

**Haribhai V. Desai College
of Arts, Science & Commerce, Pune.
(Autonomous)**

Faculty of Science and Technology

M.Sc. (Computer Applications) Program



**Syllabus
For
F.Y M.Sc. (Computer Applications)**

**Choice Based Credit System (CBCS)
Syllabus Under National Education Policy (NEP)
with effect from Academic Year 2024-25**

Title of the Course: M.Sc. (Computer Applications)**Objectives**

The objective of the Program is to produce trained software professionals with hands-on experience on state-of-the art technologies who will be able to handle challenges in IT industry. The objectives of M.Sc. (Computer Applications) program are: -

- To produce knowledgeable and skilled human resources that is employable in IT and ITES.
- To impart knowledge required for planning, designing and building Complex Application Software Systems as well as to provide support for automated systems or applications.

M.Sc. (Computer Applications) Program is of Two Years duration with four semesters. It is a Full- Time post graduate Degree Program. The program is based on credit system comprising of total 88 credit points.

It is believed that the proposed syllabus as part of the credit-based system will bring a qualitative change in the way M.Sc. (Computer Applications) is taught, which will offer a more enriched learning experience. It aims to provide students with the knowledge and ability to develop creative solutions, and better understand the effects of future developments of computer applications, systems and technology on people and society. The students shall develop self and life-long learning skills.

Eligibility

- (a) Bachelor Degree in Science/Technology/Engineering OR
- (b) Bachelor of Computer Applications (B.C.A.) OR
- (c) B.Sc.(Computer Science) OR
- (d) Bachelor of Computer Science (B.C.S.) OR
- (e) B.Sc.(Information Technology) OR
- (f) B.Sc.(Data Science) OR
- (g) B.Sc.(Cyber and Digital Science) OR
- (h) B.Sc. (Cyber Security) OR
- (i) B.Sc. (Cloud Computing) OR
- (j) Bachelor of Engineering(BE/B.Tech) in Computer Engg/Computer Science & Engg./ Computer Science and Design/ Information Technology/Electronics and

Telecommunication/AI and Data Science/AI and Machine Learning/ equivalent OR

(k) B. Voc. in Software Development/ Information Technology OR

(l) B.Sc. with Computer Science as Principal Subject OR

(m) General B.Sc. with Computer Science as one of the subject at TYBSc level Programme

Programme Outcomes:

After successful completion of the Programme, the students shall be able to

PO 1: Demonstrate understanding of fundamental and advance concepts in emerging areas

PO 2: Design and develop innovative computer applications.

PO 3: Analyze existing research reported in the literature

PO 4: Propose alternate solutions by undertaking research work.

PO 5: Create efficient, reliable, readable and maintainable code.

PO 6: Demonstrate a deeper understanding of the chosen domain.

PO 7: Select appropriate method to solve the given problem

PO 8: Explain complex technical concepts clearly and effectively, both in written and oral forms.

PO 9: Demonstrate ability to collaborate effectively with team members, understand different perspectives, and contribute productively to become successful professional.

PO 10: Demonstrate ability to work with integrity and a sense of social responsibility.

PO 11: Demonstrate self and life-long learning skills

PO 12: Solve computational problems innovatively

PO 13: Apply knowledge gained and critical thinking to develop real-world applications.

SEMESTER I

Course Type	Course Code	Course Name	Teaching Scheme		Exam Scheme			Credits		
			TH	PR	CE	EE	Total	TH	PR	Total
MC	CA-501-MJ-TH	Database Systems and SQL	04	--	30	70	100	04	--	04
	CA-502-MJ-TH	Python Programming and Data Structures	04	--	30	70	100	04	--	04
	CA-503-MJ-TH	Operating Systems	02	--	15	35	50	02	--	02
	CA-504-MJ-PR	Lab course Based on CA-501-MJ-TH & CA-503-MJ-TH	--	04	15	35	50	--	02	02
	CA-505-MJ-PR	Lab course based on CA-502-MJ-TH	--	04	15	35	50	--	02	02
ME	CA-510-MJ-TH	Java Programming	02	--	15	35	50	02	--	02
	CA-511-MJ-PR	Lab Course based on CA-510-MJ-TH	--	04	15	35	50	--	02	02
	OR									
	CA-512-MJ-TH	Cloud Computing	02	--	15	35	50	02	--	02
	CA-513-MJ-PR	Lab Course based on CA-512-MJ-TH	--	04	15	35	50	--	02	02
RM	CA-531-RM-TH	Research Methodology	04	--	30	70	100	04	--	04
Total			16	12	165	385	550	16	06	22

SEMESTER II

Course Type	Course Code	Course Name	Teaching Scheme		Exam Scheme			Credits		
			TH	PR	CE	EE	Total	TH	PR	Total
MC	CA-551-MJ-TH	Web Technologies	04	--	30	70	100	04	--	04
	CA-552-MJ-TH	Introduction to Data Science	04	--	30	70	100	04	--	04
	CA-553-MJ-TH	Computer Networks	02	--	15	35	50	02	--	02
	CA-554-MJ-PR	Lab course based on CA-551-MJ-TH	--	04	15	35	50	--	02	02
	CA-555-MJ-PR	Lab course based on CA-552-MJ-TH	--	04	15	35	50	--	02	02
ME	CA-560-MJ-TH	Advance Java Programming	02	--	15	35	50	02	--	02
	CA-561-MJ-PR	Lab Course on based on CA-560-MJ-TH	--	04	15	35	50	--	02	02
	OR									
	CA-562-MJ-TH	C# .NET	02	--	15	35	50	02	--	02
	CA-563-MJ-PR	Lab Course on based on CA-562-MJ-TH	--	04	15	35	50	--	02	02
OJT/FP	CA-581-OJT/FP	Industry Internship/Field Project	--	--	30	70	100	--	04	04
Total			12	12	165	385	550	12	10	22
ATKT :- Minimum number of credits required to take admission to S.Y.M.Sc. Computer Application is 22 credits [50%] from F.Y.M.Sc. Computer Application										

Course Type	Course Code	Course Name	Teaching Scheme		Exam Scheme			Credits		
			TH	PR	CE	EE	Total	TH	PR	Total
MC	CA-601-MJ-TH	Artificial Intelligence	04	--	30	70	100	04	--	04
	CA-602-MJ-TH	Machine Learning	04	--	30	70	100	04	--	04
	CA-603-MJ-TH	Software Engineering	02	--	15	35	50	02	--	02
	CA-604-MJ-PR	Lab Course based on CA-601-MJ-TH	--	04	15	35	50	--	02	02
	CA-605-MJ-PR	Lab Course based on CA-602-MJ-TH	--	04	15	35	50	--	02	02
ME	CA-610-MJ-TH	Mobile Application Development	02	--	15	35	50	02	--	02
	CA-611-MJ-PR	Lab Course based on CA-610-MJ-TH	--	04	15	35	50	--	02	02
	OR									
	CA-612-MJ-TH	Software Testing	02	--	15	35	50	02	--	02
	CA-613-MJ-PR	Lab Course based on CA-612-MJ-TH	--	04	15	35	50	--	02	02
Research Project	CA-631-RP-PR	Research work - I	--	--	30	70	100	--	04	04
Total			12	12	165	385	550	12	10	22

SEMESTER IV

Course Type	Course Code	Course Name	Teaching Scheme		Exam Scheme			Credits		
			TH	PR	CE	EE	Total	TH	PR	Total
MC	CA-651-MJ-PR	Industrial Training	--	--	90	210	300	--	12	12
ME	CA-660-MJ-TH	Online / MOOC / Elective	02	--	15	35	50	02	--	02
	CA-661-MJ-TH	Online / MOOC / Elective	02	--	15	35	50	02	--	02
Research Project	CA-681-RP-PR	Research work – II	--	--	45	105	150	--	06	06
Total			12	12	165	385	550	04	18	22

SEMESTER-I

<p align="center">Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. M.Sc. (Computer Applications) - Sem-I Course : CA-501-MJ-TH Course Title : Database Systems and SQL</p>		
Teaching Scheme 04 Hours/Week	No. of Credits 04	Examination Scheme CIE : 30 Marks SEE : 70 Marks
<p>Course Objectives:</p> <ul style="list-style-type: none"> • To be familiar with database management system • To get acquainted with SQL and PL/SQL • To understand advanced SQL features and procedural SQL • To know the concept of triggers and assertions 		
<p>Course Outcomes:</p> <p>On completion of the course, student will be able to–</p> <ul style="list-style-type: none"> • Enumerate database applications • Design E-R Model for given requirements and convert the same into database tables. • Apply Normalization techniques for database design • Formulate database queries using SQL • Write Embedded and dynamic queries using SQL/PLSQL 		
Course Contents:		
Chapter-1	Introduction of DBMS	Hours: 10
<p>Introduction of DBMS</p> <ul style="list-style-type: none"> • DBMS Overview • Advantages of DBMS • Users of DBMS • Applications of DBMS • Data models - (Hierarchical, Network, ER, Relational), • File system Vs. DBMS • Data independence • Levels of abstraction • Architecture of DBMS • Database Languages (DDL, DML, DCL) 		

Chapter-2	Conceptual Design (E-R model)	Hours: 14
<ul style="list-style-type: none"> ● Overview of DB design ● Entity Types, Entity Sets, ● Attributes ,Attribute Types ● Relationship Types, Relationship Sets, Relationship Degree ● ER Diagrams, Naming Conventions(<i>Attribute, Entity, Relationship</i>), and Design Issues; ● ER-to-Relational Mapping, ● Schema Diagrams ● Characteristics of Specialization and Generalization ● keys, Constraints (Primary key, Foreign key, Check. Unique key, Not Null, Default etc) 		
Chapter-3	Relational Database Management Systems (RDBMS)	Hours: 08
<ul style="list-style-type: none"> ● Introduction to Relational Database, Relational Database Design,DBMS vs RDBMS ● Functional Dependencies (Full functional dependency Partial functional dependency, Transitive functional dependency),Closure of set of Functional Dependency, Closure of set of attributes ● Decomposition,Properties of Relational Decomposition (Attribute Preservation, Dependency Preservation, Lossless join, No redundancy Non Additive Join Property.) ● Normalization, Need of Normalization, Normal form (1 NF,2NF,3NF,BCNF), ● Case Studies 		
Chapter-4	Introduction to SQL	Hours: 08
<ul style="list-style-type: none"> ● Introduction to SQL ● Data Types in SQL ● DDL commands (create, alter.drop,rename,desc) with examples ● DML command(insert,delete,update,select) ● DCL command(commit,rollback,grant,revoke) ● Basic structure of SQL SELECT query(<i>Using BETWEEN, IN, OR,Like ,ORDER BY, GROUP BY and HAVING Clause,Distinct</i>) ● Aggregate functions, ● Set operations 		
Chapter-5	Intermediate SQL	Hours: 10
<ul style="list-style-type: none"> ● Nested ,Sub-queries,(<i>Using All,ANY</i>), ● Joins and their type ● Grouping and summarizing information– A very common error with GROUP BY– The HAVING clause 		

<ul style="list-style-type: none">● Writing queries on more than one table/multiple table -JOIN– Avoiding ambiguously named columns– Outer JOINS(LEFT OUTER JOIN, RIGHT OUTER JOIN, FULL OUTER JOIN)– Using table aliases– SELF JOINS● Overview of indexes,views,sequences● Optimizing Queries with Indexes and views			
Chapter-6	PL/SQL, Embedded and Dynamic SQL	Hours: 10	
<ul style="list-style-type: none">● PL/PostgreSQL : Features,Advantages,Language structure,statements and Expressions● Control flow, conditional statements, loops● Cursors(Cursor attribute,Types-Implicit,explicit ,parameterized cursor,nesting of cursor)● Stored procedure(creation,procedure call,implementation)● Functions(creating ,calling function,passing parameters,returning a value)● Handling errors and exceptions● Triggers and Assertions			
Reference Books:			
Sr. No	Title of Books	Name of Author/s	Publisher
1	Database System Concepts	Henry F. Korth, Abraham Silberschatz, S.Sudarshan	Tata McGraw-Hill Education 7 th edition
2	Postgresql	Regina obe, Leo Hsu	OReilly publications3 rd edition
3	Database Systems	Shamkant B. Navathe, RamezElmasri,	Pearson Higher Education
4	Database Management System	Raghu Ramakrishnan and Johannes Gehrke,	McGraw-Hill 3 rd edition

<p align="center">Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. M.Sc. (Computer Applications) - Sem-I Course Code : CA-502-MJ-TH Course Title : Python Programming and Data Structures</p>		
Teaching Scheme 04 Hours/Week	No. of Credits 04	Examination Scheme CIE : 30 Marks SEE : 70 Marks
<p>Course Objectives:</p> <ul style="list-style-type: none"> • To introduce programming concepts using python • Student should be able to develop Programming logic using python • To develop basic concepts and terminology of python programming • To test and execute python programs • To be familiar with the concept of Data Structure. • To learn the systematic way of solving problem • To understand the different methods of organizing large amount of data • To efficiently implement the different data structures • To efficiently implement solutions for specific problems 		
<p>Course Outcomes:</p> <p>On completion of the course, student will be able to –</p> <ul style="list-style-type: none"> • Develop logic for problem solving • Determine the methods to create and develop Python programs by utilizing the data structures like lists, dictionaries, tuples and sets. • To be familiar about the basic constructs of programming such as data, operations, conditions, loops, functions etc. • To write python programs and develop a small application project • Design and implement Data structures and related algorithms • Understand several ways of solving the same problem. • To use well-organized data structures in solving various problems. • To differentiate the usage of various structures in problem solution. • Implementing algorithms to solve problems using appropriate data structures. 		
Course Contents:		
Chapter-1	Basics of Python Programming	Hours: 08
1.1	Introduction to python	
1.2	Features of Python,	

1.3	Identifiers, Reserved Keywords, Variables, Comments, Indentation in Python, Multiline Statements	
1.4	Input, Output and Import Functions	
1.5	Operators (Arithmetic, Comparison, Assignment, Bitwise, Logical, Membership, Identity), operator precedence	
1.6	Data Types and Flow Control (Numbers, Strings, List, Tuple, Set, Dictionary , Data type conversion , decision Making (if, for, while, nested loops, control statements, types of loops))	
1.7	Python tuples and sets Operations on tuples – Concept, operations and built-in unctions. Sets - Concept, operations and built-in functions.	
1.8	Python Dictionary(Concept (mutable),Creating and accessing values in a dictionary, Updating dictionary, delete dictionary elements, Properties of dictionary keys, built-in dictionary functions and methods	
Chapter-2		Hours: 06
Python Lists and Python Arrays		
2.1	Python Lists - concept, creating and accessing elements, updating & deleting lists, basic list operations, reverse, Indexing, slicing, built-in List functions, Functional programming tools - filter(), map(), and reduce(),Using Lists as stacks and Queues, List comprehensions	
2.2	Python Array - Concept of array- Array Representation, creating python array , accessing array elements.	
2.3	Types of Arrays – One , Two and Multidimensional array.	
2.4	Array Operations- Traverse, Insertion, deletion, search and update	
2.5	array slicing, python list vs array	
Chapter-3		Hours: 06
Functions and Object oriented concepts		
3.1	Functions: Definitions and Uses, Function Calls, Parameters and Arguments, Variables and Parameters, Void Functions, Anonymous, Recursion, Lambda function Functional programming tools - filter(), map(), and reduce()	
3.2	Python Classes / Objects Object oriented programming and classes in Python - creating classes, instance objects, accessing members ,Data hiding (the double underscore prefix) ,Built-in class attributes ,Recursive calls to methods ,Class variables, class methods, and static methods	
Chapter-4		Hours: 04
Introduction to Data Structure, Sorting and Searching		
4.1	Concept , Need of Data Structure , Types of Data Structure	
4.2.	Algorithm analysis : definition, characteristics , Space complexity, time complexity	

4.3	Asymptotic notation (Big O(Oh), Omega Ω)	
4.4	Sorting algorithms with efficiency - Bubble sort, Insertion sort, Merge sort, Quick Sort	
4.5	Searching techniques –Linear Search, Binary search	
Chapter-5	Stacks and Queues	Hours: 12
Stack : 5.1 Introduction 5.2 Representation- Using Arrays 5.3 Operations – init(), push(), pop(), isEmpty(), isFull(). 5.4 Application - infix to postfix, infix to prefix, postfix evaluation, 5.5 Simulating recursion using stack Queue : 5.6 Introduction 5.7 Representation - - Using Arrays 5.8 Operations - init(), enqueue(), dequeue(), isEmpty(), isFull() 5.9 Types of Queue - Linear Queue, Circular Queue, Priority Queue, 5.10 Concept of doubly ended queue		
Chapter-6	Linked List	Hours: 09
6.1	Introduction to Linked List	
6.2	Implementation of Linked List – Static & Dynamic representation,	
6.3	Types of Linked List – Singly, Doubly, Circular	
6.4	Operations on Linked List - create, display, insert, delete, reverse, search, sort, concatenate & merge	
6.5	Representing stacks and queues using linked lists	
Chapter-	Trees	Hours: 09
7.1	Concept & Terminologies	
7.2	Types - Binary tree, binary search tree , expression tree	
7.3	Representation – Static and Dynamic	
7.4	Operations on BST – create, Insert, delete, search , traversals (preorder, inorder, postorder), counting leaf, non-leaf & total nodes , non recursive inorder traversal	
Chapter-8	Graph	Hours: 06
8.1	Concept & terminologies	
8.2	Graph Representation – Adjacency matrix, adjacency list, inverse Adjacency list, adjacency multi list,	

8.3 Graph Traversals – Breadth First Search and Depth First Search

Reference Books:

1. An Introduction to Computer Science using Python 3 by Jason Montoyo, Jennifer Campbell, Paul Gries, The pragmatic bookshelf-2013
2. James Payne, “Beginning Python: Using Python and Python 3.1,Wrox Publication
3. Introduction to Computer Science Using Python- Charles Dierbach, Wiley Publication Learning with Python “, Green Tea Press, 2002
4. Introduction to Problem Solving with Python by E balguruswamy,TMH publication2016 5. Beginning Programming with Python for Dummies Paperback – 2015 by John Paul Mueller
- 5.Introducing Python- Modern Computing in Simple Packages – Bill Lubanovic, O,,Reilly Publication
6. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress
7. Data Structures – Horowitz, Sahani
8. Problem-Solving in Data Structures & Algorithms Using Python by Robert Karamagi
9. Algorithms & Data Structure in Python by Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser – Wiley Publication, student edition
10. Problem Solving in Data Structure & Algorithms using Python by Hemant Jain – Second Edition

Web references :

1. www.w3schools.com
2. www.tutorialspoint.com
3. www.javatpoint.com
4. www.geeksforgeeks.com
5. www.programiz.com
6. www.theserverside.com
7. www.educba.com
8. www.sanfoundry.com
9. www.prepbytes.com
10. www.codercampus.com

<p align="center">Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. M.Sc. (Computer Applications) - Sem-I Course Code : CA-503-MJ-TH Course Title : Operating Systems</p>		
Teaching Scheme 02 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
<p>Course Objectives:</p> <ul style="list-style-type: none"> ▪ To Understand the basic concepts of operating system. ▪ To study Architecture, File systems and basic operating system commands. ▪ To understand Processes, Threads and Deadlocks ▪ To analyze memory management schemes. ▪ To understand I/O management and File systems. 		
<p>Course Outcomes:</p> <p>On completion of the course, student will be able to—</p> <ul style="list-style-type: none"> • Explain basic concepts of operating system • Describe algorithms for process, memory and disk scheduling • Apply technique for inter-process communication and Multithreading. • Implement concept of critical-section • Compare and contrast deadlock avoidance and prevention. • Use functions for file system management 		
Course Contents:		
Chapter-1	Introduction	Hours: 04
<p>1.1 Introduction to Operating Systems, Different services provided by Operating System to Users.</p> <p>1.2 Introduce the concept of Process, Process States, Process Control Block, User Interface, System Calls.</p> <p>1.3 Introduction to Linux Operating System - Features of Linux, Architecture of the Linux, Introduction to File System and Process Environment.</p>		
Chapter-2	File System	Hours: 06
<p>2.1 File Concept, File Attribute, File Operations, File Types, File Structure</p> <p>2.2 Access Methods - Sequential Access Method, Direct Access Method, Other Access Methods</p> <p>2.3 Directory overview, Single level directory, Two level directory, Tree structure directory, Acyclic graph directory, General graph directory</p>		

2.4 File System Structure and Implementation - Partitions and Mounting, Virtual File Systems 2.5 Allocation Methods - Contiguous allocation, Linked allocation, Indexed allocation 2.6 Free Space Management – Bit vector, Linked list, Grouping, Counting, Space maps		
Chapter-3	Process Scheduling and Multithreading	Hours: 06
3.1 Process Scheduling – Scheduling queues, Schedulers, context switch 3.2 Operations on Process – Process creation with program using fork(), Process termination 3.3 Interprocess Communication – Shared memory system, Message passing systems 3.4 Multithreaded Programming – Overview, Multithreading Models 3.5 Basic Concept – CPU-I/O burst cycle, CPU Scheduler, Pre-emptive Scheduling, Dispatcher 3.6 Scheduling Criteria 3.7 Scheduling Algorithms – FCFS, SJF, Priority scheduling, Round robin scheduling, Multiple queue scheduling, Multilevel feedback queue scheduling		
Chapter-4	Deadlock	Hours: 06
4.1 System Model 4.2 Deadlock Characterization – Necessary Conditions, Resource Allocation Graph 4.3 Deadlock Prevention 4.4 Deadlock Avoidance - Safe state, Resource-Allocation-Graph Algorithm, Banker’s Algorithm 4.5 Deadlock Detection 4.6 Recovery from Deadlock – Process Termination, Resource Preemption		
Chapter-5	Memory Management	Hours: 08
5.1 Introduction – Requirement of Memory management, Logical and Physical Address Space, Static and dynamic Loading, Static and Dynamic Linking 5.2 Memory Management Techniques- Contiguous memory management schemes, On-Contiguous memory management schemes 5.3 Swapping- Definition, Benefits of swapping 5.4 Memory allocation- Low Memory, High Memory 5.5 Partition Allocation- Best Fit, First Fit, Worst Fit, Next Fit 5.6 Paging- Use of Paging, 5.7 Fragmentation- External & Internal Fragmentation 5.8 Segmentation-Virtual Memory Segmentation, Simple Segmentation 5.9 Dynamic Loading, Dynamic Linking		

Reference Books:

1. Operating Systems Achyut S. Godbole Tata McGraw Hill 2nd edition.
2. Operating Systems D.M. Dhamdhare Tata McGraw Hill 2nd edition.
3. Understanding Operating System: Flynn & Mctloes 4th edition, thomson.
4. Operating Systems Design & implementation Andrew S. Tanenbam, Albert S. Woodhull Pearson.
5. Operating System Concepts (7th Ed) by silberschatz and Galvin, Wiley, 2000.
6. Operating Systems (5th Ed) – Internals and Design Principles by William Stallings, Prentice Hall, 2000.
7. Operating System Concepts (2nd Ed) by James L. Peterson, Abraham Silberschatz, Addison – Wesley.
8. Computer Organisation and Architecture (4th Ed) by William Stallings, Prentice Hall India, 1996.
9. Modern Operating Systems by Andrew S Tanenbaum, Prentice hall Inida, 1992.
10. UNIX – Sumitabha Das 11.Unix Shell Programming – Yashwant Kanetkar, BPB publications.

<p align="center"> Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. M.Sc. (Computer Applications) - Sem-I Course Code : CA-504-MJ-PR Course Title : Lab course Based on CA-501-MJ-TH & CA-503-MJ-TH </p>		
Teaching Scheme 04 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Course Objectives: <ul style="list-style-type: none"> • To understand basic database management operations. • To design E-R Model for given requirements and convert the same into database tables. • To get acquainted with SQL and PL/SQL commands 		
Course Outcomes: On completion of the course, student will be able to– <ul style="list-style-type: none"> • Create database tables in postgresQL. • Write and execute simple, nested queries. 		
Course Contents:		
Assign No.	Practical Assignment using C Programming	
1.	To create simple tables with only the primary key constraint (as a table level constraint & as a field level constraint) (include all data types),	
2.	To create more than one table, with referential integrity constraint, PK constrain, Check constraint, Unique constraint , Not null constraint	
3.	To drop a table, alter schema of a table, insert / update / delete records using tables created in previous Assignments. (use simple forms of insert / update / delete statements)	
4.	To query the tables using simple form of select statement Select <field- list> from table [where <condition> order by <field list>] Select <field-list, aggregate functions > from table [where <condition> group by <> having <> order by <>]	
5.	To query table, using set operations (union, intersect)	
6.	To Write cursor and trigger, function and stored procedure	
7.	To implement scheduling algorithms like FCFS, RR, SJF	
8.	To implement bankers algorithm	

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Teaching Scheme 04 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Course Contents:		
Assign No.	Practical Assignment	
1.	<p>BASIC PYTHON</p> <p>1) Write a Python Program to Calculate the Average of Numbers in a Given List. 2) 2) Write a program which accepts 6 integer values and prints “DUPLICATES” if any of the values entered are duplicates otherwise it prints “ALL UNIQUE”. Example: Let 5 integers are (32, 10, 45, 90, 45, 6) then output “DUPLICATES” to be printed. 3) Write a program to display following pattern.</p> <pre> 1 2 3 4 5 6 7 8 9 10 </pre>	
2.	<p>PYTHON TUPLES</p> <p>1. Reverse the following tuple aTup = (10, 20, 30, 40, 50) 2. Write a Python program to create a list of tuples with the first element as the number and second element as the square of the number. 3. Copy element 44 and 55 from the following tuple into a new tuple tuple1 = (11, 22, 33, 44, 55, 66) 4. Write a Python program to get the 5th element from front and 5th element from last of a tuple. 5. Write a Python program to find the repeated items of a tuple. 6. Write a Python program to check whether an element exists within a tuple.</p>	
3.	<p>PYTHON SETS</p> <p>1. What is the output of following</p>	

	<p>program: sets = {1, 2, 3, 4, 4}</p> <p>print(sets)</p> <ol style="list-style-type: none"> Write a Python program to do iteration over sets. Write a Python program to add and remove operation on set. Write a Python program to find maximum and the minimum value in a set.
4.	<p>PYTHON DICTIONARY</p> <ol style="list-style-type: none"> Write a Python program to combine two dictionary adding values for common keys. Sample Dictionary: d1={'a':100,'b':200,'c':300} d2={'a':300,'b':200,'d':400} Sample output: Counter({'a': 400, 'b': 400, 'd': 400, 'c': 300}) Write a Python script to generate and print a dictionary that contains a number (Between 1 and n) in the form (x, x*x). Sample Dictionary (n = 5) Expected Output : {1: 1, 2: 4, 3: 9, 4: 16, 5: 25} Write a Python program to create a dictionary from a string. Sample-String: 'W3resource' Expected output: {'3': 1, 's': 1, 'r': 2, 'u': 1, 'w': 1, 'c': 1, 'e': 2, 'o': 1}
5.	<p>PYTHON ARRAY</p> <ol style="list-style-type: none"> Write a python program to create an array of 5 integers and display the array elements. Access individual elements through indexes write a python program to get the number of occurrences of specified elements in an array Write a python program to reverse the order of the items in the array
6.	<p>PYTHON FUNCTIONS</p> <ol style="list-style-type: none"> Write a python function to sum of all the elements in a list Write a python function to calculate the factorial of a number.the function accept the number as an argument. Write a python function to check whether a number falls within a given range. Write a python function that takes a list and returns a new list with distict elements from the first list Sample list:[1, 2 , 2, 3, 3, 3, 3, 4, 5] Unique list:[1, 2, 3, 4, 5]
DATA STRUCTURE ASSIGNMENT	
7.	Searching Algorithms - Implementation of searching algorithms to search an element using:

	Linear Search, Binary Search
8.	Sorting Algorithms - Implementation of sorting algorithms: Bubble Sort, Insertion Sort , Quick Sort, Merge Sort
9.	Singly Linked List -1. Dynamic implementation of Singly Linked List to perform following operations: Create, Insert, Delete, Display, Search, Reverse 2. Create a list in the sorted order.
10.	Doubly Linked List - Dynamic implementation of Doubly circular Linked List to perform following operations: Create, Insert, Delete, Display, Search
11.	Linked List Applications - Merge two sorted lists.
12.	Stack - Static and Dynamic implementation of Stack to perform following operations: Init, Push, Pop, Isempty, Isfull
13.	Applications of Stack - 1. Implementation of an algorithm that reverses string of characters using stack and checks whether a string is a palindrome. 2. Infix to Postfix conversion. Evaluation of postfix expression
14.	Linear Queue - Static and Dynamic implementation of linear Queue to perform following operations: Init, enqueue, dequeue, IsEmpty, IsFull.
15.	Circular and Priority Queue 1. Implementation of circular queue 2. Implementation of priority queue
16.	Tree Traversals, operations etc
17.	Calculate indegree and out degree of a given graph

<p align="center">Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. M.Sc. (Computer Applications) - Sem-I Course Code : CA-510-MJ-TH Course Title : Java Programming</p>		
Teaching Scheme 02 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Course Objectives: <ul style="list-style-type: none"> To learn implementation of object-oriented concepts with Java. To understand collection classes and interfaces. To know the process of application development using Graphical User Interface (GUI) 		
Course Outcomes: On completion of the course, student will be able to– <ul style="list-style-type: none"> Identify classes, objects, class members and relationships for a given problem. Design end to end applications using object-oriented constructs. Apply collection classes for storing java objects. Use Java APIs for program development. Handle abnormal termination of a program using exception handling 		
Course Contents:		
Chapter-1	Introduction of Java	Hours: 03
1.1 A Short History of Java 1.2 Features of Java 1.3 Java Environment – Compiler, Interpreter, JVM 1.4 Structure of java program 1.5 Data types, Variables, Operators, Keywords, Naming Convention 1.6 Decision Making (if, switch), Looping (for, while) 1.7 Type Casting 1.8 Array, Types of Arrays - One Dimensional arrays - Two-Dimensional array 1.9 Accepting input using Command line arguments 1.10 Accepting input from console (Using BufferedReader and Scanner)		
Chapter-2	Classes and Objects	Hours: 04

2.1 Introduction to classes and objects 2.2 Defining Your Own Classes 2.3 Access Specifiers (public, protected, private, default) 2.4 Array of Objects 2.5 Constructor, types of constructor (default and parameterized) , Overloading Constructors and use of 'this' Keyword 2.6 static block, static fields and methods 2.7 Predefined class – Object class methods (equals (), toString(), hashCode(), getClass()) 2.8 Garbage Collection (finalize() Method)		
Chapter-3	Inheritance, Interface and Package	Hours: 08
Inheritance 3.1 Inheritance Basics (extends Keyword) and Types of Inheritance 3.2 Superclass, Subclass and use of super Keyword 3.3 Method Overriding and runtime polymorphism 3.4 Use of final keyword related to variable, method and class 3.5 Use of abstract class and abstract methods Interface 3.6 Defining and Implementing Interfaces 3.7 Runtime polymorphism using interface Packages 3.8 Creating, Accessing and using Packages		
Chapter-4	Collection, Exception Handling and I/O	Hours: 08
Collections 4.1 Wrapper Classes 4.2 Introduction to the Collection framework 4.3 List – ArrayList, LinkedList and Vector 4.4 Set - HashSet, TreeSet, and LinkedHashSet 4.5 Map – HashTable ,HashMap, LinkedHashMap, TreeMap 4.6 Interfaces such as Iterators, ListIterators, Enumerations Exception Handling 4.7 Exception class, Checked and Unchecked exception 4.8 Catching exception and exception handling – try, catch, finally, throw and throws, multiple catch block		

4.9 Creating user defined exception I/O 4.10 String class(basic methods), String Buffer class 4.11 File class 4.12 DataInputStream and DataOutputStream class		
Chapter-5	Swing	Hours: 07
5.1 What is Swing? 5.2 The MVC Architecture and Swing 5.3 Layout Manager and Layouts, The JComponent class 5.4 Components – JLabel, JButton, JText, JTextArea, JCheckBox, JRadioButton, JList, JComboBox, JMenu and JPopupMenu Class, JMenuItem 5.5 Dialogs (Message, confirmation, input), JFileChooser 5.6 Event Handling: Event sources, Listeners – ActionListener, ItemListener 5.7 Mouse and Keyboard Event Handling, Adapters – MouseAdapter, KeyAdapter		
Reference Books: 1) Core Java Volume I - Fundamentals By Cay S. Horstmann, 11th Edition, Prentice Hall, ISBN 978-0-13-516630-7 2) The Complete Reference By Herbert Schildt, 11th Edition, McGraw Hill Education, ISBN 978-260-44023-2 3) Java Beginners Guide By Herbert Schildt, 8 th Edition, McGraw-Hill Education ISBN 978-1- 260-44021-8 4) Core Java Volume II – Fundamentals By Cay S. Horstmann, 11th Edition, Prentice Hall, ISBN 978-013-516631-4 5) Java 2 Programming Black Book By Steven Holzner, DreamTech Press, ISBN 978-93- 5119- 953-4 E-books: 1) The Complete Reference By Herbert Schildt https://gfgc.kar.nic.in/sirmv-science/GenericDocHandler/138-a2973dc6-c024-4d81-be6d-5c3344f232ce.pdf 2) Java 2 Programming Black Book By Steven Holzner https://idoc.pub/documents/java-2-black-book-steven-holzner-vyly2rmq9v4m		

Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous)
F.Y. M.Sc. (Computer Applications) - Sem-I
Course Code : CA-511-MJ-PR

Course Title : Lab Course based on CA-510-MJ-TH

Teaching Scheme 04 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
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Course Contents:

Assign No.	Practical Assignment
1	<p>Introduction To JAVA</p> <ol style="list-style-type: none"> 1. Write a Java program to accept a number from user and generate multiplication table of a number. Accept number using Buffered Reader class. 2. Write a Java Program to Reverse a Number. Accept number using command line argument. 3. Write a Java program to print the sum of elements of the array. Also display array elements in ascending order. 4. Write a Java program to print the factors of a given number. (Use Scanner class). 5. Write a Java program to accept a number from user and print all prime numbers up to that number (Use Buffered Reader class). 6. Write a Java Program to Display Armstrong Numbers Between range. Accept range from user. 7. Write java program to check whether number is Perfect or not. 8. Write Java program to find multiplication of two matrix. Accept matrix from user.
2	<p>Classes and Objects</p> <ol style="list-style-type: none"> 1. Define a class MyNumber having one private integer data member. Write a default constructor initialize it to 0 and another constructor to initialize it to a value. Write methods isNegative, isPositive, isOdd, iseven. Use command line argument to pass a value to the object and perform the above operations. 2. Write a program to create class Account (accno, accname, balance). Create an array of 'n' Account objects. Define static method "sortAccount" which sorts the array on the basis of balance. Display account details in sorted order. 3. Write a program which define class Product with data member as id, name and price. Store the information of 5 products and display the name of product having minimum

	<p>price (Use array of object).</p> <ol style="list-style-type: none"> Write a program which define class Employee with data member as id, name and salary Store the information of 'n' employees and display the name of employee having maximum salary (Use array of object). Define a class student having rollno, name and percentage. Define Default and parameterized constructor. Accept the 5 student details and display it. (Use this keyword). Write a program create class as MyDate with dd,mm,yy as data members. Write parameterized constructor. Display the date in dd-mm-yy format. (Use this keyword). Define a class Student with attributes rollno and name. Define default and parameterized constructor. Keep the count of Objects created. Create objects using parameterized constructor and display the object count after each object is created.
3	<p>Inheritance, Interface and Package</p> <p>Inheritance</p> <ol style="list-style-type: none"> Define a “Point” class having members – x,y(coordinates). Define default constructor and parameterized constructors. Define two subclasses “ColorPoint” with member as color and subclass “Point3D” with member as z (coordinate). Write display method to display the details of different types of Points Define a class Employee having members – id, name, salary. Define default constructor. Create a subclass called Manager with private member bonus. Define methods accept and display in both the classes. Create “n” objects of the Managerclass and display the details of the worker having the maximum total salary (salary + bonus). Write a Java program to create a super class Employee (members – name, salary). Derive a sub-class as Developer (member – projectname). Derive a sub-class Programmer (member – proglanguage) from Developer. Create object of Programmer and display the details of it. Implement this multilevel inheritance with appropriate constructor and methods. Write a Java program to create a super class Vehicle having members Company and Price. Derive two different classes LightMotorVehicle (mileage) and HeavyMotorVehicle (capacity_in_tons). Accept the information for “n” vehicles and display the information in appropriate form. While taking data, ask user about the type of vehicle first Define an abstract class Staff with members name and address. Define two sub- classes of

	<p>this class – FullTimeStaff (members - department, salary, hra - 8% of salary, da – 5% of salary) and PartTimeStaff (members - number-of-hours, rate-per- hour). Define appropriate constructors. Write abstract method as calculateSalary() in Staff class. Implement this method in subclasses. Create n objects which could be of either FullTimeStaff or PartTimeStaff class by asking the user ‘s choice. Display details of all FullTimeStaff objects and all PartTimeStaff objects along with their salary.</p> <p>6. Create an abstract class Shape with methods area & volume. Derive a class Cylinder (radius, height). Calculate area and volume.</p> <p>Interface</p> <p>1. Define an interface “Operation” which has methods area (), volume (). Define a constant PI having a value 3.142. Create a class circle (member – radius), cylinder (members – radius, height) which implements this interface. Calculate and display the area and volume.</p> <p>2. Define an Interface Shape with abstract method area (). Write a java program to calculate an area of Circle and Sphere. (Use final keyword).</p> <p>Packages</p> <p>1. Create a package named “Series” having three different classes to print series: a. Fibonacci series b. Cube of numbers c. Square of numbers Write a java program to generate “n” terms of the above series. Accept n from user.</p> <p>2. Create a package “utility”. Define a class Capital String under “utility” package which will contain a method to return String with first letter capital. Create a Person class (members – name, city) outside the package. Display the person’s name with first letter as capital by making use of Capital String.</p> <p>3. Write a package game which will have 2 classes Indoor & Outdoor. Use a function display () to generate the list of players for the specific game. Use default & parameterized constructor</p>
4	<p>Collection, Exception Handling and I/O</p> <p>Collections</p> <p>1. Construct a linked List containing names of colours: red, blue, yellow and orange. Then extend the program to do the following: i. Display the contents of the List using an Iterator ii. Display the contents of the List in reverse order using a ListIterator iii. Create another list containing pink and green. Insert the elements of this list between blue and yellow</p>

2. Write a program to accept 'n' integers from the user & store them in an Array List collection. Display the elements of Array List.
3. Accept 'n' integers from the user and store them in a collection. Display them in the sorted order. The collection should not accept duplicate elements. (Use a suitable collection). Search for a particular element using predefined search method in the Collection framework.
4. Create a Hash table containing Employee name and Salary. Display the details of the hash table.
5. Create a java application to store city names and their STD codes using an appropriate collection. i. Add a new city and its code (No duplicates) ii. Remove a city from the collection iii. Search for a cityname and display the code

Exception Handling

1. Write a java program to accept a number from the user, if number is zero then throw user defined exception —Number is 0, otherwise check whether no is prime or not.
2. Write a java program to accept Doctor Name from the user and check whether it is valid or not. (It should not contain digits and special symbol) If it is not valid then throw user defined Exception - Name is Invalid -- otherwise display it
3. Define a class MyDate (day, month, year) with methods to accept and display a MyDate object. Accept date as dd, mm, yyyy. Throw user defined exception “InvalidDateException” if the date is invalid. Examples of invalid dates : 12 15 2015, 31 6 1990, 29 2 2001.
4. Write a class Driver with attributes license_no, name, address and age. Initialize values through the parameterized constructor. If age of Driver is less than 18 then user-defined exception should be generated —Age is below 18 years –
5. Write a class Student with attributes roll no, name, age and course. Initialize values through parameterized constructor. If age of student is not in between 15 and 21 then generate user-defined exception —Age Not Within The Range. If name contains numbers or special symbols raise exception —Name not valid

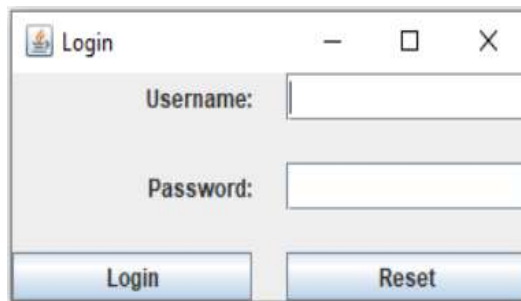
I/O

1. Write a java program that displays the number of characters, lines and words of a file.
2. Write a java program to accept details of n customers (c_id, cname, address, mobile_no) from user and store it in a file (Use DataOutputStream class). Display the details of customers by reading it from file. (Use DataInputStream class).

3. Write a program to read the contents of “abc.txt” file. Display the contents of file in uppercase as output

5**Swing**

1. Write a java program to design a following GUI. Use appropriate Layout and Components.



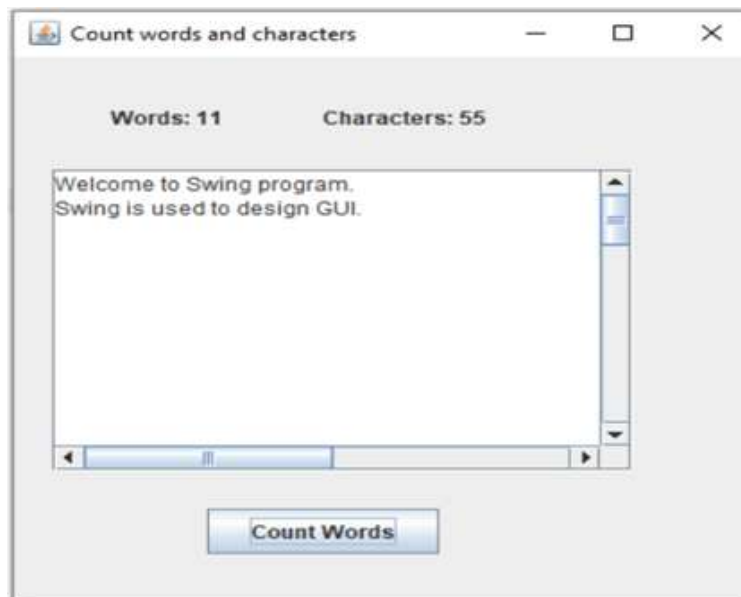
2. Write a java program to design a following GUI. Use appropriate Layout and Components

Vaccination Details	
Name:	<input style="width: 100%;" type="text"/>
Dose	Vaccine
<input type="checkbox"/> 1 st Dose	<input type="radio"/> Covishield
<input type="checkbox"/> 2 nd Dose	<input type="radio"/> Covaxin
	<input type="radio"/> Sputnik V
<div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> Name : _____ 1st Dose: _____ 2nd Dose: _____ Vaccine: _____ </div>	

3. Write a java program to implement a simple arithmetic calculator. Perform appropriate validations
4. Write a Program to design following GUI by using swing component JComboBox. On click of show button display the selected language on JLabel.



5. Write a program to design following GUI using JTextArea. Write a code to display number of words and characters of text in JLabel. Use JScrollPane to get scrollbars for JTextArea.



<p align="center">Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. M.Sc. (Computer Applications) - Sem-I Course Code : CA-512-MJ-TH Course Title : Cloud Computing</p>		
Teaching Scheme 02 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Course Objectives: <ul style="list-style-type: none"> • To understand the principles and paradigm of Cloud Computing • To appreciate the role of Virtualization Technologies • Ability to design and deploy Cloud Infrastructure • Understand Advanced Techniques and cloud security issues and solutions 		
Course Outcomes: On completion of the course, student will be able to– <ul style="list-style-type: none"> • Understand the different Cloud Computing environment • Analyze virtualization technology and install virtualization software • Develop and deploy applications on Cloud • Use advance techniques and apply security in Cloud Computing 		
Course Contents:		
Chapter-1	Introduction to Cloud Computing	Hours: 08
Overview, Layers and Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Multitenant Technology. Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology. Cloud Deployment Models.		
Chapter-2	Virtualization	Hours: 06
Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Provisioning in the Cloud Context		
Chapter-3	Programming, Environments and Applications	Hours: 08
Features of Cloud and Grid Platforms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments, Applications: Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud		

Applications.		
Chapter-4	Advanced Techniques and Security in The Cloud	Hours: 08
<p>Future Trends in cloud Computing, Mobile Cloud, Comet Cloud. Containers, Docker, and Kubernetes, Introduction to DevOps. Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security - Identity Management and Access Control, Disaster Recovery in Clouds.</p>		
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Brian J.S. Chee and Curtis Franklin, “Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center”, CRC Press, ISBN:9781439806128 2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing”, McGraw Hill Education, ISBN-13:978-1-25-902995-0 3. Dr. Kris Jamsa, “Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more”, Wiley Publications, ISBN: 978-0-470-97389-9 4.https://sjceodisha.in/wp-content/uploads/2019/09/CLOUD-COMPUTING-Principles-andParadigms.pdf 5.https://arpitapatel.files.wordpress.com/2014/10/cloud-computing-bible1.pdf 6.Cloud Computing https://onlinecourses.nptel.ac.in/noc21_cs14/preview? 		

Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous)
F.Y. M.Sc. (Computer Applications) - Sem-I
Course Code : CA-513-MJ-PR
Course Title : Lab Course on CA-512-MJ-TH

Teaching Scheme 04 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
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Course Objectives:

- To understand the principles and paradigm of Cloud Computing
- To appreciate the role of Virtualization Technologies
- Ability to design and deploy Cloud Infrastructure
- Understand Advanced Techniques and cloud security issues and solutions

Course Outcomes:

On completion of the course, student will be able to–

- Understand the different Cloud Computing environment
- Analyze virtualization technology and install virtualization software
- Develop and deploy applications on Cloud
- Use advance techniques and apply security in Cloud Computing

Course Contents:

Assign No.	Practical Assignment
1.	Working and Implementation of Infrastructure as a service
2.	Working and Implementation of Software as a service
3.	Working and Implementation of Platform as a services
4.	Practical Implementation of Storage as a Service
5.	Installation and Configuration of Virtualization Using KVM
6.	Working of Google drive to make spreadsheet and notes.
7.	Write a program for web feed.
8.	Implementation of Virtualization in cloud computing to learn Virtualization Basics, Benefits of Virtualization in Cloud using Open Source Operating System.
9.	Execute the step to Demonstrate and implementation of cloud on single sign on.
10.	Installation and configuration of cloud Hadoop and demonstrate simple query
11.	Installing and Developing Application Using Google App Engine
12.	Case study on Amazon EC2/Microsoft Azure/Google Cloud Platform
13.	Design an Assignment based on working with Manjrasoft Aneka Software.
14.	Design and Develop Custom Application (Mini Project) using Salesforce Cloud

<p align="center">Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. M.Sc. (Computer Applications) - Sem-I Course : CA-531-RM-TH Course Title : Research Methodology</p>		
Teaching Scheme 04 Hours/Week	No. of Credits 04	Examination Scheme CIE : 30 Marks SEE : 70 Marks
<p>Course Objectives:</p> <ul style="list-style-type: none"> • To investigate some existing situation or problems, explore and analyze it. • To test hypothesis or theory. • To identify patterns or trends related to the problem. • To discover the truth and fact. • To study the process of quantitative and qualitative data collection. 		
<p>Course Outcomes:</p> <p>On completion of the course, student will be able to—</p> <ul style="list-style-type: none"> • Understand and comprehend the basics in research methodology. • Formulate research aims and objectives • Organize and conduct research (advanced project) in a more appropriate manner. • Develop and practice the skills necessary to conduct, review, and publish research. • Write a research report and thesis. 		
Course Contents:		
Chapter-1	Introduction to Research	Hours: 03
<ul style="list-style-type: none"> • Definition of Research • Characteristics of Research • Objectives of Research • Nature of Research • Importance of Research • Relevance of Research • Restrictions in Research • Research Process • Difference between Research Method and Research Process 		

Chapter-2	Scientific Method	Hours: 08
<ul style="list-style-type: none"> • Introduction • Method to Eliminate Uncertainty • Scientific Method • Steps in Scientific Method • Distinction between Scientific Method & Non-Scientific Method • Difficulties encountered in Scientific Method Research • Inductive v/s Deductive Logic 		
Chapter-3	Types and Methods of Research	Hours: 10
<ul style="list-style-type: none"> • Introduction • Pure and Applied Research • Exploratory or Formulative Research • Descriptive Research • Diagnostic Research • Evaluation Studies • Action Research • Experimental Research • Analytical Study or Statistical Method • Historical Research • Surveys • Case Study • Field Studies • Research ethics • Plagiarism Tools 		
Chapter-4	Literature Survey and Formulation of Research Problem	Hours: 10
<ul style="list-style-type: none"> • Purpose of Literature Review • Literature Resources • Internet and literature review • The Research Problem • The Importance of Formulating a Research Problem • Steps in Formulation of Research Problem 		

<ul style="list-style-type: none"> • Formulation of Objectives • Establishing Operational Definitions 		
Chapter-5	Hypothesis and Sampling	Hours: 10
<ul style="list-style-type: none"> • What is Hypothesis? • Nature & Characteristics of Hypothesis • Significance of Hypothesis • Types of Hypothesis • Sources of Hypothesis • Characteristics of Good Hypothesis • What is Sampling? • Aims of Sampling • Characteristics of Good Sample • Basis of Sampling • Advantages of Sampling • Limitations of Sampling • Sampling Techniques or Methods • Probability Sampling Methods • Non-Probability Sampling Methods • Sample Design and Choice of Sampling Technique 		
Chapter-6	Data Collection Techniques	Hours: 06
<ul style="list-style-type: none"> • Introduction • Distinction between Primary Data and Secondary Data • Data Collection Procedure for Primary Data <ul style="list-style-type: none"> ○ Methods of Data Collection –Observation, Questionnaire, Interview, Focus group discussion 		
Chapter-7	Quantitative and Qualitative Data Analysis	Hours: 10
<ul style="list-style-type: none"> • What is Quantitative Data? • Types of Quantitative Data • Data Coding <ul style="list-style-type: none"> ○ Visual Aids for Quantitative Data Analysis-Tables, Bar Charts, Scatter graph, Line Graph etc. • Use of Statistics for Quantitative Data Analysis 		

<ul style="list-style-type: none"> ○ Measures of Central Tendency-Mean, Median, Mode ○ Measures of Distribution-Range, Fractiles, Standard Deviation ○ Finding Relationships in the data-Chi-Square, t-test, ANNOVA(f-test),Z-test ● What is Qualitative Data Analysis? ● Analyzing textual and non-textual qualitative data ● Grounded Theory ● Computer-aided qualitative Analysis ● Quantitative and Qualitative Data Analysis Tools 		
Chapter-8	Presentation of the Research	Hours: 03
<ul style="list-style-type: none"> ● Writing up the research ● Paper presentation in Conference/Journal/Symposium etc ● Poster presentation in exhibition ● Software demonstration ● Case Study -Preparation of Sample Research Paper 		
Reference Books: <ol style="list-style-type: none"> 1. Researching Information Systems and Computing by Briony J Oates, SAGE SOUTH ASIA EDITION 2. The Research Methods Knowledge Base, by William M. K. Trochim, James P. Donnelly 3. Introducing Research Methodology: A Beginner's Guide to Doing a Research Project , by Uwe Flick 		

SEMESTER-II

<p align="center">Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. M.Sc. (Computer Applications) - Sem-II Course Code: CA-551-MJ-TH Course Title : Web Technologies</p>		
Teaching Scheme 04 Hours/Week	No. of Credits 04	Examination Scheme CIE : 30 Marks SEE : 70 Marks
Prerequisites: <ul style="list-style-type: none"> • Awareness of HTML/CSS • Basic knowledge of web design principles • Familiarity with Server-Side Concepts • Knowledge of XML and Basic JavaScript knowledge 		
Course Objectives: <ul style="list-style-type: none"> • To understand and learn HTML and CSS • To learn PHP programming and database connectivity • To understand and learn AJAX and XML 		
Course Outcomes: <ul style="list-style-type: none"> • On completion of the course, student will be able to– • Develop web based application using suitable client side and server side web technologies. • Build Dynamic web site using server side PHP Programming and Database connectivity. • Build applications using AJAX and XML 		
Course Contents:		
Chapter-1	Chapter Name: Introduction to Web Technology, HTML and CSS	Hours: 06
<ul style="list-style-type: none"> • Introduction to Web Technologies (Define terms : web page, web site, Web Browser, Web Server, URL, www) • How the Website Works? • Software to create your website (Traditional method and best website builder) • What makes good website? • Client-Server and its Communication • Internet-Basic, Internet Protocols (HTTP,FTP,IP) • Overview of popular frameworks (React, Angular, Vue.js) • Introduction to cloud services like AWS, Azure, or Netlify. • Introduction to HTML (different tags) • Introduction to CSS, CSS types. 		
Chapter-2	Chapter Name: Introduction to PHP	Hours: 08
<ul style="list-style-type: none"> • Introduction to PHP • PHP - Lexical structure, Language basics. • Echo, Print Statement • Variables, Data Types • Operators • Control Structures • Strings 		

Chapter-3	Chapter Name: Function and Array in PHP	Hours: 08
<ul style="list-style-type: none"> Defining and calling a function Default parameters, Variable parameters, Missing parameters Variable function, Anonymous function Arrow Functions: Comparison between traditional anonymous functions and arrow functions; implications on this Higher-Order Functions: Concept of functions that take other functions as parameters Indexed Vs Associative arrays, Identifying elements of an array Storing data in arrays, Multidimensional arrays Extracting multiple values, Traversing arrays, Sorting Using arrays 		
Chapter-4	Chapter Name: Object Oriented Programming	Hours: 06
<ul style="list-style-type: none"> Classes Objects Introspection Serialization Inheritance Interfaces Encapsulation 		
Chapter-5	Chapter Name: Web Techniques	Hours: 08
<ul style="list-style-type: none"> Variables Server information Processing forms Setting response headers Maintaining state TLS (Transport Layer Security) OAuth and OpenID Connect 		
Chapter-6	Chapter Name: Databases	Hours: 10
<ul style="list-style-type: none"> Using PHP to access a database Relational databases and SQL PEAR DB basics Advanced database techniques Real-Time Applications with WebSockets : Develop a real-time web application (such as a chat app or collaborative tool) using WebSockets for live updates and interactions. 		
Chapter-7	Chapter Name: JavaScript	Hours: 06
<ul style="list-style-type: none"> Concept of script, Types of Scripts : client side scripting language and server side scripting language, Introduction to JavaScript Data types, Variables, comments in JavaScript , operators, control structures. Functions Event Handling in Java Scripts (Event types, dialogue boxes) Concept of array, how to use it in JavaScript ,JavaScript array method, types of an Array Concept of String DOM concept in JavaScript - Methods of document object, How to access field value by document object. 		
Chapter-8	Chapter Name: XML and Ajax	Hours: 08

- What is XML?
- XML document Structure
- PHP and XML
- XML parser
- The document object model
- The simple XML extension
- Changing a value with simple XML
- Understanding java scripts for AJAX
- AJAX web application model
- AJAX –PHP framework
- Performing AJAX validation
- Handling XML data using PHP and AJAX
- Connecting database using PHP and AJAX

Reference Books:

1. Steven Holzner, "HTML Black Book", Dremtech press.
2. Web Technologies, Black Book, Dreamtech Press
3. Web Applications : Concepts and Real World Design, Knuckles, Wiley-India
4. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson
5. Programming PHP By Rasmus Lerdorf and Kevin Tatroe, O'Reilly publication
6. Beginning PHP 5 , Wrox publication
7. PHP web services, Wrox publication
8. AJAX Black Book, Kogent solution
9. Mastering PHP , BPB Publication
10. PHP cookbook, O'Reilly publication
11. PHP for Beginners, SPD publication 8. Programming the World Wide Web , Robert W Sebesta(3rd Edition)

Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. M.Sc. (Computer Application) - Sem-II Course Code : CA-552-MJ-TH Course Title :: Introduction to Data Science			
Teaching Scheme 04 Hours/Week	No. of Credits 04		Examination Scheme CIE : 30 Marks SEE : 70 Marks
Prerequisites: <ul style="list-style-type: none">Mathematical foundation and concepts of statistics			
Course Objectives: <ul style="list-style-type: none">Provide students with knowledge and skills for data-intensive problem solving and scientific discoveryBe prepared with a varied range of expertise in different aspects of data science such as data collection, visualization, processing and modeling of large data sets.Acquire good understanding of both the theory and application of applied statistics and computer science based existing data science models to analyze huge data sets originating from diversified application areas.Be better trained professionals to cater the growing demand for data scientists in industry.			
Course Outcomes: On completion of the course, student will be able to– <ul style="list-style-type: none">Perform Exploratory Data AnalysisObtain, clean/process, and transform data.Detects and diagnoses common data issues, such as missing values, special values,outliers, inconsistencies, and localization.Demonstrate proficiency with statistical analysis of data.Present results using data visualization techniques.Prepare data for use with a variety of statistical methods and models and recognize how the quality of the data and the means of data collection may affect conclusions.			
Course Contents:			
Chapter-1	Chapter Name: Introduction to Data Science	Hours: 10	
<ul style="list-style-type: none">Introduction to data science, The 3 V’s: Volume, Velocity, Variety,Applications of Data ScienceThe Data Science LifecycleEssential Tools used in data science projectsTypes of Data<ul style="list-style-type: none">Structured, semi-structured, Unstructured Data,Problems with unstructured dataData sources: Open Data, Social Media Data, Multimodal Data, Standard datasetsData Formats<ul style="list-style-type: none">Integers, Floats, Text Data, Text Files, Dense Numerical Arrays, Compressed or Archived Data, CSV Files, JSON Files, XML Files, HTML Files , Tar Files, GZip Files, Zip Files,Image Files: Rasterized, Vectorized, and/or Compressed			
Chapter-2	Chapter Name: Statistical Data Analysis	Hours: 18	

- Role of statistics in data science
- Descriptive statistics
 - Measuring the Frequency
 - Measuring the Central Tendency: Mean, Median, and Mode
 - Measuring the Dispersion: Range, Standard deviation, Variance, InterquartileRange
- Inferential statistics
 - Hypothesis testing, Multiple hypothesis testing, Parameter Estimation methods
- Measuring Data Similarity and Dissimilarity
 - Data Matrix versus Dissimilarity Matrix, Proximity Measures for Nominal
 - Attributes, Proximity Measures for Binary Attributes, Dissimilarity of
 - NumericData: Euclidean, Manhattan, and Minkowski distances,
 - Proximity Measures for Ordinal Attributes
- Concept of Outlier, types of outliers, outlier detection methods: **Z-Score, Local Outlier Factor (LOF), Isolation Forest, DBSCAN**

Chapter-3	Chapter Name: Data Preprocessing	Hours: 16
<ul style="list-style-type: none"> ● Data Objects and Attribute Types: What Is an Attribute?, Nominal , Binary, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes ● Data Quality: Why Preprocess the Data?Data munging/wrangling operations ● Cleaning Data - Missing Values, Noisy Data (Duplicate Entries, Multiple Entries for a Single Entity, Missing Entries, NULLs, Huge Outliers, Out-of- Date Data, Artificial Entries, Irregular Spacings, Formatting Issues - Irregular between Different Tables/Columns, Extra Whitespace, Irregular Capitalization,Inconsistent Delimiters, Irregular NULL Format, Invalid Characters, Incompatible Datetimes) ● Data Transformation – Rescaling, Normalizing, Binarizing, Standardizing,Label and OneHot Encoding ● Data reduction ● Data discretization 		
Chapter-4	Chapter Name:Data Visualization	Hours: 16
<ul style="list-style-type: none"> ● Introduction to Exploratory Data Analysis ● Data visualization and visual encoding ● Data visualization libraries ● Basic data visualization tools <ul style="list-style-type: none"> ○ Histograms, Bar charts/graphs, Scatter plots, Line charts, Area plots, Pie charts,Donut charts, Pair plot ● Specialized data visualization tools <ul style="list-style-type: none"> ○ Box Plots, Bubble plots, Heat map, Dendrogram, Venn diagram, Treemap, 3d Scatter plots ○ Advanced data visualization tools Word cloud Visualization of geospatial data ○ Data Visualization types 		
Reference Books: <ul style="list-style-type: none"> ● Data Science Fundamentals and Practical Approaches, Gypsy Nandi, Rupam Sharma, BPB Publications, 2020. ● The Data Science Handbook, Field Cady, John Wiley & Sons, Inc, 2017 ● Data Mining Concepts and Techniques, Third Edition, Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann, 2012. 		

- A Hands-On Introduction to Data Science, Chirag Shah, University of Washington Cambridge University Press
- <https://dataheroes.ai/>

<p align="center">Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. M.Sc. (Computer Application) - Sem-II Course Code: CA-553-MJ-TH Course Title : Computer Networks</p>		
Teaching Scheme 02 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Prerequisites: Knowledge of basics of computer		
Course Objectives: <ul style="list-style-type: none"> ● <i>To understand the fundamental concepts of networking standards, protocols and technologies.</i> ● <i>To study different techniques for framing, error control, flow control and routing.</i> ● <i>To learn the role of protocols at various layers in the protocol stacks.</i> ● <i>To develop an understanding of modern network architectures from a design and performance perspective</i> 		
Course Outcomes: After successful completion of this course, learner will be able to- <ul style="list-style-type: none"> ● <i>Analyze the requirements for a given organization and select appropriate network architecture, topologies, transmission mediums and technologies.</i> ● <i>Analyze data flow between TCP/IP model using Application, Transport and Network Layer Protocols.</i> ● <i>Illustrate applications of Computer Network.</i> ● <i>Compare and contrast different routing and switching algorithms.</i> 		
Course Contents:		
Chapter-1	Chapter Name: Introduction to Data Communications Computer Networks	Hours: 06
<ul style="list-style-type: none"> ● Data communications, <ul style="list-style-type: none"> ○ Characteristics of Data Communication ○ Components of Data communication ● Data Representation – Text, Numbers, Images, Audio, Video ● Types of Data flow – Simplex, Half Duplex, Full Duplex ● Computer Networks applications –Business Application, Home Application, Mobile User ● Broadcast and point-to-point networks ● Network Topologies - Bus, Star, Ring, Mesh ● Network Types- LAN, MAN, WAN, internetworks ● Protocols and standards – Definition of a Protocol, Protocol standards: De facto and De jure ● OSI Model – layered architecture, peer-to-peer processes, ● TCP/IP Model – layers and Protocol Suite ● Addressing - Physical, Logical, Port addresses, Specific addresses 		
Chapter-2	Chapter Name: Physical Layer	Hours: 06
<ul style="list-style-type: none"> ● Analog and Digital data, Analog and Digital signals, Digital Signals-Bit rate, Bit length ● Baseband Transmission, Broadband Transmission ● Transmission Impairments– Attenuation, Distortion and Noise ● Data Rate Limits– Noiseless channel: Nyquist’s bit rate, noisy channel : Shannon's Law ● Performance of the Network Bandwidth, Throughput, Latency (Delay), Bandwidth – Delay Product, Jitters ● Line Coding Characteristics, Line Coding Schemes–Unipolar -NRZ, Polar-NRZ-I, NRZ-L, RZ, , Problems 		

<ul style="list-style-type: none"> • Transmission Modes, Parallel Transmission and Serial Transmission– Asynchronous and Synchronous • Multiplexing- FDM and TDM • Switching-Circuit Switching, Message Switching 		
Chapter-3	Chapter Name:Data Link Layer	Hours: 05
<ul style="list-style-type: none"> • Framing – Concept, Methods – Character Count, Flag bytes with Byte Stuffing,Starting & ending Flags with Bit Stuffing • Error detection code – Hamming Distance, CRC • Elementary data link protocols - Simplex stop & wait protocol, Simplex protocol for noisy channel, • Sliding Window Protocols – 1-bit sliding window protocols, • Pipelining – Go-Back N and Selective Repeat • Random Access Protocols - ALOHA– pure and slotted, CSMA-1- persistent, p-persistent and nonpersistent CSMA/CD,CSMA/CA • Controlled Access - Reservation, Polling and Token Passing 		
Chapter-4	Chapter Name:Network Layer	Hours: 05
<ul style="list-style-type: none"> • IPv4 addresses: Address space, Notation, Classful addressing, Classless addressing, • IPv4: Datagram, Fragmentation, checksum, options • IPv6 addresses: Structure, address space • IPv6:packet format, Extension headers 		
Chapter-5	Chapter Name:Transport and Application Layer	Hours: 08
<ul style="list-style-type: none"> • Process-to-Process Delivery, Multiplexing and Demultiplexing • User Datagram Protocol (UDP) - Datagram Format, Checksum, UDP operations, Use of • UDP 6.3. Transmission Control Protocol (TCP) - TCP Services – Process to-Process • Communication, Stream Delivery Service, Sending and Receiving Buffers, Segments, Full – Duplex Communication, Connection oriented service, Reliable service • TCP Features – Numbering System, Byte Number, Sequence Number, Acknowledgement Number, Flow Control, Error Control, Congestion Control • TCP Segment Format • TCP Vs UDP • Domain Name System (DNS) - Distribution of Name Space, DNS in the Internet • E-MAIL - Architecture, User Agent, Message Transfer Agent - SMTP, Web Based Mail • HTTP - HTTP Transaction 		
Reference Books: <ol style="list-style-type: none"> 1. Data Communications and Networking by Behrouz Forouzan, Fifth Edition, ISBN 978-0-07-337622-6 McGraw Hill. 2. Computer Networks, ANDREW S. Tanenbaum, Fifth Edition, ISBN-13: 978-0-13- 212695-3, Pearson 		

<p align="center">Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. M.Sc. (Computer Applications) - Sem-II Course Code: CA-554-MJ-PR Course Title : Lab Course based on CA-551-MJ-TH</p>		
Teaching Scheme 04 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Course Contents:		
Practical Assignment : Set I (HTML and CSS)		
<ul style="list-style-type: none"> • Write an HTML program to display the message “Exploring the Future of Web Development”. • Write an HTML program to display the word “Cascading Style Sheets” (CSS) in sizes h1 to h6, with each heading having a different background color. • Write an HTML script to display the phrase "Learning Web Development" with different styles: bold for "Learning", italic for "Web", and underline with a strike for "Development". Apply separate effects on different words. • Write an HTML script that uses an image of your favorite vacation destination as a background and displays a welcoming message on top of it. • Create an HTML page with the following specifications: a. Title should be about “My Favorite Vacation Spot”. b. Place the name of the vacation spot at the top of the page in large text and in blue color. c. Add names and images (as links) of activities available at your vacation spot, each styled in different colors and fonts. d. After clicking on the images, it should display fun facts about each activity. • Write HTML code to display the following output: <ul style="list-style-type: none"> ▪ Fruits ▪ Apples ▪ Bananas ▪ Vegetables ▪ Carrots ▪ Spinach • Write HTML code to display a list of different student clubs available at your college using both ordered and unordered lists, and categorize them by type (e.g., Academic, Cultural, Sports). • Design a table that shows the monthly schedule of events for a specific club or organization within your college, including details such as event name, date, time, and location. • Divide a screen in four equal part . Each frame shows : list of different activities conducted by your department. • Design a admission form. which should contains : text box, multiline text box, a table which shows your academic record, radio button, check box, submit button etc. • Write inline CSS program to display with background color pink with red colored text. • Write internal CSS program to display with background color black with white colored text. • Write external CSS program to display with background color sky blue with blue colored text. • Write CSS using HTML which uses of text decoration, border, padding and margin. • Write CSS using HTML which displays following output: 		

Positioning in CSS : Static, Relative, Fixed and Absolute

This div element has position: static;

This div element has position: relative;

- Write CSS using HTML which displays following output
- List Property in CSS

Unordered lists

- o Coffee
- o Tea
- o Milk
- ☐ Apple
- ☐ Mango
- ☐ Banana
- ☐ Watermelon

Ordered list

- I. Rose
- II. Jasmine
- III. Marigold
- a. Sunflower
- b. Tulip
- c. Lily
- d. Tuberose

- Write CSS using HTML which displays following output

Add a border to a table:

Firstname	Lastname
Ram	Joshi
Sham	Kulkarni

- Write CSS using HTML which displays following output : use image property



- Write CSS using HTML which displays following output

The display Property

Display : none

Display : inline

Web Technology !

Display : block

Web Technology !

Display : inline-block

Web Technology !

- Write CSS using HTML which displays following output : Use of Id and classes in CSS

Web Technology !

This paragraph is not affected by the style.

Web Technology !

This paragraph is affected by the style.

- Write CSS using HTML which displays following output : Use of <div> and in CSS
The < span > element ! : I have a Red rose and dark Chocolate.

The < div >

Computer Application !

Practical Assignment : Set II (Introduction to PHP)

- Write a PHP script for the following: a) Design a form to accept the details of 5 different items such as Item code, Item Name, Quantity, Sold, and Rate. b) Display a consolidated bill in tabular format that includes total amount for each item and overall total. Ensure that the form accepts items as a single string (comma-separated values) and utilize explode to process the data.
- Design an HTML form to accept a paragraph of text. Write a PHP script for the following: a) Write a function to calculate the total number of vowels in the input paragraph. b) Display a breakdown showing the occurrences of each vowel (A, E, I, O, U) from the input.
- Write a PHP script for the following. Design a form to accept a string and check whether the given string is a palindrome. Additionally, provide a feature that ignores spaces and is case-insensitive during the palindrome check.
- Write a PHP Script to accept a customer's full name from the user and do the following: a) Transform the customer's full name into all upper case letters. b) Capitalize the first letter of each word in the customer's name.
- Write a PHP script to generate and print Floyd's triangle, but modify it to allow for variable rows based on user input. Allow the user to specify how many rows of Floyd's triangle they would like to see.
- Write a PHP script that allows a user to input a URL. Upon submission, display the source code of the webpage at the specified URL.
- Write a PHP script that accepts a number from a user and uses a ternary operator to determine if the number is greater than 50, 30, or 20. Provide appropriate output messages based on the user's input.
- Write a PHP script to display a multiplication table for a user-input number. Design an HTML page that accepts a number and allows the user to specify how many rows of the multiplication table to display.
- Write a PHP script that accepts a number (up to one million) and converts it into words. Design an HTML page to accept the number.
- Write a PHP script to accept the details of an Employee (Name, Salary, Designation, Address, and join date) and display it on a new page in a well-formatted layout. Include validation to ensure salary is a positive number and the join date is in the correct format.

Practical Assignment : Set III (Function and Array)

- Write a PHP script to accept the number from user and Write a PHP function to calculate the factorial of a number (a non-negative integer). The function accepts the number as an argument.
- Design a HTML form to accept a string. Write a PHP function that checks whether a passed string is a palindrome or not?
- Design a HTML form to accept a string. Write a PHP script for the following. a) Write a function to count the total number of Vowels from the script. b) Show the occurrences of each Vowel from the script.
- Write a PHP script for the following: a) Design a form to accept two numbers from the users. b) Give option to choose an arithmetic operation (use Radio Button). c) Display the result on next form. d) Use concept of default parameter.
- Write a PHP script for the following: Design a form to accept two strings. Compare the two strings using both methods (== operator & strcmp function). Append second string to the first string. Accept the position from the user; from where the characters from the first string are reversed. (Use radio buttons)
- Write a menu driven program to perform the following operations on an associative array: a) Display the elements of an array along with the keys. b) Display the size of an array
- Write a menu driven program the following operation on an associative array a) Reverse the order of each element's key-value pair. [Hint: array_flip()] b) Traverse the element in an array in random order. [Hint: shuffle()]
- Declare array. Reverse the order of elements, making the first element last and last element first and similarly rearranging other array elements.[Hint : array_reverse()]
- Write a menu driven program to perform the following stack related operations. a) Insert an element in stack. b) Delete an element from stack.[Hint: array_push(), array_pop()]
- Write a menu driven program to perform the following operations on associative arrays: a) Merge the given arrays. b) Find the intersection of two arrays. c) Find the union of two arrays. d) Find set difference of two arrays.
- Write a menu driven program to perform the following queue related operations a) Insert an element in queue b) Delete an element from queue c) Display the contents of queue

Practical Assignment : Set IV(Class and Object)

- Write a PHP program to define Interface shape which has two method as area() and volume (). Define a constant PI. Create a class Cylinder implement this interface and calculate area and Volume.
- Write a PHP script to create a Class shape and its subclass triangle, square and display area of the selected shape.(use the concept of Inheritance) Display menu (use radio button)
 - a) Triangle
 - b) Square
 - c) Rectangle
 - d) Circle
- Write PHP script to demonstrate the concept of introspection for examining object.
- Create a class named DISTANCE with feet and inches as data members. The class has the following member functions: convert_feet_to_inch() , convert_inch_to_feet() . Display options using radio button and display conversion on next page.
- Write a PHP program to create a class temperature which contains data members as Celsius and Fahrenheit . Create and Initialize all values of temperature object by using parameterized constructor . Convert Celsius to Fahrenheit and Convert Fahrenheit to Celsius using member functions. Display conversion on next page.
- Write a Calculator class that can accept two values, then add them, subtract them, multiply them together, or divide them on request.

- Write a PHP Script to create a super class Vehicle having members Company and price. derive 2 different classes LightMotorVehicle (members – mileage) and HeavyMotorVehicle (members – capacity-in-tons). Define 5 Object of each subclass and display details in table format.

Practical Assignment : Set V (Web Techniques)

- Write a PHP script to display following information using super global variable. a) Client IP Address. b) Browser detection/information. C) To check whether the page is called from 'https' or 'http'.
- Write a PHP script to keep track of number of times the web page has been access. [Use Session]
- Write a PHP script to accept username and password. If in the first three chances, username and password entered is correct then display second form with 'welcome message' otherwise display error message. [Use Session]
- Write a PHP script to accept Employee details (eno, ename, address) on first page. On second page accept earning (Basic, Da, HRA). On third page print Employee information(eno,ename, Address, BASIC, DA, HRA, TOTAL) [Hint: Use Session]
- Write a PHP script to check how many times the web page access.[Use cookies]
- Write a PHP script to change the preference of your web page like font style, font, size, font color, background color using cookie. Display selected settings on next page and actual implementation (with new settings) on third page.

Practical Assignment : Set-VI (Databases (MySQL))

- Consider the following entities and their relationship.
Doctor (doc_no, dname, address, city, area)
Hospital (hosp_no, hname, hcity)
Doctor-Hospital related with many-one relationship.
Create a RDB in 3NF for above and solve the following.
Using above database write a script in PHP to print the Doctor visiting to the hospital in tabular format. Accept hospital name from user[Use MySQL]
- Consider the following entities and their relationship. Student (stud_id, name, class)
Competition(c_no,c_name, type) a) Relationship between student and competition In many-many with attributes rank and year. b) Create a RDB in 3NF for above and solve the following. c) Using above database write a script in PHP to accept a competition from user and display information of student who has secured 1st rank in that competition.
- Consider the following entities and their relationship Emp(e_no, ename, address, phone, salary)
Dept(d_no, dname, location) Emp-Dept related with many-one relationship. Create a RDB in 3NF for above and solve the following. Using above database write a script in PHP which will a) Insert Employee records and Department records into respective tables. b) Print a salary statement in the format given below, for a given Department. [Hint : create a HTML form to accept Department name form user]Maximum Salary Minimum Salary Sum salary.

Practical Assignment : Set VII (JavaScript)

- Write the JavaScript to convert temperature from Kelvin to Celsius and Fahrenheit.
- Modify the program to accept any number of subjects and calculate the average score along with the percentage.
- Write the JavaScript to calculate compound interest over a specified number of years.
- Write the JavaScript to swap two values using an array. For example: if A = 100 and B = 200, demonstrate how to swap without using a temporary variable.
- Write the JavaScript to take input as student's age and check eligibility for voting and driving in different regions (age requirements may vary).
- Write the JavaScript to determine how many leap years exist between two given years.
- Write the JavaScript to print the grade of a student based on different grading scales (letter grades, percentage brackets) using If-Else and switch statements.

- Modify the program to categorize students into different classes (first, second, third) based on the overall percentage.
- Write the JavaScript to accept a string representing a weekday and return whether that day is a weekday or weekend.
- Write the JavaScript to print the multiplication tables for numbers between 1 and n in a tabular format.

Practical Assignment : Set-VIII (XML and AJAX)

- Write a script to create XML file as 'Employee.xml'. The element of this xml file are as follows:

```
<Empdetails>
<Employee EMPno= Empname=>
<Salary>-----</Salary>
<Designation>-----</Designation>
</Employee>
</Empdetails>
```
- Write a PHP script to generate an XML in the following format in php.

```
<? Xml version='1.0'encoding=''ISO-8859-1'?>
<Book Store>
<Books>
<PHP>
<Title> Programming in PHP </ Title>
<Publication>O'RELLY<Publication>
</PHP>
<PHP>
<Title> Beginners PHP</ Title>
<Publication> WORX</Publication>
</PHP></Books>
</Book Store>
```
- Write a script to create XML file 'University.xml'. The element details of
- 'University.xml' Are as follows:

```
<Univ>
<Uname>-----</Uname>
<CITY>-----</CITY>
<Rank>-----</Rank>
</Univ>
```

 - a) Store the details of at least 3 universities.
 - b) Link the 'University.xml' file to CSS and get well formatted output as given below.
 - i) Uname :
Color : black;
Font-family: copperplate G0thic Light;
Font size: 16pt;
Font:Bold;
 - ii) City and Rank
Color: Yellow;
Font-family: Arial;
Font-size : 12pt;
Font: Bold;
- Write a PHP Script to read 'BOOK.xml' file and print specific content of a file using DOMDocument parser. 'Book.xml' file should contain following information with at least 5 records with values.
BookInfo : Book NO, Book Name, Author Name, Price, Year. [Note: Examiners can change the Book info file to Student info, Teacher info]

- Write a AJAX program to read contact. Dat file and print the contain of a file in a Tabular form when the user clicks on print button. Contact.dat file contain srno, name, residence number, mobile number, context/ relation. [Enter at least 3 record in contact.dat file] [Note: Examiner may change the contact. dat, dept.dat and provide proper structure of the file]
- Write AJAX program to print movie by selecting an actor's name. create table Movie and Actor with 1:M cardinality as follows:
Movie (mno, mname, release_year) Actor(ano, aname) [USE MySQL]
- Write a AJAX program to search Student name according to the character typed and display list using array
- Write a AJAX program to print Teacher information from MySQL table
- Teacher: Teacher (Tno, Name, Subject, Research area). [Note: Examiner can change MySQL table]

Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous)**F.Y. M.Sc. (Computer Application) - Sem-II****Course Code :CA-555-MJ-PR****Course Title : Lab course Based on CA-552-MJ-TH**

Teaching Scheme 04 Hours/Week	No. of Credits 02		Examination Scheme CIE : 15 Marks SEE : 35 Marks
1) Write a R program to take input from the user (name and age) and display the values. Also print the version of R installation. 2) Write a R program to create a sequence of numbers from 20 to 50 and find the mean of numbers from 20 to 60 and sum of numbers from 51 to 91. 3) Write a R program to create a simple bar plot of five subjects marks. 4) Write a R program to get the unique elements of a given string and unique numbers of vector. 5) Write a R program to multiply two vectors of integers type and length 3. 6) Write a R program to list containing a vector, a matrix and a list and give names to the elements in the list. 7) Write a R program to create a list containing a vector, a matrix and a list and give names to the elements in the list. Access the first and second element of the list. 8) Write a R program to create a list containing a vector, a matrix and a list and remove the second element. 9) Write a R program to merge two given lists into one list. 10) Write a R program to assign new names "a", "b" and "c" to the elements of a given list. 11) Write a R program to create an empty data frame. 12) Write a R program to create a data frame from four given vectors. 13) Write a R program to create a data frame using two given vectors and display the duplicated elements and unique rows of the said data frame. 14) Write a R program to save the information of a data frame in a file and display the information of the file. 15) Write a R program to create an ordered factor from data consisting of the names of months. 16) Write R program to find whether given number is positive or negative. 17) Write R program to read number and print corresponding day name in a week 18) Create a Matrix using R and Perform the operations addition, subtraction, multiplication. 19) Using R import the data from Excel/.CSV file and find mean, median, mode, quartiles. 20) Using R import the data from Excel/.CSV file and find standard deviation, variance and co-variance. 21) Write a R program to count the number of NA values in a data frame column. 22) Write a R program to call the (built-in) dataset air quality. Remove the variables 'Solar.R' and 'Wind' and display the data frame. 23) Write a R program to compare two data frames to find the row(s) in first data frame that are not present in second data frame 24) Write a R program to create a factor corresponding to height of women data set, which contains height and weights for a sample of women. 25) Write a R program to find nth highest value in a given vector. 26) Write an R program to sort a Vector in ascending and descending order. 27) Write an R program to extract first 10 English letter in lower case and last 10 letters in upper case and extract letters between 22nd to 24th letters in upper case. 28) Write an R Program to calculate Decimal into binary of a given number. 29) Write an R program to convert a given matrix to a list and print list in ascending order. 30) Write an R program to create Data frames which contain details of 5 employees and display the details in ascending order.			

- 31) Consider the inbuilt iris dataset i) Create a variable “y” and attach to it the output attribute of the “iris”dataset .ii) Create a barplot to break down your output attribute. iii) Create a density plot matrix for each attribute by class value.
- 32) Consider Weather dataset i) Selecting using the column number ii)Selecting using the column name iii) Make a scatter plot to compare Wind speed and temperature.
- 33) Write a script in R to create a list of students and perform the following
- i) Give names to the students in the list. ii) Add a student at the end of the list.
 - iii) Remove the first Student.iv) Update the second last student

<p align="center">Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. M.Sc. (Computer Applications) - Sem-II Course Code : CA-560-MJ-TH Course Title : Advanced Java Programming</p>		
Teaching Scheme 02 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Prerequisites: <ul style="list-style-type: none"> • Basic knowledge of Java programming • Understanding of Object-Oriented Programming concepts 		
Course Objectives: <ul style="list-style-type: none"> • To learn database programming using Java • To study web development concept using Servlet and JSP • To develop a game application using multithreading • To learn socket programming concept 		
Course Outcomes: <ul style="list-style-type: none"> • On completion of the course, student will be able to– • To access open database through Java programs using Java Data Base Connectivity (JDBC) and develop the application. • Understand and create dynamic web pages, using Servlets and JSP. • Work with basics of framework to develop secure web applications 		
Course Contents:		
Chapter-1	Chapter Name: Database Programming	Hours: 08
<ul style="list-style-type: none"> • The role of jdbc, The design of jdbc • Types of drivers • Steps of jdbc to access database • Connectivity with database • Create JDBC Statements – Statement, PreparedStatement, CallableStatement • Scrollable and updatable result sets - TYPE_FORWARD_ONLY, TYPE_SCROLL_INSENSITIVE, TYPE_SCROLL_SENSITIVE - CONCUR_READ_ONLY, CONCUR_UPDATABLE • 1.6 Metadata – DatabaseMetadata, ResultSetMetadata (Database : PostgreSQL) 		
Chapter-2	Chapter Name: Networking	Hours: 04
<ul style="list-style-type: none"> • The java.net package - InetAddress, URL, URLConnection class • Connection oriented transmission – Stream Socket Class, SocketServer and Socket class • Creating a Socket to a remote host on a port (creating TCP client and server) • Simple Socket Program Example. • Implementing Client-Server Applications 		

Chapter-3	Chapter Name: Multithreading	Hours: 06
<ul style="list-style-type: none"> • Introduction to Thread • Life cycle of thread • Thread Creation <ul style="list-style-type: none"> - By using Thread Class - By Using Runnable interface • Priorities and Synchronization • Running multiple thread • Concurrency API: Executors, Locks, and Synchronizers • Deadlocks and Thread Safe Design Patterns 		
Chapter-4	Chapter Name: Servlet	Hours: 06
<ul style="list-style-type: none"> • 4.1 Introduction to Servlet and Hierarchy of Servlet • 4.2 Life cycle of servlet • 4.3 Tomcat configuration (Note: Only for Lab Demonstration) • 4.4 Handling get and post request (HTTP) • 4.5 Handling a data from HTML to servlet • 4.6 Retrieving a data from database to servlet • 4.7 Session tracking – User Authorization, URL rewriting, Hidden form fields, Cookies and HTTP Session 		
Chapter-5	Chapter Name: JSP	Hours: 04
<ul style="list-style-type: none"> • Simple first JSP program • Life cycle of JSP • Implicit Objects • Scripting elements – Declarations, Expressions, Scriptlets, Comments • JSP Directives – Page Directive, include directive • Mixing Scriptlets and HTML • Example of forwarding contents from database to servlet, servlet to JSP and displaying it using JSP scriptlet tag • Introduction to JavaServer Faces (JSF) 		
Chapter-6	Chapter Name: Introduction to Frameworks	Hours: 02
<ul style="list-style-type: none"> • Spring • Introduction of Spring framework, Bean • Spring Applications • Spring – MVC framework • Introduction to Components of Hibernate • Building a Simple CRUD Application with Spring and Hibernate 		
Reference Books: <ul style="list-style-type: none"> • Core Java Volume I - Fundamentals By Cay S. Horstmann, 11th Edition, Prentice Hall, ISBN 978-0-13-516630-7 • The Complete Reference By Herbert Schildt, 11th Edition, McGraw Hill Education, ISBN 978-260-44023-2 • Java Beginners Guide By Herbert Schildt, 8 th Edition, McGraw-Hill Education ISBN 978-1- 260-44021-8 • Core Java Volume II – Fundamentals By Cay S. Horstmann, 11th Edition, Prentice Hall, ISBN 978-013-516631-4 		

- Java 2 Programming Black Book By Steven Holzner, DreamTech Press, ISBN 978-93-5119-953-4

E Books:

- The Complete Reference By Herbert Schildt

<https://gfgc.kar.nic.in/sirmv-science/GenericDocHandler/138-a2973dc6-c024-4d81-be6d-5c3344f232ce.pdf>

- Java 2 Programming Black Book By Steven Holzner

[https://idoc.pub/documents/java-2-black-book-steven-holzner-vyly2rmq9v4m,](https://idoc.pub/documents/java-2-black-book-steven-holzner-vyly2rmq9v4m)

<div>Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous)</div> <div>F.Y. M.Sc. (Computer Applications) - Sem-II</div> <div>Course Code : CA-561-MJ-PR</div> <div>Course Title : Lab Based on CA-560-MJ-TH</div>		
Teaching Scheme 02 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Course Contents:		
Chapter-1	Chapter Name: Database Programming	
<ul style="list-style-type: none">Write a JDBC program to display all the details of the Person table in proper format on the screen. Create a Person table with fields as PID, name, gender, birth_year in PostgreSQL. Insert values in Person table.Write a program to display information about the ResultSet like number of columns available in the ResultSet and SQL type of the column. Use Person table. (Use ResultSetMetaData).Write a JDBC program to display all the countries located in West Region. Create a table Country in PostgreSQL with fields (Name, continent, Capital,Region). Insert values in the table.Write a JDBC program to insert the records into the table Employee(ID,name,salary) using PreparedStatement interface. Accept details of Employees from user.Write a JDBC program to perform search operation on Person table.<ul style="list-style-type: none">Search all the person born in the year 1986.Search all the females born between 2000- 2005.Create an Employee Management System Using JDBC.Build a Library Management System with JDBC.		
Chapter-2	Chapter Name: Networking	
<ul style="list-style-type: none">Write a client-server program which displays the server machine’s date and time on the client machine.Write a program to find primary IP address of the host name which you passed as a parameterWrite a program which sends the name of a text file from the client to server and displays the contents of the file on the client machine. If the file is not found, display an error message.Write a program to accept a list of file names on the client machine and check how many exist on the server. Display appropriate messages on the client side.Write a server program which echoes messages sent by the client. The process continues till the client types “END”.		
Chapter-3	Chapter Name: Multithreading	
<ul style="list-style-type: none">Write a multithreading program in java to display all the vowels from a given String. 2. Write a multithreading program using Runnable interface to blink Text on the frame.Write a program that create 2 threads – each displaying a message (Pass the message as a parameter to the constructor). The threads should display the messages continuously till the user presses ctrl-c. Also display the thread information as it is running.Write a java program to calculate the sum and average of an array of 1000 integers (generated randomly) using 10 threads. Each thread calculates the sum of 100 integers. Use these values to calculate average. [Use join method]		

- Define a thread called “PrintText_Thread” for printing text on command prompt for n number of times. Create three threads and run them. Pass the text and n as parameters to the thread constructor. Example:
 - i. First thread prints “I am in FY” 10 times
 - ii. Second thread prints “I am in SY” 20 times
 - iii. Third thread prints “I am in TY” 30 times
- Write a program to simulate traffic signal using threads
- Write a program to calculate prime numbers using concept of multithreading.

Chapter-4**Chapter Name: Servlet**

- Write a servlet program to display current date and time of server.
- Design a servlet to display “Welcome IP address of client” to first time visitor. Display Welcome-back IP address of client” if the user is revisiting the page. (Use Cookies)(Hint: Use req.getRemoteAddr() to get IP address of client)
- Design the table User (username, password) using Postgre Database. Design HTML login screen. Accept the user name and password from the user. Write a servlet program to accept the login name and password and validates it from the database you have created. If it is correct then display Welcome.html otherwise display Error.html.
- Design a servlet that provides information about a HTTP request from a client, such as IP address and browser type. The servlet also provides information about the server on which the servlet is running, such as the operating system type, and the names of currently loaded servlets.
- Write a servlet which counts how many times a user has visited a web page. If the user is visiting the page for the first time, display a welcome message. If the user is re-visiting the page, display the number of times visited. (Use cookies).
- Create Dynamic User Registration and Authentication Servlet: A Comprehensive Web Application for Secure User Account Management with Input Validation, Session Handling, and Database Integration

Chapter-5**Chapter Name: JSP**

- Write a Program to make use of following JSP implicit objects:
 - i. out: To display current Date and Time.
 - ii. request: To get header information.
 - iii. response: To Add Cookie
 - iv. config: get the parameters value defined in
 - v. application: get the parameter value defined in
 - vi. session: Display Current Session ID
 - vii. pageContext: To set and get the attributes.
 - viii. page: get the name of Generated Servlet
- Create a JSP page which will accept the file extension and display all files in the current directory having that extension. Each filename should appear as a hyperlink on screen.
- Create a JSP page to accept a number from a user and display it in words: Example: 123 – One Two Three.
- Write a JSP program to perform Arithmetic operations such as Addition, Subtraction, Multiplication and Division. Design a HTML to accept two numbers in text box and radio buttons to display operations. On submit display result as per the selected operation on next page using JSP.
- Create a JSP page, which accepts user name in a text box and greets the user according to the time on server side. Example: If user name is Admin Output: If it is morning then display message in red color as, Good morning, Admin Today’s date: dd/mm/yyyy format Current time: hh:mm:ss format If it is afternoon then display message in green color as, Good afternoon, Admin Today’s date: dd/mm/yyyy format Current time: hh:mm:ss format If it is evening then display message in blue color as, Good evening, Admin Today’s date: dd/mm/yyyy format Current time: hh:mm:ss format (Hint: To display date and time use GregorianCalendar and Calendar class)
- Write a JSP program to display number of times user has visited the page. (Use cookies)

<p align="center">Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. M.Sc. (Computer Applications) - Sem-II Course Code : CA-562-MJ-TH Course Title : C# and .NET</p>		
Teaching Scheme 02 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Course Objectives: <ul style="list-style-type: none"> To understand development of windows application To learn data access mechanism. Create a web application Understand MVC Framework 		
Course Outcomes: On completion of the course, student will be able to– <ul style="list-style-type: none"> Understand the VB.NET,C# and ASP Design and develop window based and web based .NET applications. Design and Implement database connectivity using ADO.NET 		
Course Contents:		
Chapter-1	Introduction to VB .NET	Hours: 08
1.1 Basics of VB.Net 1.1.1 Operators 1.1.2 Data Types 1.1.3 Control Structures 1.2 Build Windows Applications 1.2.1 Controls: Form, TextBox, Button, Label, CheckBox, ListBox, ComboBox, RadioButton, atTimePicker, MonthCalender, Timer, Progressbar,Scrollbar, PictureBox, ImageBox, ImageList, TreeView, ListView, Toolbar, StatusBar, Datagridview 1.2.2 Menus and PopUp Menu 1.2.3 Predefined Dialog controls: Color,Save,File,Open, Font 1.2.4 DialogBox - InputBox(), MessageBox, MsgBox()		
Chapter-2	Introduction to C#	Hours: 07
2.1. Language Fundamentals 2.1.1 Data type and Control Constructs 2.1.2 Value and Reference Types, Boxing 2.1.3 Arrays 2.1.4 String 2.1.5 Functions 2.2. Object Oriented Concepts 2.2.1 Defining classes and Objects 2.2.2 Access modifiers 2.2.3 Constructors 2.2.4 Inheritance 2.2.5 Interface 2.2.6 Abstract Class 2.2.7 Method Overloading and Overriding		

Chapter-3	ASP .NET	Hours: 08
3.1 What is ASP.NET? 3.2 Architecture of ASP.NET 3.3 Forms, WebPages, HTML forms 3.4 Request & Response in Non-ASP.NET pages 3.5 Using ASP.NET Server Controls 3.6 Overview of Control structures 3.7 Functions 3.8 Introduction to Web forms <ul style="list-style-type: none"> 3.8.1 Web Controls 3.8.2 Server Controls 3.8.3 Client Controls 3.8.4 Navigation Controls 3.8.5 Validations 3.8.6 Master Page 		
Chapter-4	ADO .NET and MVC	Hours: 07
4.1 Basics of Ado.net <ul style="list-style-type: none"> 4.1.1 Connection Object 4.1.2 Command Object 4.1.3 Dataset 4.1.4 Data Table 4.1.5 Data Reader Object 4.1.6 Data Adapter Object 4.2 Datagridview & Data Binding: Insert, Update, Delete records 4.3 Navigation Using Data Source 4.4 MVC Framework <ul style="list-style-type: none"> 4.4.1 Creating MVC Application 4.4.2 MVC File & Folder structure 		

<p align="center">Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. M.Sc. (Computer Applications) - Sem-II Course Code : CA-563-MJ-PR Course Title : Lab Based on CA-562-MJ-TH</p>		
Teaching Scheme 02 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Course Contents:		
<p>Sample C#.NET Assignments:</p> <ol style="list-style-type: none"> 1. Write a program to check whether the number is even or odd, print out an appropriate message to the user. 2. Write a program which will find all such numbers which are divisible by 5. 3. Write a program which can compute the factorial of a given numbers. 4. Write a program that prints out all the elements of the list that are less than 10. 5. Write a program to determine whether the number is prime or not. 6. Write a program to check whether a number is palindrome or not. (using recursion and without recursion). 7. Write a C# program that reads a number from the user and calculates its square root. Handle the exception if the number is negative. 8. Write a C# program that prompts the user to input two numbers and divides them. Handle an exception when the user enters non-numeric values. 9. Write a C# Sharp program that takes three letters and displays them in reverse order. 10. Write a C# Sharp program that takes a character as input and checks if it is a vowel, a digit, or any other symbol. 11. Write a C# Sharp program to accept a person's height in centimeters and categorize them according to their height. 12. Write a C# Sharp program to read roll no, name and marks of three subjects and calculate the total, percentage and division. 13. Write a program in C# Sharp which is a menu-driven program to perform simple calculations. 14. Write a program in C# Sharp to create a function to input a string and count the number of spaces within the string. 15. Write a program in C# Sharp to calculate the sum of elements in an array. 16. Write a program in C# Sharp to create a recursive function to find the factorial of a given number. 17. How to interact with the user, with the Request.QueryString command. 18. Write a program to interact with the user, with the Request.Form command. 19. Write a program to interact with the user, through radio buttons, with the Request.Form command. 20. Write a program to create an open connection to a data source using the ADO Connection object. Through this connection, you can access and manipulate a database. 		

<p align="center">Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. M.Sc. (Computer Applications) - Sem-II Course Code : CA-581-OJT/FP Course Title : Industry Internship / Field Project (FP)</p>		
Teaching Scheme 120 Hours	No. of Credits 04	Examination Scheme CIE : 30 Marks SEE : 70 Marks
<p>Course Objectives</p> <ul style="list-style-type: none"> • To provide students with an experience in working on projects or working within industry • To inculcate Problem solving skills and work culture of the industry • To foster team spirit • To expose students with documentation used in industry 		
<p>Course Outcomes</p> <p>On Completion of this course, student will be able to –</p> <ul style="list-style-type: none"> • CO1: Make Use of tools used in industry • CO2: Solve complex problems • CO3: Effectively communicate and collaborate with team members and mentors. • CO4: Demonstrate the ability to prepare documentation needed in the SDLC 		
<p align="center">Guidelines for Conduction of Industry Internship / Field Project</p> <ol style="list-style-type: none"> 1. Faculty advisors / mentors shall decide whether a student shall work on industry internship or on a field project as per his/her plan/inclination at the beginning of the semester-II or earlier. The OJT may be carried out in physical or online form at the chosen industry. 2. Field Project should be strictly carried out under the guidance of the assigned faculty advisor / mentor. The assigned Faculty advisor / mentor shall monitor and track the OJT/FP 3. Internship / Field Project of 120 Hrs to be undertaken immediately after the end of SEM II examination and should be completed before the commencement of Semester III. However, Field Project may be undertaken during the semester II itself. 4. At the end of the industry internship / Field Project the student shall submit the report based on work undertaken during internship / Field Project as per prescribed format. 5. Student shall submit progress report on a periodic basis to Faculty advisor/ Mentor. Faculty advisor / mentor shall evaluate the work carried out by the student during internship / Field Project on a continuous basis for 30 marks. 6. The panel of examiners appointed shall evaluate the internship / Field Project based on submitted report and documentation for 70 marks. 		

The Poona Gujarati Kelvani Mandal's
Haribhai V. Desai College of Arts, Science and Commerce, Pune
(Autonomous)

Program Name: - M.Sc. Computer Application

Eligibility:

- (a) Bachelor Degree in Science/Technology/Engineering OR
- (b) Bachelor of Computer Applications (B.C.A.) OR
- (c) B.Sc.(Computer Science) OR
- (d) Bachelor of Computer Science (B.C.S.) OR
- (e) B.Sc.(Information Technology) OR
- (f) B.Sc.(Data Science) OR
- (g) B.Sc.(Cyber and Digital Science) OR
- (h) B.Sc. (Cyber Security) OR
- (i) B.Sc. (Cloud Computing) OR
- (j) Bachelor of Engineering(BE/B.Tech) in Computer Engg/Computer Science & Engg./
Computer Science and Design/ Information Technology/Electronics and
Telecommunication/AI and Data Science/AI and Machine Learning/ equivalent OR
- (k) B. Voc. in Software Development/ Information Technology OR
- (l) B.Sc. with Computer Science as Principal Subject OR
- (m) General B.Sc. with Computer Science as one of the subject at TYBSc level Programme

Objectives:

The objective of an M.Sc. in Computer Application is to provide advanced knowledge in computing, algorithms, and software development. It equips students with problem-solving and research skills to tackle complex technological challenges. The course emphasizes practical applications, innovation, and emerging technologies like AI, Machine Learning, Android Programming etc. Graduates are prepared for careers in academia, industry, and research.

Workload

1. Each theory credit is equivalent to 15 clock hours of teaching (i.e. for 2 Credits – 30 Clock Hours) and each practical credit is equivalent to 30 clock hours (i.e. for 2 Credits – 60 Clock Hours) of teaching in a semester.
2. There is 15 weeks of teacher-student interaction during the semester.
3. The 15 week is divided into 12 weeks teaching and 3 weeks for continuous assessment including preparation time to students during the semester.
4. The workload will be calculated based on 12 weeks teaching only.
5. For the purpose of computation of work-load the following mechanism may be adopted as per UGC guidelines.
6. Workload as per credit is as follows:
 - i. 1 Credit = 1 Theory period of one hour duration per week.
 - ii. 1 Credit = 1 Tutorial period of one hour duration per week.
 - iii. 1 Credit = 1 Practical period of two-hour duration per week.
7. Each theory Lecture time for FY, SY is of 60 min.
8. Each practical session time for FY, SY is of 4 hour i.e. 240 min.

Credit Framework

Level	Semester	Credit Related to Major		Research Methodology (RM)	Internship On Job Training (OJT)	Research Project	Total
		Major Core	Major Elective				
6.0	I	10 (T) + 4 (P)	2 (T) + 2(T/P)	4	--	--	22
	II	10 (T) + 4 (P)	2 (T) + 2(T/P)	--	4 (OJT)	--	22
Exit Option :- Award PG diploma on Completion of 44 Credit OR Continue with PG Second Year							
6.5	III	10 (T) + 4 (P)	2 (T) + 2(T/P)	0	0	4	22
	IV	8 (T) + 4 (P)	2 (T) + 2(T/P)	0	0	6	22
Total		54	16	4	4	10	88
2 years – 4 Semester :- Award of PG Degree on completion of 88 Credit after Three years UG Degree or 1 Year -2 Semester after Four year UG Degree.							

Reference Books:-

1. Database System Concepts by Henry F. Korth, Abraham Silberschatz, S.Sudarshan, Tata McGraw-Hill Education 7th edition
2. Postgresql by Regina obe, Leo Hsu OR eilly publications 3rdedition
3. Database Systems by Shamkant B. Navathe, RamezElmasri, Pearson Higher Education
4. Database Management System by Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill 3rd edition
5. An Introduction to Computer Science using Python 3 by Jason Montojo, Jennifer Campbell, Paul Gries, The pragmatic bookshelf-2013
6. James Payne, “Beginning Python: Using Python and Python 3.1,Wrox Publication
7. Introduction to Computer Science Using Python- Charles Dierbach, Wiley Publication Learning with Python “, Green Tea Press, 2002
8. Introduction to Problem Solving with Python by E balguruswamy,TMH ublication2016
9. Beginning Programming with Python for Dummies Paperback – 2015 by John Paul Mueller
10. Introducing Python- Modern Computing in Simple Packages – Bill Lubanovic, O,,Reilly Publication
11. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress
12. Data Structures – Horowitz, Sahani
13. Problem-Solving in Data Structures & Algorithms Using Python by Robert Karamagi
14. Algorithms & Data Structure in Python by Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser – Wiley Publication, student edition
15. Problem Solving in Data Structure & Algorithms using Python by Hemant Jain – Second Edition
16. Operating Systems Achyut S. Godbole Tata McGraw Hill 2nd edition.
17. Operating Systems D.M. Dhamdhare Tata McGraw Hill 2nd edition.
18. Understanding Operating System: Flynn & Mctloes 4th edition, thomson.
19. Operating Systems Design & implementation Andrew S. Tanenbam, Albert S. Woodhull Pearson.
20. Operating System Concepts (7th Ed) by silberschatz and Galvin, Wiley, 2000.
21. Operating Systems (5th Ed) – Internals and Design Principles by William Stallings, Prentice Hall, 2000.
22. Operating System Concepts (2nd Ed) by James L. Peterson, Abraham Silberschatz, Addison – Wesley.
23. Computer Organisation and Architecture (4th Ed) by William Stallings, Prentice Hall India, 1996.
24. Modern Operating Systems by Andrew S Tanenbaum, Prentice hall Inida, 1992.

25. UNIX – Sumitabha Das 11.Unix Shell Programming – Yashwant Kanetkar, BPB publications.
26. Core Java Volume I - Fundamentals By Cay S. Horstmann, 11th Edition, Prentice Hall, ISBN 978-0-13-516630-7
27. The Complete Reference By Herbert Schildt, 11th Edition, McGraw Hill Education, ISBN 978-260-44023-2
28. Java Beginners Guide By Herbert Schildt, 8 th Edition, McGraw-Hill Education ISBN 978-1- 260-44021-8
29. Core Java Volume II – Fundamentals By Cay S. Horstmann, 11th Edition, Prentice Hall, ISBN 978-013-516631-4
30. Java 2 Programming Black Book By Steven Holzner, DreamTech Press, ISBN 978-93- 5119-953-4
31. Brian J.S. Chee and Curtis Franklin, “Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center”, CRC Press, ISBN:9781439806128
32. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing”, McGraw Hill Education, ISBN-13:978-1-25-902995-0
33. Dr. Kris Jamsa, “Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more”, Wiley Publications, ISBN: 978-0-470-97389-9
34. Researching Information Systems and Computing by Briony J Oates, SAGE SOUTH ASIA EDITION
35. The Research Methods Knowledge Base, by William M. K. Trochim, James P. Donnelly
36. Introducing Research Methodology: A Beginner’s Guide to Doing a Research Project , by Uwe Flick
37. Steven Holzner, ”HTML Black Book”, Dremtech press.
38. Web Technologies, Black Book, Dreamtech Press
39. Web Applications : Concepts and Real World Design, Knuckles, Wiley-India
40. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson
41. Programming PHP By Rasmus Lerdorf and Kevin Tatroe, O'Reilly publication
42. Beginning PHP 5 , Wrox publication
43. PHP web sevice, Wrox publication
44. AJAX Black Book, Kogent solution
45. Mastering PHP , BPB Publication
46. PHP cookbook, O'Reilly publication
47. PHP for Beginners, SPD publication 8. Programming the World Wide Web , Robert W.

48. Data Science Fundamentals and Practical Approaches, Gypsy Nandi, Rupam Sharma, BPB Publications, 2020.
49. The Data Science Handbook, Field Cady, John Wiley & Sons, Inc, 2017
50. Data Mining Concepts and Techniques, Third Edition, Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann, 2012.
51. A Hands-On Introduction to Data Science, Chirag Shah, University of Washington Cambridge University Press
52. Data Communications and Networking by Behrouz Forouzan, Fifth Edition, ISBN 978-0-07-337622-6 McGraw Hill.
53. Computer Networks, ANDREW S. Tanenbaum, Fifth Edition, ISBN-13: 978-0-13- 212695-3, Pearson

54. Core Java Volume I - Fundamentals By Cay S. Horstmann, 11th Edition, Prentice Hall, ISBN 978-0-13-516630-7
55. The Complete Reference By Herbert Schildt, 11th Edition, McGraw Hill Education, ISBN 978-260-44023-2
56. Java Beginners Guide By Herbert Schildt, 8 th Edition, McGraw-Hill Education ISBN 978-1- 260-44021-8
57. Core Java Volume II – Fundamentals By Cay S. Horstmann, 11th Edition, Prentice Hall, ISBN 978-013-516631-4

Examination Pattern

1. Exam pattern is 70-30 i.e. Semester End Examination (SEE) is of 70 % and Continuous Internal Assessment is of 30 %.

Theory, Practical/Project: -

Continuous Internal Assessment (CIA): 30 % [15 Marks / 30 Marks]

1. Internal Test- 20 Marks
2. End Sem - 20 Marks
3. Assignment : -20 Marks

Semester End Examination (SEE): - 70 % [35 Marks / 70 Marks]

Paper Pattern

SEE Paper Pattern (for 70 Marks)

Note:-

- 1) Question 1 is compulsory
- 2) Solve any five from Q2 to Q7
- 3) Q2 to Q7 Carry equal marks

Q.1 Solve any five of following (2 *5 =10 Marks)

- a)
- b)
- c)
- d)
- e)
- f)
- g)

Q.2 Solve Following

- a) 4 Marks +3 Marks
- b) 5 Marks

Q.3 Solve Following

- a) 4 Marks +3 Marks
- b) 5 Marks

Q.4 Solve Following

- a) 4 Marks +3 Marks
- b) 5 Marks

Q.5 Solve Following

a) 4 Marks +3 Marks

b) 5 Marks

Q.6 Solve Following

a) 4 Marks +3 Marks

b) 5 Marks

Q.7 Solve Following

a) 4 Marks +3 Marks

b) 5 Marks

Note :- Subject teachers can make necessary changes if required.

Completion of Degree**Award of Degree:**

CGPA will be calculated for students who completed 88 credits, grades are given as per the following table.

Sr. No.	Grade Letter	Grade Point	Marks
1.	O (Outstanding)	10	90<= Marks <= 100
2.	A+ (Excellent)	9	75<= Marks <= 89
3.	A (Very Good)	8	60<= Marks <= 74
4.	B+ (Good)	7	55<= Marks <= 59
5.	B (Above Average)	6	50<= Marks <= 54
6.	C (Average)	5	45<= Marks <= 49
7.	D (Pass)	4	40<= Marks <= 40
8.	F (Fail)	0	Marks <40
9.	AB (Absent)	0	-