Department of Computer Science and Application
Atal Bihari Vajpayee University, Bilaspur (C.G.)

Learning Outcome Based Scheme and Syllabus

for

Master of Computer Applications (M.C.A.)

(AICTE Approved)

(As approved by AC/EC in its meeting held on 28.03.2018 and 31.03.2018 respectively)

Course Effective from Academic Session 2020-21

Department of Computer Science and Application

Atal Bihari Vajpayee Vishwavidyalaya, Bilaspur (C.G.)

Scheme and Syllabus

of

Master of Computer Applications (MCA)

(Approved by AICTE, w.e.f. Academic Session 2020-21)

(As approved by academic council and executive council in its meeting held on /   /2020 and   /   /2020 respectively)

Bridge Course

As per the eligibility criteria of AICTE, a student taking admission into MCA program from non computer background at undergraduate level, must clear a bridge course during the MCA program. Rules and details of bridge course are as follows:

1. Student taking admission after graduating with any non computer background (B.Sc. (PCM or PCB)/BA/B.Com. or equivalent) has to undergo a bridge course.
2. Students having computer proficiency other than undergraduate level (Diploma/Certificate etc.) will not be counted for bridge course.

3. Students have to complete the bridge course till the end of maximum duration provided for the program and as mentioned in the ordinance. Examination of the bridge course will be conducted both in odd as well as in the even semesters.
4. Students can appear in bridge courses either fully or partially.
5. Degree will not be awarded without completing the bridge course.
6. The courses under bridge course will be non credit course i.e. marks of these courses will not be added in the mark sheet. But they will get a certificate of completion of the bridge course or the status of the bridge course will be mentioned in the mark sheet of each semester. The course details of the bridge course will be mentioned in the back side of the mark sheet.

S. No.	Course Code	Course Name	Credit				Marks		Total	
			L	T	P	Total	ESE	IA	Max	Min
1	BC-101	Fundamentals of computer	3	1	-	4	75	25	100	40
2	BC-102	Object Oriented Programming with C++	3	1	-	4	75	25	100	40
3	BC-103	LAB-0 Object Oriented Programming with C++	-	-	2	2	75	25	100	40
Total			6	2	2	10	225	75	300	120

Bridge Course

Semester – I

S. No.	Course Code	Course Name	Credit				Marks		Total	
			L	T	P	Total	ESE	IA	Max	Min
1	MCA-101	Programming in Python	3	1	-	4	75	25	100	40
2	MCA-102	Relational Database Management System	3	1	-	4	75	25	100	40
3	MCA-103	Operating System	3	1	-	4	75	25	100	40
4	MCA-104	Computer System Architecture	3	1	-	4	75	25	100	40
5	MCA-105	Software Engineering	3	1	-	4	75	25	100	40
6	MCA-106	Lab-1: Python Programming	-	-	2	2	75	25	100	40
7	MCA-107	Lab-2: Oracle/My SQL	-	-	2	2	75	25	100	40
8	MCA-108	Participation in any activity/Event/Workshop etc. *	**Non Credit but mandatory course**							
		Total	15	5	4	24	525	175	700	280

Abbreviation: L-Lecture, P-Practical, T-Tutorial, ESE-End Semester Examination, IA-Internal Assessment

*Student must participate in some activity or event like cultural/technical/sports/social/spiritual either in the university or outside of the university and will produce a certificate of completion for the above noncredit course.

Semester – II

S. No.	Course Code		Course Name	Credit				Marks		Total	
				L	T	P	Total	ESE	IA	Max	Min
1	MCA-201		Compiler Design	3	-	1	4	75	25	100	40
2	MCA-202		Advanced Java Programming	3	-	1	4	75	25	100	40
3	MCA-203		Data Structure & Algorithms	3	-	1	4	75	25	100	40
4	MCA-204		Artificial Intelligence & Machine Learning	3	-	1	4	75	25	100	40
5	Elective-I	MCA-205-E-1	Cryptography and Network Security	3	-	1	4	75	25	100	40
		MCA-205-E-2	Data Communication and Networking								
		MCA-205-E-3	Computer Graphics								
6	MCA-206		Lab-3:Advanced Java programming	-	2	-	2	75	25	100	40
7	MCA-206		Lab-4: AI and Machine Learning through python	-	2	-	2	75	25	100	40
8	MCA-108		MOOC course or equivalent	Non Credit but mandatory course							
	Total			15	5	4	24	525	175	700	280

1. Abbreviation: L-Lecture, P-Practical, T-Tutorial, ESE-End Semester Examination, IA-Internal Assessment
2. Students should register for any one MOOC course from SWAYAM/NPTEL/Coursera/Edx etc. under the guidance of a mentor and a certificate of completion must be submitted to the mentor.
3. MOOC courses will be notified at the beginning of each semester and students have to opt from the list only.
4. Students not able to enroll or complete MOOC course due to any valid reasons shall be assigned a similar task by the HOD/Mentor as an alternative option.

Semester – III

S. No.	Course Code		Course Name	Credit				Marks		Total	
				L	T	P	Total	ESE	IA	Max	Min
1	MCA-301		Mobile application development	3	-	1	4	75	25	100	40
2	MCA-302		Data Mining & Data Warehousing	3	-	1	4	75	25	100	40
3	MCA-303		Big Data Analytics	3	-	1	4	75	25	100	40
4	MCA-304		Cloud Computing	3	-	1	4	75	25	100	40
5	Elective-II	MCA-305-E-1	Pattern Recognition	3	-	1	4	75	25	100	40
		MCA-305-E-2	Soft Computing								
		MCA-305-E-3	Adhoc Wireless Network								
6	MCA-306		Lab-5: Android programming Lab	-	2	-	2	75	25	100	40
7	MCA-306		Minor Project	-	2	-	2	75	25	100	40
8	MCA-108		MOOC course or equivalent	Non Credit but mandatory course							
	Total			15	5	4	24	525	175	700	280

1. Abbreviation: L-Lecture, P-Practical, T-Tutorial, ESE-End Semester Examination, IA-Internal Assessment
2. Students should register for any one MOOC course from SWAYAM/NPTEL/Coursera/Edx etc. under the guidance of a mentor and a certificate of completion must be submitted to the mentor.
3. MOOC courses will be notified at the beginning of each semester and students have to opt from the list only.
4. Students not able to enroll or complete MOOC course due to any valid reasons shall be assigned a similar task by the HOD/Mentor as an alternative option.

Semester – IV

S. No.	Course Code	Course Name	Credit				Marks		Total	
			L	T	P	Total	ESE	IA	Max	Min
1	MCA-401	Major project	-	-	20	20	500	-	400	200
2	MCA-402	MOOC	Non Credit but mandatory course							
	Total		-	-	20	20	500	-	400	200

1. Abbreviation: L-Lecture, P-Practical, T-Tutorial, ESE-End Semester Examination, IA-Internal Assessment
2. Students should register for any one MOOC course from SWAYAM/NPTEL/Coursera/Edx etc. under the guidance of a mentor and a certificate of completion must be submitted to the mentor.
3. MOOC courses will be notified at the beginning of each semester and students have to opt from the list only.
4. Students not able to enroll or complete MOOC course due to any valid reasons shall be assigned a similar task by the HOD/Mentor as an alternative option.

BC-101 FUNDAMENTALS OF COMPUTER

Total Credit: 04   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
- Understand the concept of input and output devices and the basic terminologies used in the computer.
- Understand the Programming, flow chart symbols, complete and correct flow chart algorithms, create a program based on a flow chart.
- Identify categories of programs, system software and applications. Organize and work with files and folders
- Utilize the Internet Web resources and evaluate on-line e-business systems.
- Solve common business problems using appropriate Information Technology applications and systems.

UNIT-I
Introduction: Concept of data and information, History of computer, Generation and Classification of computers, Organization of computers, Input and output devices, Storage devices.

UNIT-II
Introduction and Evolution of Programming Language: Types of programming language, characteristics of a good programming language, programming paradigms: procedural oriented and object oriented programming. Planning the computer program: algorithm, representation of algorithms, flowchart, flowchart symbols, advantages and limitations of flowchart, Pseudo code: definition, pseudo codes for basic control structures, advantages and limitations of pseudo code.

UNIT-III
Software and Its Need: Types of software, system software, application software, utility software, firmware, middleware; Software development life cycle (SDLC).
Software Engineering: Definition, need, goal, principles.

UNIT-IV
Internet: Definition, History of Internet, basic services of internet, uses of internet, internet search engine; Internet security: firewall, encryption.

UNIT-V
Application of IT: IT in business, Industry, home, education, entertainment, science, engineering and medicine. Ecommerce, M-commerce.
Latest IT trends, Artificial intelligence, Data mining, Cloud computing, Big Data.

TEXT/ REFERENCE BOOKS:
1. Computer Fundamentals, P.K. Sinha, BPB Publication
2. Fundamental of computer , V. Rajaraman, PHI Publication
3. Introduction to information technology, V. Rajaraman, PHI Publication
4. Information Technology today , S. Jaiswal
5. Fundamental of IT, Leon and Leon , Leon Tec world

BC- 102 OBJECT ORIENTED PROGRAMMING WITH C++

Total Credit: 04   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
* Understand the fundamental programming concepts and methodologies which are essential to create good C++ programs.
* Code, test, and implement a well-structured, robust computer program using the C++ programming language.
* Write reusable modules (collections of functions).
* Understand design/implementation issues involved with variable allocation and binding, control flow, types, subroutines, parameter passing.
* Develop an in-depth understanding of functional, logic, and object-oriented programming paradigms.
* Do File handling like Creating /reading/ writing.

UNIT-I
Introduction: Procedure-Oriented Programming paradigm, Object-Oriented Programming paradigm, Procedure oriented Vs Object oriented, basic characteristics of OOP's: object, class, encapsulation, inheritance, reusability, polymorphism and overloading, static and dynamic binding, message passing, benefits of OOP's and application of OOP's.

UNIT-II
C++ Basics: Overview, Environment Setup, Basic Syntax, Comments, Basic Data types, Tokens, identifiers, Keywords, Constants/Literals, Variables, Variable Scope, Modifier Types, Storage Classes, Operator, array, pointer and reference variable, I/O statements, namespace, typecasting, control statements: if statement, if- else statement, nested if-else statement, ladder if-else, switch statement, for loop statement, while loop statement, do-while loop statement.
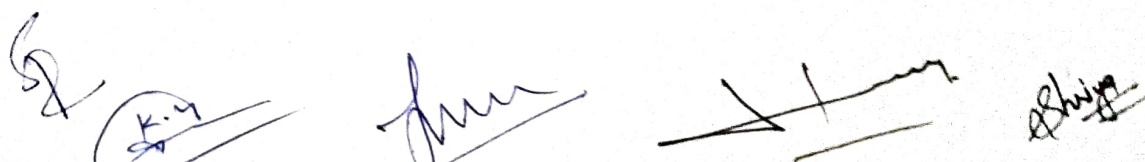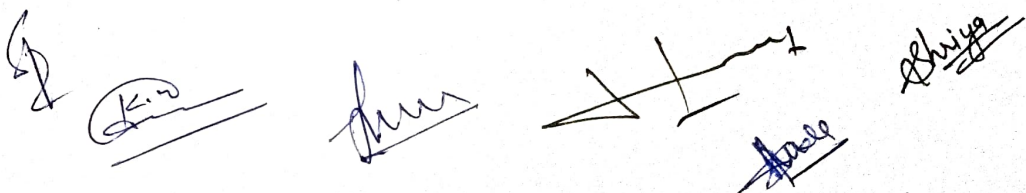
UNIT-III
Objects and Classes: Basics of object and class and abstract class in C++, private and public members, static data and function members, function prototype, inline functions, function overloading, friend functions, default arguments, constructors and their types, destructors, friend class, dynamic allocation operator new and delete.

UNIT-IV
Inheritance: Concept of Inheritance, types of inheritance: single, multiple, multilevel, hierarchical, hybrid, protected members, overriding, virtual base class, resolving ambiguity. Polymorphism: Pointers in C++, Pointers to objects, this pointer, virtual class, virtual and pure virtual functions.

UNIT-V
I/O Files and Streams: Concept of streams, cin and cout objects, C++ stream classes, Unformatted and formatted I/O, File stream, C++ File stream classes, File management functions(read(), write(), put(), get(),tellg() tellp(), seekg() seekp()).

TEXT/ REFERENCE BOOKS:

1. E. Balagurusamy, Programming in ANSI C, Tata McGraw-Hill.
2. Object oriented Programming with C++, E. Balagurusamy, Tata McGraw-Hill.
3. C++ Complete reference, Herbert Schildt, Tata McGraw-Hill.
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

BC - 103 LAB-0: OBJECT ORIENTED PROGRAMMING WITH C++

Total Credit: 02   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
* Understand the fundamental programming concepts and methodologies which are essential to create good C/C++ programs.
* Code, test, and implement a well-structured, robust computer program using the C/C++ programming language.
* Write reusable modules (collections of functions).
* Understand design/implementation issues involved with variable allocation and binding, control flow, types, subroutines, parameter passing.
* Develop an in-depth understanding of functional, logic, and object-oriented programming paradigms.

List of Experiments:

1. WAP to print the sum and product of digits of an integer.
2. WAP to reverse a number.
3. WAP to compute the sum of the first n terms of the following series $S=1+1/2+1/3+1/4+\ldots\ldots$
4. WAP to compute the sum of the first n terms of the following series $S=1-2+3-4+5\ldots\ldots\ldots$
5. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by the user is Palindrome or not.
6. Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.
7. WAP to compute the factors of a given number.
8. Write a macro that swaps two numbers. WAP to use it.
9. WAP to print a triangle of stars as follows (take number of lines from user):

```
*
***
*****
*******
*********
```

10. WAP to perform following actions on an array entered by the user:
    i) Print the even-valued elements.
    ii) Print the odd-valued elements.
    iii) Calculate and print the sum and average of the elements of the array.
    iv) Print the maximum and minimum element of the array.
    v) Remove the duplicates from the array.
    vi) Print the array in reverse order
    The program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter the array and to quit the program.

11. WAP that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.
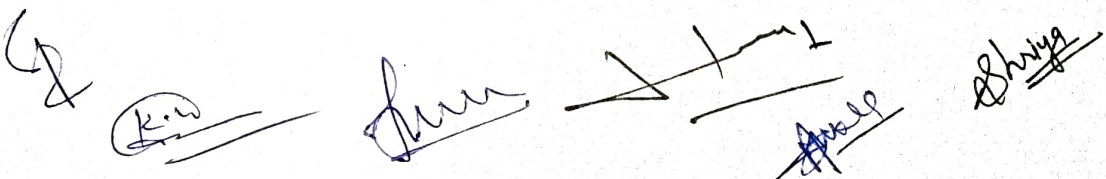
12.	Write a program that swaps two numbers using pointers.

13.	Write a program in which a function is passed an address of two variables and then alter its contents.

14.	Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main() function.

15.	Write a program to find the sum of n elements entered by the user. To write this program, allocate memory dynamically using malloc() / calloc() functions or new operators.

16. Write a menu driven program to perform following operations on strings:

a)	Show address of each character in string

b)	Concatenate two strings without using strcat function.

c)	Concatenate two strings using strcat function.

d)	Compare two strings.

e)	Calculate length of the string (use pointers).

f)	Convert all lowercase characters to uppercase.

g)	Convert all uppercase characters to lowercase.

h)	Calculate number of vowels.

i)	Reverse the string.

17.	Given two ordered arrays of integers, write a program to merge the two-arrays to get an ordered array.

18. WAP to display Fibonacci series (i)using recursion, (ii) using iteration.

19. WAP to calculate Factorial of a number (i)using recursion, (ii) using iteration.

20.	WAP to calculate GCD of two numbers (i) with recursion (ii) without recursion.

21.	Create a Matrix class using templates. Write a menu-driven program to perform following Matrix Operations (2-D array implementation):

a) Sum	b) Difference c) Product	d) Transpose

22.	Create the Person class. Create some objects of this class (by taking information from the user). Inherit the class Person to create two classes Teacher and Student class. Maintain the respective information in the classes and create, display and delete objects of these two classes (Use Runtime Polymorphism).

23.	Create a class Triangle. Include overloaded functions for calculating areas. Overload assignment operator and equality operator.

24.	Create a class Box containing length, breadth and height. Include following methods in it:

a)	Calculate surface Area

b)	Calculate Volume

c)	Increment, Overload ++ operator (both prefix & postfix)

d)	Decrement, Overload -- operator (both prefix & postfix)

e)	Overload operator == (to check equality of two boxes), as a friend function

f)	Overload Assignment operator

g)	Check if it is a Cube or cuboid

Write a program which takes input from the user for length, breadth and height to test the above class.

25.	Create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.

26.	Write a program to retrieve the student information from file created in previous question and print it in following format:

Roll No.	Name	Marks

27. Copy the contents of one text file to another file, after removing all whitespaces.
28. Write a function that reverses the elements of an array in place. The function must accept only one pointer value and return void.

Note: List of experiments may be changed by the concerned teacher.

MCA-101 PROGRAMMING IN PYTHON

Total Credit: 04   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
- Define the structure and components of a Python program.
- Demonstrate proficiency in handling of loops and creation of functions. Identify the methods to create and manipulate lists, tuples and dictionaries.
- Discover the commonly used operations involving regular expressions and file systems.
- Determine the need for scraping websites and working with CSV, JSON and other file formats.
- Interpret the concepts of Object-Oriented Programming as used in Python.

UNIT-I
Introduction to Python: Installing Python, basic syntax, interactive shell, editing, saving, and running a script, The concept of data types; variables, assignments; immutable variables; numerical types, operators (Arithmetic operator, Relational Operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator) and expressions; comments in the program; understanding error messages.

UNIT-II
Creating Python Programs: Input and Output Statements, Control statements (Branching, Looping, Conditional Statement, Exit function, Difference between break, continue and pass.)
Function: Defining a function, calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.

UNIT-III
Strings and Text Files: Manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated).
String Manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers.
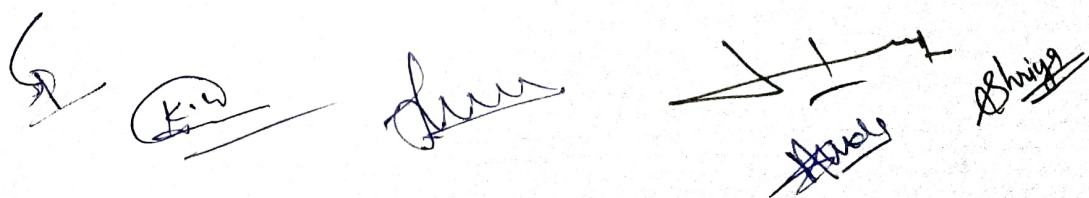
UNIT-IV
Lists, Tuples and Dictionaries: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; Accessing tuples, Operations, Working, Functions and Methods, dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries.

UNIT-V
Modules: Importing module, Math module, Random module, Packages, Composition
Exception Handling: Exception, Exception Handling, Except clause, Try? Finally clause, User Defined Exceptions.
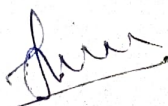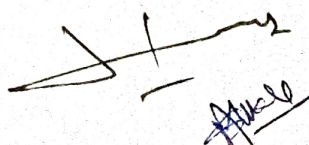
TEXT/ REFERENCE BOOKS:

1. T. Budd, Exploring Python, TMH, 1st Ed, 2011
2. Allen Downey, Jeffrey Elkner, Chris Meyers, How to think like a computer scientist: Learning with Python, Freelyavailableonline.2012
3. Luca Massaron John Paul Mueller, Python for Data Science For Dummies,Wiley, 2ed, 2019
4. http://docs.python.org/3/tutorial/index.html
5. http://interactivepython.org/courselib/static/pythonds

MCA-102 RELATIONAL DATABASE MANAGEMENT SYSTEM

Total Credit: 04   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
- Learn and practice data modelling using the entity relationship and developing database designs.
- Apply normalization techniques to normalize the database.
- Design database and normalize data and understand how queries are being processed and executed.
- Understand the needs of database processing and learn techniques for controlling the consequences of concurrent data access.
- Understand types of database failures and recovery.

UNIT-I
Database: Introduction to database, relational data model, DBMS architecture, data independence, DBA, database users, end users, front end tools.

UNIT-II
E-R Modeling: Entity types, entity set, attribute and key, relationships, relation types, E-R diagrams, database design using ER diagrams.

UNIT -III
Relational Data Model: Relational model concepts, relational constraints, primary and foreign key, Normalization.

UNIT- IV
Structured Query Language: SQL queries, create a database table, create relationships between database tables, modify and manage tables, queries, forms, reports, modify, filter and view data.

UNIT-V
Transaction: Introduction, Desirable properties of transaction (ACID), Concurrency control techniques, Serializability.

TEXT/ REFERENCE BOOKS:
1. P. Rob, C. Coronel, Database System Concepts by, Cengage Learning India, 2008
2. R.Elmasri, S.Navathe, Fundamentals of Database Systems, PearsonEducation, Fifth Edition, 2007
3. MySQL: Reference Manual

MCA-103 OPERATING SYSTEM

Total Credit: 04   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
- Demonstrate need for operating systems and different types of operating systems.
- Apply suitable techniques for management of different resources.
- Use processor, memory, storage and file system commands.
- Understand the process management policies and scheduling of processes by CPU.
- Evaluate the requirement for process synchronization and coordination handled by the operating system.

UNIT-I
Introduction: Definition, Basic Functions of Operating System, Types of Operating System, Micro Kernel and Monolithic Operating System, Operating-System Operations, Operating system services, System Call.

UNIT-II
Process Management: Process, Process State, Process Control Block, Process Scheduling, CPU Scheduling: Scheduling criteria, Scheduling algorithms; Inter-process communication.
Classical IPC problems: Producer Consumer problem, Peterson's Solution, Dining Philosophers problem, Semaphores. Deadlock: Necessary Conditions, deadlock handling methods: Deadlock Prevention, Deadlock detection and recovery, Deadlock avoidance, Bankers Algorithm.

UNIT-III
Memory Management: Contiguous Memory allocation, Paging, Segmentation, Virtual Memory, Demand Paging, Page Replacement, Thrashing.
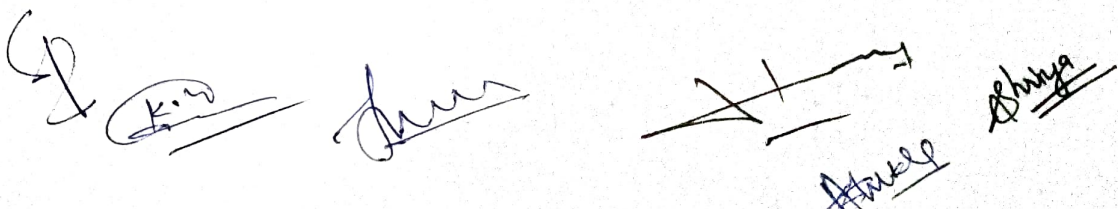
UNIT-IV
File Management: File Concept, Access Methods, Directory Structure, File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free-space Management, and Recovery.

UNIT-V:
I/O Management: I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations, Disk Structure, Disk Scheduling, Disk Management.

TEXT/ REFERENCE BOOKS:
1. An Introduction to Operating Systems, H. M. Deitel, Addition Wiley.
2. Modern Operating Systems, Andrew S Tanenbaum.
3. Operating System Concepts, 2nd Edition - Peterson & Silberschatz, Addison Wiley.
4. Operating Systems, Mardrick and Donovan, Mcgraw Hill.
5. Operating System Concepts, Galvin & Silberschatz, Addison Wiley, (Latest Edition)

MCA-104 COMPUTER SYSTEM ARCHITECTURE

Total Credit: 04   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
- Introduce the basic organization of computer systems.
- Describe control unit operations and conceptualize instruction level parallelism.
- Demonstrate and perform computer arithmetic operations on integer and real numbers
- Categorize memory organization and explain the function of each element of a memory hierarchy.
- Identify and compare different methods for computer I/O mechanisms

UNIT-I
Introduction to Computer Organization: Von Neumann Architecture, Harvard Architecture, Functional Units and Components in Computer Organization, Instruction Codes, Computer Registers, Computer Instructions, Instruction cycle.

UNIT-II
Central Processing Unit: Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC, CISC.

UNIT-III
Pipeline & Vector Processing: Basic Concepts in Pipelining, Speed-Up, Throughput, Efficiency, Instruction pipeline, Arithmetic pipeline, Vector Processing, Instruction Pre-Fetch and Branch Handling, Data Buffering, Internal Forwarding, Data Dependent Hazards.

UNIT-IV
Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Associative memory, Cache memory, Virtual memory, Memory Management Hardware.

UNIT-V
Input-Output Organization: Peripheral Devices, I/O Interface, Programmed I/O, Interrupt-Driven I/O, Direct memory Access, Memory mapped I/O.

TEXT/ REFERENCE BOOKS:
1.   Computer System Architecture, M Morris Mano, 3rd Edition, PHI / Pearson, 2006.
2.   Computer Organization and Architecture, William Stallings 7th Edition, PHI/Pearson, 2006.
3.   Computer Organization, Car Hamacher, Zvonks Vranesic & Safwat Zaky, 5th Edition, TMH, 2002.
4.   Computer Architecture and Organization, John P. Hayes, TMH International Editions, 1998.
5.   Computer Architecture and Organization, Raj Kamal, Nicholas Carter, 2nd Edition, TMH Education, 2009
6.   Computer Architecture and parallel processing, Kai Hwang & Faye Briggs, McGraw hill, 1985
7.   Computer Organization and Architecture design for Performance, 4th edition - W. Stallings, PHI
8.   Computer Engineering - Hardware Design, M. Morris Mano, PHI

MCA-105 SOFTWARE ENGINEERING

Total Credit: 04   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
- Select and implement different software development process models.
- Extract and analyze software requirements specifications for different projects.
- Apply standard coding practices.
- Apply different testing and debugging techniques and analyzing their effectiveness.
- Define the concepts of software quality and reliability on the basis of International quality standards.

UNIT-I
Introduction to Software Engineering: Definition, Evolution, Principles, Exploratory style of software development, Need of software engineering, Emergence of software engineering, Computer systems engineering.

UNIT-II
Software Life Cycle Models: Definition, Classical Waterfall model, Iterative Waterfall model, V-model, Prototyping model, Incremental development model, Evolutionary model, Rapid Application Development(RAD), Agile model, Extreme programming model, Spiral model.

UNIT-III
Software Project Management (SPM): SPM complexities, responsibilities of a software project manager, project planning, metrics for project size estimation, project estimation techniques, COCOMO model, Scheduling: Work breakdown structure, Activity networks, Critical Path Method (CPM), PERT, risk management, software configuration management.
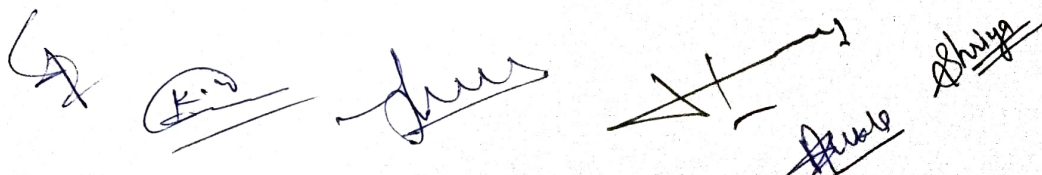
UNIT-IV
Requirements Analysis and Specification: Requirements gathering, requirements analysis, Software Requirements Specification (SRS): Users of SRS Document, Need of SRS, Characteristics of SRS Document, functional requirements, non-functional requirements, goals of implementation; Software Design: Characteristics, Outcome of the Design process, Cohesion and Coupling, Approaches to software design, Data Flow Diagram (DFD), Data dictionary.

UNIT-V
Coding and Testing: Coding standards and guidelines, code review, software documentation, Testing: Basic concepts and terminologies, verification, validation, testing process, unit testing, black-box testing, white-box testing, Control flow graph, cyclomatic complexity, mutation testing, debugging, integration testing, system testing.

TEXT/ REFERENCE BOOKS:
1. Fundamentals of Software Engineering, Rajib Mall, PHI.
2. Software Engineering, A Practitioner's Approach, Roger Pressman", 4th Edition, TMH.
3. Software Engineering, P. S. Pressman, TMH.
4. An Integrated Approach of Software Engineering, Pankaj Jalote, Galgotia.
5. Software Engineering, M. Shooman, TMH.

MCA-106 LAB-1: PYTHON PROGRAMMING

Total Credit: 02   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
- Learn the Numbers, Math functions, Strings, List in Python.
- Learn the tuples and dictionaries in Python.
- Demonstrate proficiency in handling of loops and creation of functions.
- Identify the methods to create and manipulate lists, tuples and dictionaries.
- Express different decision making statements and functions.

Interpret Object Oriented Programming in Python
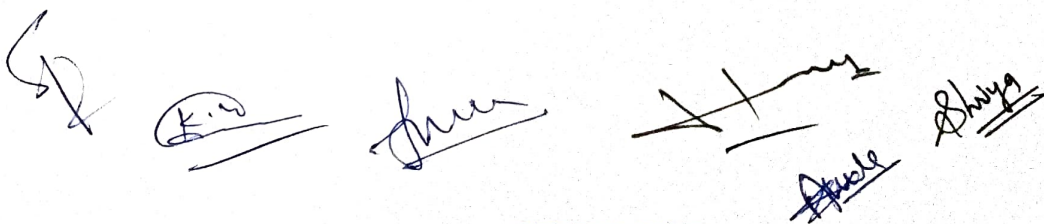
1. Using for loop, print a table of Celsius/Fahrenheit equivalences. Let c be the Celsius temperatures ranging from 0 to 100, for each value of c, print the corresponding Fahrenheit temperature.
2. Using a while loop, produce a table of sins, cosines and tangents. Make a variable x in range from 0 to 10 in steps of 0.2. For each value of x, print the value of sin(x), cos(x) and tan(x).
3. Write a program that reads an integer value and prints —leap year ‖ or —not a leap year ‖ .
4. Write a program that takes a positive integer n and then produces n lines of output shown as follows.

For example enter a size: 5
```
*
**
***
****
*****
```

5. Write a function that takes an integer _n' as input and calculates the value of 1 + 1/1! + 1/2! + 1/3! + … + 1/n
6. Write a function that takes an integer input and calculates the factorial of that number.
7. Write a function that takes a string input and checks if it's a palindrome or not.
8. Write a list function to convert a string into a list, as in list (_abc') gives [a, b, c].
9. Write a program to generate Fibonacci series.
10. Write a program to check whether the input number is even or odd.
11. Write a program to compare three numbers and print the largest one.
12. Write a program to print factors of a given number.
13. Write a method to calculate GCD of two numbers.
14. Write a program to create Stack Class and implement all its methods. (Use Lists).
15. Write a program to create Queue Class and implement all its methods. (Use Lists)
16. Write a program to implement linear and binary search on lists.
17. Write a program to sort a list using insertion sort and bubble sort and selection sort.

Note: List of experiments may be changed by the concerned teacher.

MCA-107 LAB-2: ORACLE/MySQL

Total Credit: 02   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
- Gain knowledge about SQL Fundamentals.
- Perform Unary & Binary table operations.
- Write Embedded and Nested Queries.
- Create Table View, Log & Triggers.
- Create Database connectivity with front-end.
- Develop database applications using front-end tools and back-end DBMS.

Create and use the following database schema to answer the given queries.

EMPLOYEE SCHEMA

Field	Type	NULL	KEY	DEFAULT
Eno	Char(3)	NO	PRI	NIL
Ename	Varchar(50)	NO		NIL
Job_type	Varchar(50)	NO		NIL
Manager	Char(3)	Yes	FK	NIL
Hire_date	Date	NO		NIL
Dno	Integer	YES	FK	NIL
Commission	Decimal(10,2)	YES		NIL
Salary	Decimal(7,2)	NO		NIL

DEPARTMENT Schema

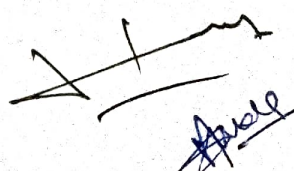| Field	Type	NULL	KEY	DEFAULT
Dno	Integer	No	PRI	NULL
Dname	Varchar(50)	Yes		NULL
Location	Varchar(50)	Yes		New Delhi

Query List

1. Query to display Employee Name, Job, Hire Date, Employee Number; for each employee with the Employee Number appearing first.
2. Query to display unique Jobs from the Employee Table.
3. Query to display the Employee Name concatenated by a Job separated by a comma.
4. Query to display all the data from the Employee Table. Separate each Column by a comma and name the said column as THE_OUTPUT.
5. Query to display the Employee Name and Salary of all the employees earning more than $2850.
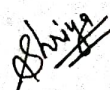6. Query to display Employee Name and Department Number for the Employee No= 7900.

7. Query to display Employee Name and Salary for all employees whose salary is not in the range of $1500 and $2850.

8. Query to display Employee Name and Department No. of all the employees in Dept 10 and Dept 30 in the alphabetical order by name.

9. Query to display Name and Hire Date of every Employee who was hired in 1981.

10. Query to display Name and Job of all employees who don't have a current Manager.

11. Query to display the Name, Salary and Commission for all the employees who earn commission.

12. Sort the data in descending order of Salary and Commission.

13. Query to display Name of all the employees where the third letter of their name is _A'.

14. Query to display Name of all employees either have two _R's or have two _A's in their name and are either in Dept No = 30 or their Manager's Employee No = 7788.

15. Query to display Name, Salary and Commission for all employees whose Commission Amount is 14 greater than their Salary increased by 5%.

16. Query to display the Current Date.

17. Query to display Name, Hire Date and Salary Review Date which is the 1st Monday after six months of employment.

18. Query to display Name and calculate the number of months between today and the date each employee was hired.

19. Query to display the following for each employee <E-Name> earns < Salary> monthly but wants < 3 * Current Salary >. Label the Column as Dream Salary.

20. Query to display Name with the 1st letter capitalized and all other letter lowercase and length of their name of all the employees whose name starts with 'J', 'A 'and 'M'.

21. Query to display Name, Hire Date and Day of the week on which the employee started.

22. Query to display Name, Department Name and Department No for all the employees.

23. Query to display Unique Listing of all Jobs that are in Department # 30.

24. Query to display Name, Dept. Name of all employees who have an 'A'in their name.

25. Query to display Name, Job, Department No. and Department Name for all the employees working at the Dallas location.

26. Query to display Name and Employee no. Along with their Manager's Name and the Manager's employee no; along with the Employee's Name who do not have a Manager.

27. Query to display Name, Dept No. And Salary of any employee whose department No. and salary matches both the department no. And the salary of any employee who earns a commission.

28. Query to display Name and Salaries represented by asterisks, where each asterisk (*) signifies $100.

29. Query to display the Highest, Lowest, Sum and Average Salaries of all the employees.

30. Query to display the number of employees performing the same Job type functions.

31. Query to display the no. of managers without listing their names.

32. Query to display the Department Name, Location Name, No. of Employees and the average salary for all employees in that department.

33. Query to display Name and Hire Date for all employees in the same dept. as Blake.

34.   Query to display the Employee No. And Name for all employees who earn more than the average salary.

35.   Query to display Employee Number and Name for all employees who work in a department with any employee whose name contains a _T'.

Note: List of experiments may be changed by the concerned teacher.

MCA-201 COMPILER DESIGN

Marks: 100

Total Credit: 04

Course Outcome: At the end of course, Students will be able to
- Specify and analyse the lexical, syntactic and semantic structures of advanced language features.
- Separate the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation.
- Write a scanner, parser, and semantic analyser without the aid of automatic generators.
- Describe techniques for intermediate code and machine code optimisation.
- Design the structures and support required for compiling advanced language features.

UNIT I
Introduction: Introduction to Compiler, Analysis of the source program, phases of compiler, cousins of compiler, grouping of phases, compiler construction tools. Lexical Analysis: Role of Lexical Analyzer, Specification of tokens, Recognition of tokens, Regular expression, Finite automata, from regular expression to finite automata transition diagrams, Lex.

UNIT II
Syntax Analysis And Parsing Techniques: Context free grammars, Bottom-up parsing and top down parsing. Top down Parsing : elimination of left recursion, recursive descent parsing, Predictive Parsing ,Bottom Up Parsing : Operator precedence parsing, LR parsers, Construction of SLR, canonical LR and LALR parsing tables, Construction of SLR parse tables for Ambiguous grammar, the parser generator – YACC.

UNIT III
Syntax Directed Translation & Intermediate Code Generation : Synthesized and inherited attributes, dependency graph, Construction of syntax trees, bottom up and top down evaluation of attributes, S-attributed and L-attributed definitions ,Postfix notation; Three address codes, quadruples, triples and indirect triples, Translation of assignment statements, control flow, Boolean expression and Procedure Calls.
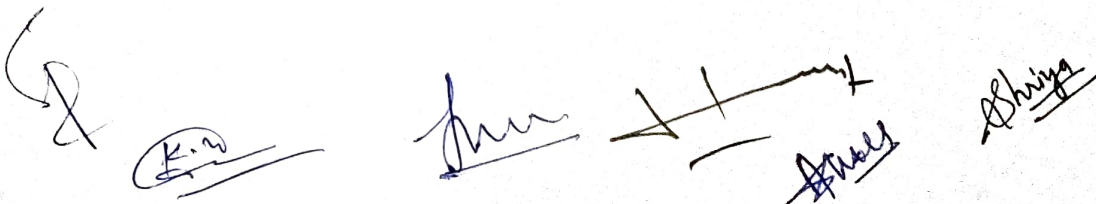
UNIT IV
Runtime Environment: Storage organization, activation trees, activation records, allocation strategies, Parameter passing symbol table, dynamic storage allocation.

UNIT V
Code Optimization & Code Generation: Basic blocks and flow graphs, Optimization of basic blocks, Loop optimization, Global data flow analysis, Loop invariant computations. Issue in the design of Code generator, register allocation, the target machine, and simple Code generator.

TEXT/ REFERENCE BOOKS:
1. Compilers-Principles, Techniques and Tools, Alfred V. Aho, Ravi Sethi and Ullman J.D. Addison Wesley, 2 nd Ed.
2. Principle of Compiler Design, Alfred V. Aho, and J.D. Ullman, Narosa Publication.
3. Compiler design in C, A.C. Holub, PHI.

4. Compiler construction (Theory and Practice), A.Barrett William and R.M. Bates, Galgotia Publication.
5. Compiler Design, Kakde.

MCA-202 ADVANCED JAVA PROGRAMMING

Total Credit: 04

Marks: 100

Course Outcome: At the end of course, Students will be able to
- Design console based, GUI based and web based applications.
- Understand an integrated development environment to create, debug and run multi-tier and enterprise-level applications.
- Develop distributed applications using RMI .
- Develop component-based Java software using JavaBeans.
- Develop server side programs in the form of servlets.
- Develop Swing-based GUI.

UNIT–I
Core Java: History and Evolution of JAVA, Overview of JAVA, Java Magic, JDK and JRE, Java SE and EE, Different IDE for writing JAVA programs like Eclipse, NetBeans etc. Primitive Data Types, Variables, Array, operators, control statement, classes and objects, Abstract Classes, Polymorphism, Inheritance, Method Overriding, Method Overloading, Constructors, Keyword super, this, final, static, Packages and Interfaces, Multithreading and Exception Handling.

UNIT–II
JAVA Applet and Packages: Applet class, Event Handling, AWT, Exploring JAVA Packages: java.lang, java.util, java.io.

UNIT–III
Network-Socket Programming and JDBC: Introduction to Collections, Java Serialization, Network Programming, Socket Programming, Socket for client and server, Processing E-Mails with Java: Protocols and Servers, Creating Mailer, Writing the Mail Sender. Database Using JDBC: Concept, JDBC Driver Types, JDBC package, Establishing a database connection and executing SQL statements, Introduction to Swing, Introduction to Remote Method Invocation (RMI).
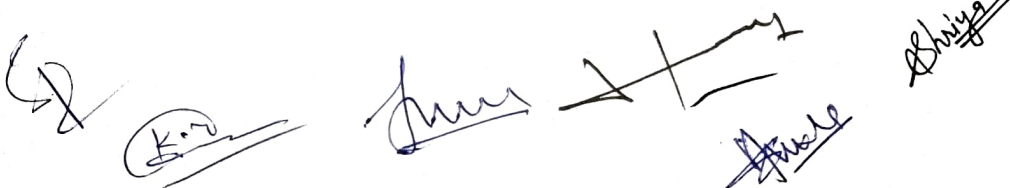
UNIT–IV
Java Server Page (JSP): Basics of Servlet, writing simple program in servlet, Introduction to Java Server Page (JSP), Embedding Java Code into HTML, Implicit JSP Objects, Overview of the JSP Tags, Directives, Declarations, Expressions, Deploying Servlet and JSP, JSTL.

UNIT–V
JAVA, XML and Advance API: Java and XML, XML syntax, Document type definition, Parsers, Simple API for XML (SAX), JAVA API for XML Processing (JAXP), Introduction, Types and Benefits of EJB, EJB Containers, Deploying EJB, Introduction to the Java Persistence API, Overview of Spring, Model View Controller (MVC).Introduction to Struts, JavaFX and Hibernate.

TEXT/ REFERENCE BOOKS:
1. The Complete Reference JAVA, Herbert Schildt, Tata McGraw Hill publication, 5th Edition.
2. Advance JAVA, Gajendra Gupta, Firewall Media, 1st Edition, 2006.
3. JAVA network programming, Elliotte Rusty Harold, O'Reilly Publication, 3rd Edition.
4. Core Java for Beginners, Rashmi Kanta Das, Vikas Publishing House Pvt. Ltd.

MCA-203 DATA STRUCTURE AND ALGORITHMS

Total Credit: 04   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
- Use different types of data structures, operations and algorithms.
- Implement appropriate sorting/searching technique for any given problem.
- Use stack, Queue, Lists, Trees and Graphs in problem solving.
- Find suitable data structure during application development/Problem Solving.

UNIT 1
Introduction of Data Structure: Data types: primitive, non-primitive data types, ADT, Linear and non linear data structure.

List Structures: Arrays: One dimensional, Multidimensional arrays, allocation methods, address calculations, sparse arrays. Linked List: Singly and Doubly Linear linked lists, singly and doubly circular linked list: Definitions, operations (INSERT, DELETE, TRAVERSE) on these lists. (Insertion operation includes – insertion before a given element, insertion after a given element, insertion at given position, insertion in sorted linked list)

UNIT 2
Stack: Definition, Operations PUSH, POP, TRAVERSE, implementations using array and linked list, Applications of stack: Infix, Prefix, Postfix representation and conversion using stack, Postfix expression evaluation using stack. Queues: Introduction, and Types of Queues: Priority Queue, Circular queue, Double Ended Queue, operations (INSERT, DELETE, TRAVERSE), implementation using array and linked list and applications

UNIT 3
Definition of Trees and Their Types: Binary trees, Properties of Binary trees and Implementation operation (Insertion, deletion, searching and traversal algorithm: preorder, post order, in-order traversal), Binary Search Trees, Implementations, Threaded trees, AVL Trees, Balanced multi way search trees: 2-3 tree, Red Black tree, B tree, B+ tree, their applications
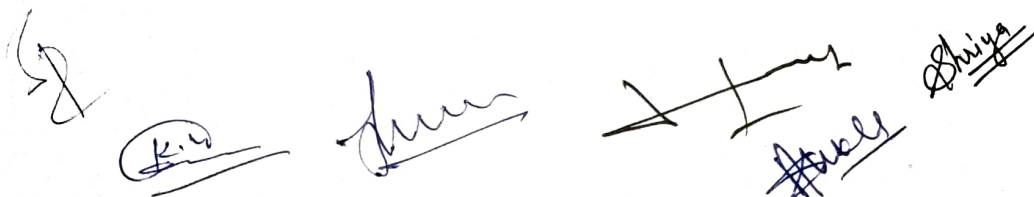
UNIT 4
Sorting: Types of sorting, Sequential Sort, Insertion Sort, Bubble Sort, Quick Sort, Merge Sort, Heap Sort, Radix sort. Searching: Linear search, Binary search, Hashing, collision resolution methods.

UNIT 5:
Definition of Graph and Their Types: Adjacency and incident (matrix & linked list) representation of graphs, Graph Traversal – Breadth first Traversal, Depth first Traversal, Connectivity of graphs; Connected components of graphs, Weighted Graphs, Shortest path Algorithm, spanning tree, Minimum Spanning tree, Kruskal and prim's algorithms.

TEXT/REFERENCE BOOKS:
1. Data Structures and Algorithms in C++, Michael T. Goodrich, Wiley, 2007
2. Fundamentals of Data Structures, Horowitz and Sahani, Computer Science Press, 1978
3. Data structures and Algorithms, Aefred V. Aho, John E. Joperoft and J.E. Ullman.

MCA-204 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Total Credit: 04   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
- Understand a wide variety of learning algorithms.
- Understand how to evaluate models generated from data.
- Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.
- Apply ML algorithms in various domains.
- Simulate real world problems using ML techniques.
- Apply deep learning techniques for computer vision.

UNIT -I
Introduction: Overview of Artificial Intelligence (AI), Foundations of A.I., History of AI, Areas and state of the art in A.I. ,Knowledge: Introduction ,Knowledge Based system ,Knowledge representation techniques.

UNIT -II
Searching Techniques: Problem solving as state space search, production system, control strategies and problem characteristics, Search techniques: Breadth First search, Depth-first search, Hill-climbing, Heuristics search, Best-First search, greedy method, A* algorithm.

UNIT -III
Machine Learning: What is Machine learning, Types of machine learning, Statistical learning: background and general methods, Bayesian network, decision trees, supervised learning: linear regression, artificial neural network, Back propagation network, support vector machine, radial basis function network, unsupervised learning: types of clustering, K-means clustering, hierarchical clustering, self organization map, reinforcement learning.
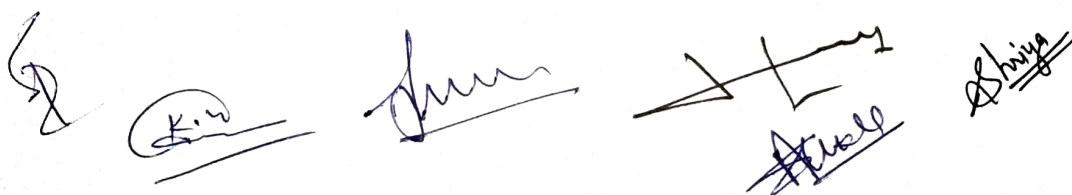
UNIT -IV
Machine Learning Model: Measuring classification accuracy, data preprocessing , feature selection and generation, dimensionality reduction: Principal component analysis (PCA), training, testing and validation data sets, ensemble methods: Bagging and boosting.

UNIT V
Application of ML and Deep Learning: Applying ML to solve real world problems in various domains like financial forecasting, classification problems, clustering, Natural language processing (NLP), health care, image classification etc. Introduction to deep learning, Convolutional Neural Network (CNN), Long Short Term Memory (LSTM), solving computer vision and other problems through deep learning techniques.

TEXT/ REFERENCE BOOKS:
1. Artificial Intelligence and machine learning, Vinod Chandra S.S., Anand Hareendrn S., PHI learning private Ltd.
2. Introduction to Artificial Intelligence and Expert Systems, Dan W. Patterson, PHI Publication.
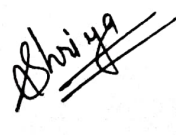3. Artificial Intelligence , Elaine Rich and Kevin Knight TMH publication.

4. Machine learning, Anuradha Srinivasaraghavan, Vincy Joseph, Wiley publication , India , 2019 edition.

5. Introduction to Machine Learning with python A guide for data scientists, Andreas, C. Muller & Sarah Guido, O'Reilly.

6. Understanding machine learning: From theory to algorithms, shai shalev-shwartez, shai ben-david, Cambridge university press.

7. Machine learning with python, Abhishek Vijayvargia, BPB publication.

8. Machine learning using python, U Dinesh Kumar, Manaranjan Pradhan, Wiley publication.

9. Deep learning, Ian Goodfellow , Yoshua Bengio, Aoran Courville, Adaptive computation and machine learning series.

10. Machine learning, Tom M. Mitchell, McGraw Hill, Indian Edition.

MCA-205-E-1 CRYPTOGRAPHY AND NETWORK SECURITY

Marks: 100

Total Credit: 04

Course Outcome: At the end of course, Students will be able to
- Classify the symmetric encryption techniques.
- Illustrate various Public key cryptographic techniques.
- Evaluate the authentication and hash algorithms.
- Summarize the intrusion detection and its solutions to overcome the attacks.
- Understand the basic concepts of system level security.

UNIT-I
Classical Encryption Technique: Basics of computer network, TCP/IP model, Foundations of Cryptography and security trends, Secret key Vs public key cryptography, Symmetric cipher model, substitution techniques, Transportation techniques, Mathematical tools for cryptography: modular arithmetic, Euclidean algorithm, finite fields, polynomial arithmetic.

UNIT-II
Symmetric Cipher: Symmetric cipher model, Traditional block cipher: Stream and block cipher, Feistel cipher network structure, Design Principles of Block Ciphers, Data Encryption Standard (DES), Strength of DES Triple DES, Block cipher design principle, Block cipher operation, Advanced encryption Standard (AES), Evaluation criteria of AES, AES transformation function, key distribution.

UNIT-III
Public Key Cryptography and Hash Function: Principles of public key cryptosystem, requirement, RSA algorithm. Hash function, Key management: Diffie-Hellman Key exchange, Man in the middle attack, elliptic curve arithmetic, elliptic curve cryptography, Application of cryptographic hash function, Hash and Message authentication Code (MAC), Hash and MAC algorithms, MAC based on hash function, Digital signature and Authentication protocol. Key management and distribution: Distribution of symmetric key and public key, Public key Infrastructure (PKI).

UNIT-IV
IP and Web Security Protocols: User authentication: principle, Remote user authentication using symmetric and asymmetric encryption, Kerberos, Email security: Pretty Good Privacy (PGP), S/MIME, IP security: IPsec, transport layer Security: Secure Socket layer (SSL), Secure Electronic Transaction (SET).

UNIT-V
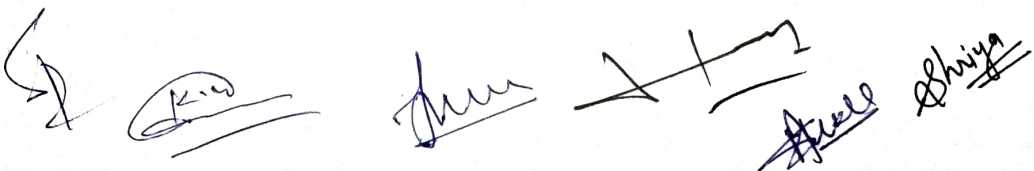**System Security:** Firewall, Intrusion Detection and prevention system (IDPS), Malicious Software.

TEXT/ REFERENCE BOOKS:
1. Cryptography and Network Security, William Stallings, 4th Edition Pearson Publication.
2. Network security and cryptography, Bernard Menezes, Cengage Learning India Pvt. Ltd. First edition 2010.
3. Applied cryptography - protocols and algorithm, Buce Schneier, Springer Verlag 2003.

4. Cryptography and Network Security, Atul Kahate , TMH Publication.
5. Cryptography and Network Security, Behrouz A. Forouzan, First Edition, TMH Publication.
6. Network Security: Private Communication in Public World By Charlie Kaufman ,Radia Perlman and Mike Speciner, PHI Publication.

MCA-205-E-2 DATA COMMUNICATION AND NETWORKING

Total Credit: 04

Marks: 100

Course Outcome: At the end of course, Students will be able to
- Understand the basic computer network technology.
- Understand and explain the data communications system and its components.
- Identify the different types of network topologies and protocols.
- Understand the layers of the OSI model and TCP/IP.
- Expose wireless and wired LANs.

UNIT-I
Overview of Data Communication and Networking: Data Communications: components, data representation, direction of data flow (simplex, half duplex, full duplex); Networks: distributed processing, network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN), Protocols and standards; Reference Models: OSI & TCP/IP reference model comparative study.

UNIT-II
Physical Layer: Analog & Digital Transmission: Transmission Impairments, Data Rates Limits, Digital to Digital Conversion, Line coding Scheme; Analog To Digital Conversion: PCM, PAM, Delta Modulation, Transmission Modes, Parallel, Serials Asynchronous and Synchronous Communication; Digital To Analog Conversion: ASK, FSK, PSK, QPSK Constellation Diagram, QAM; Analog To Analog Conversion: AM, FM, PM, Bandwidth Utilization, Multiplexing: FDM, WDM and TDM, Switching Circuits; Transmission Media: Guided Media: Twisted Pair, Coaxial and Fiber Optic, Unguided Media: Wireless, Radio Waves, Microwaves and Infrared.

UNIT-III
Data Link Layer: Flow Control: Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC; Medium Access Sublayer: Point to point protocol, LCP, NCP, FDDI, token bus, token ring; Multiple Access Protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, FDMA, TDMA, CDMA; Traditional Ethernet, Fast Ethernet.

UNIT-IV
Network Layer: Internetworking Devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing: Internet address, classful address, subnetting, classless address; Routing: Techniques, static vs. dynamic routing, and routing table for classful address; Routing Algorithms: Shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP, IPV6; Unicast and multicast routing protocols.

UNIT-V
Transport Layer and Application Layer: UDP, TCP; Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, choke packets; Quality of service: techniques to improve Qos; DNS, SMTP, SNMP, FTP, HTTP, Firewalls; Modern Topics: Wireless LAN: IEEE 802.11; Introduction to blue-tooth, VLAN's, Cellular telephony & Satellite network.

TEXT/ REFERENCE BOOKS:

1. Data Communications and Networking, B. A. Forouzan, TMH, (Latest Edition)
2. Computer Networks, A. S. Tanenbaum, 4th Edition, Pearson Education/PHI
3. Data and Computer Communications, W. Stallings, 5th Edition, PHI/ Pearson Education
4. Computer Networking -A top down approach featuring the internet, Kurose and Rose, Pearson Education
5. Communication Networks, Walrand, TMH (Latest Edition)
6. Internetworking with TCP/IP, vol. 1, 2, 3, Douglas E. Comer, 4th Edition Pearson Education/PHI

MCA-205-E-3 COMPUTER GRAPHICS

Total Credit: 04   **Marks: 100**

Course Outcome: At the end of course, students will be able to
- Design and implement algorithms for 2D graphics primitives and attributes.
- Apply concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models.
- Demonstrate Geometric transformations, viewing on both 2D and 3D objects.
- Infer the representation of curves, surfaces, Colour and Illumination models
- Design and implementation of algorithms for 2D graphics Primitives and attributes.
- Explain hardware, software and OpenGL Graphics Primitives.

UNIT-I
Introduction: Introduction to Computer Graphics, Application of Graphics, Display Devices: Refresh Cathode-Ray Tubes, Raster Scan Displays, Random Scan Displays, Color CRT Monitors and Flat Panel Displays. Video cards/display cards. Graphic Software, Graphics Software Standard and Software Packages.

UNIT-II
Line Generation Algorithms: DDA algorithm, Bresenham's algorithm; Circle Generation Algorithms: Midpoint Circle algorithm; Polygon filling Algorithms: Scan Line Polygon fill algorithm, Inside - Outside Tests, Boundary-Fill algorithm, Flood - Fill algorithm. Fundamentals of aliasing and Antialiasing Techniques.

UNIT-III
Two Dimensional Viewing: Window to Viewport coordinates transformation. Clipping: Clipping operations, Point clipping, Line clipping: Cohen Sutherland Algorithm, Liang Barsky Algorithm, Nicholl-Lee-Nicholl Algorithm, Polygon clipping: Sutherland- Hodgeman Algorithm, Weiler Atherton Algorithm, Text clipping, Exterior clipping. Two Dimensional Transformations: Translation, Scaling, Rotation, Reflection, Shear.

UNIT-IV
Three Dimensional Viewing: 3D Geometry, 3D display techniques, transformations. Projections: Parallel Projection, Perspective Projection. Orthogonal Projection.

UNIT-V
Color Models and Color Application: Color Model, Standard Primaries and the Chromaticity Diagram, XYZ Color Model, CIE Chromaticity Diagram. RGB Color Model, YIQ Color Model, CMY Color Model, HSV Color Model. Conversion between HSV and RGB Models. HLS Color Model, Color Selection and Application.

TEXT/REFERENCE BOOKS:
1. Principles of Interactive Computer Graphics, Newman, W. Sproul, R.F., TMH,1980
2. Fundamentals of Interactive Computer Graphics, Foley J.D., Van Dome, Addison Wesley,1982

3. Computer Graphics, Hearn D., Baker, PHI, 1986
4. Procedural Elements for Computer Graphics, Rogers D. F., TMH, 1986
5. Computer Graphics using OpenGL, F. S. Hill Jr., Pearson Education, 2003.

MCA-206 LAB-3: ADVANCED JAVA PROGRAMMING LAB

Total Credit: 02   **Marks: 100**

Course Outcome: At the end of course, Students will be able to:
- Design and develop GUI applications using Abstract Windowing Toolkit (AWT), Swing and Event Handling.
- Design and develop Web applications.
- Designing Enterprise based applications by encapsulating an application's business logic.
- Designing applications using pre-built frameworks.

List of Advanced JAVA Programs:

1. Write a java program to create an abstract class named shape that contains two integers and an empty method named printArea() Provide three classes named Rectangle,, Triangle and Circle such that each one of the classes extends the class shape. Each one of the class contains only the method printArea() that print the area of the given shape.

2. Write a Java program that implements a multithreaded program that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd the third thread will print the value of the cube of the number.

3. Write a Java program that correctly implements the producer – consumer problem using the concept of inter-thread communication. (use of synchronize)

4. Write an applet program that displays a rainbow pattern using appletviewer and command prompt.

5. Develop an applet that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the **button named "Compute" is clicked.**

6. Write a program in java which creates a list containing at least 3 states of india.On the click of any state, the capital of that state should be displayed in a TextField.

7. Write a java program which creates a list containing ice cream flavours.On selection of any flavor price should be displayed in a text field.

8. Write a java program to demonstrate Borderlayout.

9. Write a java program to demonstrate Gridlayout.

10. Write a program in java which takes name,age from user.On click of the button and display a message on label "user is eligible to vote or not".

11. Write a JDBC program to create a table product (id number,name varchar,price varchar).And insert a record in the table.

12. Write a program to execute a select query using JDBC.

13. Write a program to execute an Update query using JDBC.

14. Write a server program to return the square root of a number to the client using Socket.

15. Write a server program to return Date and time to clients using socket programming.

16. Write a JDBC program to accept empid as command line argument.And display the name of employee who is getting highest salary from employee table(EMPID,EMPNAME,EMPSAL)

17. Write a swing program containing 3 text fields.First text field accepts Last name and second text field accepts First name.On click of button full name is displayed in third box.

18. Write a java program that accepts a computer name as a command line argument and to display its Inet Address.

19. Write a servlet program to display cookie id.

20. Write a JSP program for basic arithmetic functions.

21. Write a JAVA bean program to generate plain texts.

Note: List of experiments may be changed by the concerned teacher.

MCA-206 LAB-4: AI AND MACHINE LEARNING

Total Credit: 02   **Marks: 100**

1.   Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
2.   Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
3.   Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a CSV file. Compute the accuracy of the classifier, considering few test data sets.
4.   Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using the standard Heart Disease Data Set.
5.   Apply   algorithms to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.
6.   Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.
7.   Write a program to classify social media data using Deep learning
8.   Write a program to classify health care data.
9.   Write a program to process CT scan image using deep learning
10.   Write a program to forecast financial data using machine learning algorithms..

Note: List of experiments may be changed by the concerned teacher.

MCA-301 MOBILE APPLICATION DEVELOPMENT

Total Credit: 04

Marks: 100

Course Outcome: At the end of course, Students will be able to
- Apply general programming knowledge in the field of developing mobile applications.
- Understand the specific requirements, possibilities and challenges when developing for a mobile context.
- Interact between user interface and underlying application.
- Plan and carry out a design work including developing a prototype that can be evaluated with a specified user group.
- Reflect over possibilities and demands in collaborative software development.

UNIT-I
Introduction to Mobile Applications: History of Android, Android Features, Android Versions, Fundamentals: Basic Building blocks, Activities, Services, Broadcast Receivers & Content providers; UI Components: Views & notifications.

UNIT-II
Android Development: Java, Android Studio, Eclipse, Virtualization APIs. Android tools: Debugging with DDMS, Android File system, Working with emulator and smart devices, A Basic Android Application, Deployment. Android Activities: The Activity Lifecycle, Lifecycle methods, Creating Activity; Intents, Intent Filters, Activity stack.

UNIT-III
Basic UI Design: Styles & Themes Form widgets, Text Fields, Layouts :RelativeLayout ,TableLayout, FrameLayout, LinearLayout, Nested layouts (dip,dp,sip,sp versus px), styles.xml, drawable resources for shapes, gradients(selectors), Style attribute in layout file, AlertDialogs & Toast, Time and Date, Images and media .

UNIT-IV
Android User Interface: Menus: Option menu, context menu, pop-up menu; Lists and Notifications: creation and display. Input Controls: Buttons,Text Fields, Checkboxes, alert dialogs, Spinners, rating bar, progress bar, Android Threads and Thread handlers. Files, Content Providers, and Databases.

UNIT-V
Messaging and Location-Based Services: Sending SMS Messages Programmatically, Getting Feedback after Sending the Message Sending SMS Messages Using Intent Receiving, sending email, Introduction to location-based service, configuring the Android Emulator for Location-Based Services, Geocoding and Map-Based Activities; Introduction to App Deployment and Testing: Doodlz app, Tip calculator app, Weather viewer app.

TEXT/REFERENCE BOOKS:
1. Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, Android Programming: The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 3rd edition, 2017.

2. Rajiv Ramnath, Roger Crawfis, and Paolo Sivilotti, Android SDK 3 for Dummies, Wiley.

MCA-302 DATA MINING AND DATA WAREHOUSING

Total Credit: 04   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
- Store voluminous data for online processing
- Preprocess the data for mining applications
- Apply the association rules for mining the data
- Design and deploy appropriate classification techniques
- Cluster the high dimensional data for better organization of the data
- Evaluate various mining techniques on complex data objects

UNIT-I
Introduction: What is data mining?, Why it is important?, Mining on what kind of data, Data mining Functionalities, steps of data mining, Knowledge discovery.

UNIT-II
Data Warehouse: Meaning, definition, OLTP Vs. OLAP, Data warehouse architecture, Three Tier Architecture Data warehouse architecture, Data cube and OLAP technology

UNIT-III
Association Rule: Basic concept, Frequent itemset mining: Apriori algorithm etc., Mining various kind of association rules: Mining Multilevel association rules, Mining multidimensional association rules

UNIT-IV
Classification and Prediction: What is classification and prediction, Decision tree algorithms: CART, ID3 C4.5, CHAID, Bayesian classification, Rule based classification, Classification by backpropagation, Support vector machine, Association classification and other classification methods. Prediction using Regression and Neural Network methods, Accuracy measures, Ensemble methods.

UNIT-V
Cluster Analysis and Data Mining Tools: What is cluster analysis?, Partitioning method, Hierarchical methods, Experiments with WEKA data mining tools for model development, data preprocessing, feature selection for Financial data, health care data etc.

TEXT/REFERENCE BOOKS:
1. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers (Elsevier, 2nd edition), 2006
2. Data Mining Methods for Knowledge Discovery, Cios, Pedrycz, Swiniarski, Kluwer Academic Publishers, London – 1998
3. Data mining techniques, Arun K Pujari, Universities Press (India) private limited, 2007.
4. Data Mining, Data Warehousing and OLAP, Gajendra Sharma, S.K. Kateria and Sons, 2010.

MCA-303 BIG DATA ANALYTICS

Total Credit: 04   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
- Understand fundamentals of Big Data analytics. Investigate Hadoop framework and Hadoop Distributed File system.
- Demonstrate the Map Reduce programming model to process the big data along with Hadoop tools.
- Analyze web contents and social networks to provide analytics with relevant visualization tools.
- Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.

UNIT-I
Introduction to Big Data: Big Data and its importance, Characteristics of Big Data, What Comes Under Big Data, Who's Generating Big Data, Challenges in Handling Big Data, How Big Data Impact on IT, Big Data Analytics, Big data applications, Future of Big Data, Risks of Big Data.

UNIT-II
Introduction to Hadoop: Introduction to Hadoop, Hadoop Architecture, Design Principles of Hadoop, Advantages of Hadoop, Hadoop Storage: Hadoop Distributed File System (HDFS), Properties of HDFS, Name Node, Secondary Name Node, Data Node, Goals of HDFS, Hadoop vs. Other Systems.

UNIT-III
Hadoop Mapreduce: Hadoop Map Reduce, Map Reduce paradigm, Resource manager, Node manager, Partitioner, combiner.

UNIT-IV
YARN: Introduction to YARN, YARN Framework, Classic Map Reduce Vs YARN, Schedulers: FIFO, Fair, Capacity.

UNIT-V
Hadoop Ecosystem: Spark, Hive, HBase, Pig, Sqoop, Oozie.

TEXT/ REFERENCE BOOKS:
1. Professional Hadoop Solutions, Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, Wiley, 2015.
2. Understanding Big data, Chris Eaton, Dirk deroos et al., McGraw Hill, 2012.
3. HADOOP: The definitive Guide , Tom White, O Reilly 2012.
4. Big Data Analytics with R and Hadoop, VigneshPrajapati, Packt Publishing 2013.
5. Oracle Big Data Handbook, Tom Plunkett, Brian Macdonald et al , Oracle Press, 2014.
6. http://www.bigdatauniversity.com/
7. Big Data and Business analytics, Jay Liebowitz, CRC press, 2013.

MCA-304 CLOUD COMPUTING

Total Credit: 04   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
- Identify the appropriate cloud services for a given application.
- Assess the comparative advantages and disadvantages of Virtualization technology.
- Analyze authentication, confidentiality and privacy issues in cloud computing.
- Identify security implications in cloud computing.
- Understand the importance of protocols and standards in management for cloud services.

Unit-I
Introduction: Introduction to Cloud Computing Defining Cloud computing, Characteristics, Components, deployment model, service model, Applications, Benefits of cloud computing, Limitations of 26 cloud computing. Grid Computing, Grid vs Cloud Computing.

Unit-II
Cloud Architecture, Services and Applications: Exploring cloud computing stack – Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Defining Infrastructure as a Service (IaaS), Defining Software as a Service (SaaS), Defining Platform as a Service (PaaS), Defining Identity as a Service (IDaaS), Defining Compliance as a Service (CaaS).

Unit-III
Cloud Infrastructure and Virtualization: Hardware and Infrastructure – Clients, Security, Network and Services, use of Virtualization technology, Load Balancing and Virtualization, virtualization benefits, Hypervisors, porting application, Defining cloud capacity by defining baselines and Metrics.

Unit-IV
Exploring Cloud Services: Software as a Service – Overview, advantages, limits, virtualization benefits, examples. Platform as a Service – overview, advantages and functionalities, PaaS application frameworks – Drupal, Long Jump. Case study – Google Apps and Web Services.

Unit-V
Cloud Administration and Security Management: Management responsibilities, lifecycle management, cloud management products, Cloud management standards. Cloud security, data security, Identity and presence protocol standards, Availability management in SaaS, IaaS, PaaS, Access Control, Security Vulnerability, Patch and Configuration Management, Security as a Service of cloud, Future of Security in Cloud computing.

TEXT/REFERENCE BOOKS:
1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, McGraw Hill Education.
2. Barrie Sosinsky, "Cloud Computing Bible", Wiley India Edition.
3. Anthony Velte, tobyVelte, Robert Elsenpeter, "Cloud Computing – A Practical Approach", Tata McGraw-Hill Edition.

4. Cloud Computing:Black Book, Kailash Jayaswal et al., Kogent Learning Solutions, Dreamtech Press.
5. Cloud Computing: Principles and Paradigms,RajkumarBuyya et al., Wiley India.
6. Cloud Computing: Concepts, Technology & Architecture,Erl, Pearson Education India.
7. Cloud Computing Bible, Barrie Sosinsky, O'Reilly Media
8. Cloud Computing: A Practical Approach, Toby Velte, Anthony Vote and Robert Elsenpeter, McGraw Hill
9. Cloud Application Architectures: Building Applications and Infrastructures in the Cloud, George Reese, O'Reilly Media.

MCA-305-E-1 PATTERN RECOGNITION

Total Credit: 04

Marks: 100

Course Outcome: At the end of course, Students will be able to
- Search, collect, classify and critically interpret relevant information to design a simple pattern recognition system.
- Implement an advanced pattern recognition algorithm.
- Evaluate the result from a simple pattern recognition system.

Unit-I

Introduction: Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations: Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.

Unit-II

Statistical Pattern Recognition: Bayesian Decision Theory, Classifiers, Normal density and discriminant functions.

Unit – III

Parameter Estimation Methods: Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.

Unit - IV

Nonparametric Techniques: Density Estimation, Parzen Windows, K-Nearest Neighbour Estimation, Nearest Neighbour Rule, Fuzzy classification.

Unit - V

Unsupervised Learning & Clustering: Criterion functions for clustering, Clustering Techniques: Iterative square - error partitional clustering – K means, agglomerative hierarchical clustering, Cluster validation.

TEXT/REFERENCE BOOKS:

1. Pattern Classification, Richard O. Duda, Peter E. Hart and David G. Stork, , 2nd Edition, John Wiley, 2006.
2. Pattern Recognition and Machine Learning, C. M. Bishop, Springer, 2009.
3. Pattern Recognition.S. Theodoridis and K. Koutroumbas, , 4th Edition, Academic Press, 2009

MCA-305-E-2 SOFT COMPUTING

Total Credit: 04   **Marks: 100**

Course Outcome: At the end of course, Students will be able to
- Analyze and appreciate the applications which can use fuzzy logic.
- Understand the difference between learning and programming and explore practical applications of Neural Networks (NN).
- Students would understand the efficiency of a hybrid system and how Neural Network and fuzzy logic can be hybridized to form a Neuro-fuzzy network and its various application
- Ability to appreciate the importance of optimizations and its use in computer engineering fields and other domains.
- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.

UNIT–I
Introduction: What is soft computing? Different tools of soft computing and its comparison, Area of application.

UNIT-II
Artificial Neural Network (ANN): Architecture, Introduction, Evolution of Neural Network, Biological Neural Network Vs ANN, Basic Model of ANN, Different types of ANN, Single layer Perceptron, Solving XOR problem, Activation function, Linear severability, Supervised and unsupervised learning, perceptron learning, delta learning, Feed-forward and Feedback networks, Error Back Propagation Network (EBPN), Associative memories and its types, Hopfield Network, Kohonen Self-organizing Map.

UNIT-III
Fuzzy Logic: Introduction to Classical Sets and Fuzzy Sets, Membership Function, properties and operations of classical set and Fuzzy set, a-cuts, Properties of a-cuts, Linguistic Variables, Membership function, Classical relation and Fuzzy Relation and its properties and operations, Defuzzification and its methods, Fuzzy rule base.

UNIT–IV
Genetic Algorithm: What is Optimization?, Introduction, Application, GA operators: selection, crossover and mutation ,different techniques of selection ,crossover and mutation, different types of chromosomes, Application of GA.

UNIT-V
Hybrid Soft Computing: Design of Neuro-Fuzzy models like ANFIS, Neuro-Genetic, Fuzzy-Genetic Neuro-Fuzzy-Genetic model, MATLAB environment for soft computing.

TEXT/REFERENCE BOOKS:
1. Principles of soft computing , S.N. Shivanandan and S.N Deepa , Wiley publication, Wiley India Edition.

2.   Neural network and Learning Machines, Simon Haykin, Pearson Education, 2011.

3.   Artificial Neural Networks, Robert J. Scholkoff, McGraw Hill Education(India) Pvt. Limited,1997.

4.   Neural Networks and Fuzzy Systems, A dynamical Systems Approach to Machine Learning, Bart Kosko, PHI learning private limited.

5.   Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, S. Rajasekaran, G.A. VijayalakshmiPai, PHI learning private limited, 14th Edition. 2003.

6.   Neural Networks and Fuzzy Logic, K. Vinoth Kumar, R. Saravana Kumar, S. K. Kataria and Sons publication.

7.   Artificial Neural Networks, B.Yegnanarayana Prentice Hall of India (P) Limited.

8.   Introduction to Artificial Neural Systems, Jacek M. Zurada, Jaico Publication House.

9.   Fuzzy Sets, Uncertainty and Information, G. J. Klir and T.A. Folger, PHI learning private limited. Publisher– Pearson 3Edition 1999

MCA-305-E-3 ADHOC WIRELESS NETWORK

Total Credit: 04

Marks: 100

Course Outcome: At the end of course, Students will be able to
- Describe the unique issues in ad-hoc wireless networks.
- Describe current technology trends for the implementation and deployment of wireless ad-hoc networks.
- Discuss the challenges in designing MAC, routing and transport protocols for wireless ad-hoc networks.
- Discuss the challenges in designing routing and transport protocols for wireless ad-hoc networks.

UNIT – I
Introduction: Introduction to wireless Networks. Characteristics of Wireless channel, Ad hoc Networks: Introduction, Issues in Ad hoc wireless networks, Adhoc mobility models, applications.

UNIT – II
MAC: MAC Protocols for Ad hoc wireless Networks: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols, Contention based protocols with reservation mechanisms.

UNIT –III
MAC: Contention-based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, IEEE standards: 802.11a, 802.11b, 802.11g, 802.15 and 802.16.

UNIT – IV
Routing: Routing protocols for Ad hoc wireless Networks: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Proactive routing protocol, Reactive Routing protocol, Hybrid routing protocol, Hierarchical routing protocols, Power aware routing protocols.

UNIT – V
Transport Layer: Transport layer protocols for Ad hoc wireless Networks: Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, Classification of transport layer solutions, TCP over Ad hoc wireless Networks.

TEXT/REFERENCE BOOKS:
1.   Ad hoc Wireless Networks – Architectures and Protocols, C. Siva Ram Murthy and B.S.Manoj, Pearson Education, 2004
2.   Wireless Sensor Networks, Feng Zhao and Leonidas Guibas, , Morgan Kaufman Publishers, 2004.
3.   Adhoc Mobile Wireless Networks, C.K.Toh, Pearson Education, 2002.
4.   Wireless Mesh Networking Thomas Krag and Sebastin Buettrich, , O'Reilly Publishers, 2007

MCA-306 LAB-5: ANDROID PROGRAMMING LAB

Total Credit: 02

Marks: 100

1. Create a "Hello World" application to "Hello World" in the middle of the screen in the red color with white background.
2. User interface design layouts.
3. User interface design elements,events and dialogs.
4. Working with text and shapes.
5. Create an application to display "Hello World" string the number of times the user inputs a numeric value. (Example. If a user enters 5, the next screen should print "Hello World" five times.)
6. Create a spinner with strings from the resource folder (res >> value folder). On changing spinner value, change image.
7. Create an application to change screen color as per the user choice from a menu.
8. Create a sample application with a login module.(Check username and password), validate it for the login screen or alert the user with a Toast.
9. Create and validate a login application using username as Email ID else login button must remain disabled.
10. Create a Login application and open a browser with any one search engine.
11. Create an application that will display toast (Message) at some regular interval of time.
12. Create a background application that will open activity on specific time.
13. Create an application that will have a spinner with a list of animation names. On selecting the animation name, that animation should affect the images displayed below.
14. Create an UI listing the degree of utd college branches. If a user selects a branch name, display the number of semesters and subjects in each semester.
15. Use content providers and permissions by implementing read phonebook contacts with content providers and display in the list.
16. Create an application to call a phone number entered by the user the Edit Text.
17. Create an application that will create a database to store username and password.
18. Create an application to insert, update and delete a record from the database.

Note: List of experiments may be changed by the concerned teacher.