disk scheduling algorithms

Programs

1. Unix Shell Commands
    a) File handling commands
    b) Directory handling commands
    c) General purpose commands
2. Unix Shell Scripts
    a) Print Multiplication table of a given no. using all loops
    b) Perform all arithmetic operations
    c) Print the type of a file
    d) Rename all files whose names end with .c as .old
    e) Display the no. of lines in each of text file in a given dir
3. Simulate the following CPU scheduling algorithms.
    a. FCFS
    b. SJF
    c. Round Robin
    d. Priority.
4. Write a C program to simulate producer-consumer problem using Semaphores
5. Write a C program to simulate the concept of Dining-philosophers problem.
6. Simulate MVT and MFT.
7. Write a C program to simulate the following contiguous memory allocation techniques

   a. Worst fit
   b. Best fit
   c. First fit.
8. Simulate following page replacement algorithms
   a. FIFO
   b. LRU
   c. OPTIMAL
9. Simulate following File Organization Techniques
   a. Single level directory
   b. Two level directory
10. Simulate following file allocation strategies
   a. Sequential
   b. Indexed
   c. Linked.
11. Simulate Bankers Algorithm for Dead Lock Avoidance.
12. Simulate Bankers Algorithm for Dead Lock Prevention.
13. Write a C program to simulate disk scheduling algorithms.
   a. FCFS
   b. SCAN
   c. C-SCAN

LCC252 Data Engg. With Python Lab

Credits : 1.5

Instruction	3P hrs per week	Duration of SEE	3 hours
CIE	25 marks	SEE	50 marks

Course objectives:

- Understand the process of Importing and Exporting the data.
- Learn how to collect, store and manage data from multiple data sources.
- Know the insights of data using statistical methods
- Identify different techniques for data analysis and data visualization.
- Put into practice the ETL (extract, transform, load) pipeline which will extract raw data, clean the data, perform transformations on data, load data and visualize the data.

Course Outcomes: students would be able to:

- Demonstrate various data types in python and develop programs using files, exception handling, functions, classes in Python.
- Examine the process for importing and exporting the data.
- Apply appropriate data collection and pre-processing methods.
- Identify different data analysis Techniques suitable for a given applications
- Demonstrate data visualization techniques for Data Analysis.

Libraries
In this course students are expected to extract, transform and load input data that can be text files, CSV files, XML files, JSON, HTML files, SQL databases, NoSQL databases etc.,. For doing this, they should learn the following Python libraries/modules:
pandas, numpy, BeautifulSoup, pymysql, pymongo, nltk, matplotlib

Datasets
For this laboratory, appropriate publicly available datasets, can be studied and used. Example:
MNIST (http://yann.lecun.com/exdb/mnist/),
UCI Machine Learning Repository(https://archive.ics.uci.edu/ml/datasets.html),
Kaggle(https://www.kaggle.com/datasets)
Twitter Data

Exercises

1. Write programs to parse text files, CSV, HTML, XML and JSON documents and extract relevant data. After retrieving data check any anomalies in the data, missing values etc.
2. Write programs for reading and writing binary files
3. Write programs for searching, splitting, and replacing strings based on pattern matching using regular expressions
4. Design a relational database for a small application and populate the database. Using SQL do the CRUD (create, read, update and delete) operations.
5. Create a Python MongoDB client using the Python module pymongo. Using a collection object practice functions for inserting, searching, removing, updating, replacing, and aggregating documents, as well as for creating indexes

6. Write programs to create numpy arrays of different shapes and from different sources, reshape and slice arrays, add array indexes, and apply arithmetic, logic, and aggregation functions to some or all array elements
7. Write programs to use the pandas datastructures: Frames and series as storage containers and for a variety of data-wrangling operations, such as:
    - Single-level and hierarchical indexing
    - Handling missing data
    - Arithmetic and Boolean operations on entire columns and tables
    - Database-type operations (such as merging and aggregation)
    - Plotting individual columns and whole tables
    - Reading data from files and writing data to files

Additional Exercises (for learning and practice) :

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 python that takes 2numbers 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 and
    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 andRecursion
    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 from2 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 nanddisplay.
    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 textfile
    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 total 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 in to a dictionary.

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

6. Demonstrate data analysis using NumPy
   a. Create an array of 10 zeros
   b. Create an array of even integers upto 50
   c. Create a 3x3 matrix
   d. Generate an array of 25 random numbers sampled from a standard normal distribution.
   e. Create an array of 20 linearly spaced points between 0 and 1
   f. Demonstrate slicing and indexing operations
   g. Get the sum of all columns in matrix

7. Write a Program in Python to create and combine student and subject data frames in Pandas.

8. Create a data frame 'Book' that contains three vectors [Name, Price, Author]. Convert this data frame into a matrix and list the object using the operator 'as'.

9. Performing Exploratory data analysis on web scraped data of 2021-22 NBA player stats (http://www.basketball-reference.com/)
   Perform data cleaning
   Handle missing values by replacing with 0
   Write to CSV file
   Which player scored the most points per game?
   Which player had the highest 3-point field goals per game?
   Demonstrate Group By() function

10. Data visualization through Sea born for the above program 9.
    Box plot of points scored grouped by position
    Compute the correlation matrix

11. To determine the mean of a set of numbers. To plot the numbers in a bar plot and have a straight line run through the plot at the mean.

12. To determine the median of a set of numbers. To plot the numbers in a barplot and have a straight line run through the plot at the median.

13. To determine the standard deviation. To plot the numbers in a bar plot and have a straight line run through the plot at the mean and another straight line run through the plot at mean + standard deviation.

More dataset to perform data analysis

Source of the Data: https://www.kaggle.com/chirin/africa-economic-banking-and-systemic-crisis-data/downloads/africa-economic-banking-and-systemic-crisis-data.zip/1

Data set: https://www.kaggle.com/khalidative/crimeanalysis

LCC253 Database Management Systems Lab

Credits : 1.5

Instruction	3P hrs per week	Duration of SEE	3 hours
CIE	25 marks	SEE	50 marks

Course Objectives

1. Learn SQL queries
2. Learn PL/SQL stored procedures
3. Learn Triggers
4. Learn report generation methods
5. Learn database application creation

Course Outcomes

1. Write SQL queries
2. Write stored procedures
3. Write triggers
4. Use file locking and table locking facilities
5. Create small full-fledged database application

Creation of database (exercising the commands for creation)

1. Simple to Complex condition query creation using SQL Plus.
2. Usage of Triggers and Stored Procedures.
3. Creation of Forms for Student information, Library information, Pay roll etc.
4. Writing PL/SQL procedures for data validation.
5. Report generation using SQL reports.
6. Creating password and security features for applications.
7. Usage of File locking, Table locking facilities in applications.
8. Creation of small full- fledged database application spreading over 3 sessions.

Note: The creation of sample database for the purpose of the experiments is expected to be pre-decided by the instructor.

SIP321 Summer Internship/ Mini Project *

Program Description

The Internship Program/ Mini Project allows MCA students to gain practical experience in the workplace before receiving their graduate degrees.

The internship is a required academic course. The student identifies companies willing to hire him/her on a full time basis for 6-week period (minimum required), usually in the summer. The Internship Program supervises the students and awards academic credits (2) upon successful completion of all the required assignments.

Those students who wish to do a Mini Project can use Problem statements and Data Sources from good quality sources and implement a solution. The Student will be evaluated based on the working system that is presented in Semester III of this course.

Intended Learning Outcomes

Upon successful completion of the internship, you should be able to

1. Communicate a practical understanding of how a technology actually operates
2. Demonstrate the ability to integrate and apply theoretical knowledge and skills developed in various courses to real-world situations in a business organization
3. Exhibit the ability to effectively work in a professional environment and demonstrate work ethic and commitment in a work-based environment
4. Demonstrate the ability to successfully complete internship assignments.
5. Reflect on personal and professional development needs and set strategic goals for advancing along an intended career path
6. Communicate effectively in a professional environment in both English and regional language, orally and in writing.