APPENDIX – C
MADURAI KAMARAJ UNIVERSITY
(University with Potential for Excellence)
Accredited by NAAC with 'A++' Grade in the 4th Cycle

Syllabus for
B.Sc. Computer Science (Artificial Intelligence)
CBCS- Semester Pattern
(for those who joined in the academic year 2022-23 and after)
Regulation, Scheme of Examination and Syllabus

1. **Course Objectives:**

- To prepare the students to manage the software components in a computer independently and to be a Programmer.

- To motivate the students to take up higher studies in Computer Science and Artificial Intelligence.

2. **Eligibility for Admission:**

    A candidate should have studied +2 level Mathematics with Physics /Computer Science as one of the subjects in the $10 + 2$ stream.

3. **Duration of the Course:**

    The students shall undergo the prescribed course of study for a period of not less than three academic years (Six semesters).

4. **Medium of Instruction :** English
5. **Subjects/ Structure of Course Study :** See Page No.2.
6. **Scheme of Examinations/ Structure of Question Paper::** See Page No.6.
7. **Detailed Syllabus**: See Page No.8.
8. **Eligibility for the Degree:**

    i. A Candidate shall be eligible for the award of the degree on completion of the prescribed course of study and passing all the prescribed external examinations.

    ii. Attendance progress, internal examinations, conduct certificate from the Head of the Institution shall be required for taking the external examination.

    iii. The passing minimum and the ranking are as per the existing rule of the Choice Based Credit System for the affiliated college of the University.

(Subject/Structure of Course Study)

Sem.	Subjects							Total Hours	Total Credits
I	T1(6) [3]	E1(6) [3]	CS1(4) [4]	CS2(6) [4]	AS1(4) [4]	SBS1(2) [2]	VE(2) [2]	30	22
II	T2(6) [3]	E2(6) [3]	CS3(4) [4]	CS4(6) [4]	AS2(4) [4]	SBS2(2) [2]	EVS(2) [2]	30	22
III	T3(6) [3]	E3(6) [3]	CS5(4) [4]	CS6(4) [3]	CS7(4) [4]	AS3(4) [4]	SBS3(2) [2]	30	23
IV	T4(6) [3]	E4(6) [3]	CS8(4) [4]	CS9(4) [3]	CS10(4) [4]	AS4(4) [4]	SBS4(2) [2]	30	23
V	CS11(5) [4]	CS12(5) [4]	CS13(5) [4]	CS14(6) [4]	ES1(5) [4]	NME1(2) [2]	SBS5(2) [2]	30	24
VI	CS15(5) [4]	CS16(6) [4]	CS17(5) [4]	ES2(5) [4]	ES3(5) [5]	NME2(2) [2]	SBS6(2) [2]	30	25
Extension Activity									1
TOTAL CREDITS									140

( )	-	Number of Hours	[ ]	-	Number of Credits
T	-	Tamil	E	-	English
CS	-	Core Subject	AS	-	Allied Subject
SBS	-	Skill Based Subject	NME	-	Non Major Elective
ES	-	Elective Subject	VE	-	Value Education
EVS	-	Environmental Studies	EA	-	Extension Activities

I SEMESTER

S No	CODE	Subject	Hours	Credits	Internal Marks	External Marks
1	T1	Tamil	6	3	25	75
2	E1	English	6	3	25	75
3	CS1	Programming in C	4	4	25	75
4	CS2	**Lab 1** : Programming in C	6	4	40	60
5	AS1	Mathematical Foundations I	4	4	25	75
6	SBS1	**Lab 2**: Linux Programming	2	2	40	60
7	VE	Value Education	2	2	25	75
		Total	30	22		

II SEMESTER

S. No.	CODE	Subject	Hours	Credits	Internal Marks	External Marks
1	T2	Tamil	6	3	25	75
2	E2	English	6	3	25	75
3	CS3	Object Oriented Programming with C++	4	4	25	75
4	CS4	**Lab 3:** Object Oriented Programming with C++	6	4	40	60
5	AS2	Mathematical Foundations II	4	4	25	75
6	SBS2	Design Thinking	2	2	25	75
7	EVS	Environmental Studies	2	2	25	75
		Total	30	22		

III SEMESTER

S. No.	CODE	Subject	Hours	Credits	Internal Marks	External Marks
1	T3	Tamil	6	3	25	75
2	E3	English	6	3	25	75
3	CS5	Data Structures and Computer Algorithms	4	4	25	75
4	CS6	**Lab 4:** Data Structures and Computer Algorithms Lab	4	3	40	60
5	CS7	Introduction to Artificial Intelligence	4	4	25	75
6	AS3	Resource Management Techniques	4	4	25	75
7	SBS3	**Lab 5:** Python Programming Lab	2	2	40	60
		Total	30	23		

IV SEMESTER

S No	CODE	Subject	Hours	Credits	Internal Marks	External Marks
1	T4	Tamil	6	3	25	75
2	E4	English	6	3	25	75
3	CS8	Introduction to Machine Learning	4	4	25	75
4	CS9	**Lab 6:** Machine Learning Lab-I	4	3	40	60
5	CS10	Soft Computing	4	4	25	75
6	AS4	Numerical Methods	4	4	25	75
7	SBS4	**Lab 7:** Open CV Lab	2	2	40	60
8	EA	Extension Activities		1	100	
		Total	30	24		

V SEMESTER

S. No.	CODE	Subject	Hours	Credits	Internal Marks	External Marks
1	CS11	Algorithms in Artificial Intelligence	5	4	25	75
2	CS12	Machine Learning Techniques	5	4	25	75
3	CS13	Principles of Deep Learning	5	4	25	75
4	CS14	**Lab 8:** Machine Learning Lab -II	6	4	40	60
5	ES1	1. Ethics and Social Implications of AI 2. Digital Image Processing 3. Operating System	5	4	25	75
6	NME1	Introduction to computers and Office Automation	2	2	25	75
7	SBS5	**Lab 9:**Open source Technology Lab	2	2	40	60
		Total	30	24		

VI SEMESTER

S No	CODE	Subject	Hours	Credits	Internal Marks	External Marks
1	CS15	Internet of Things and Robotics	5	4	25	75
2	CS16	Natural Language Processing	6	4	25	75
3	CS17	**Lab 10:** Natural Language Programming	5	4	40	60
4	ES2	1. Data science with R Programming For AI 2. Data Mining and Warehousing 3. Software Engineering	5	4	25	75
5	ES3	Project Work / Viva-Voce	5	5	25	75
6	NME2	Introduction to Internet	2	2	25	75
7	SBS6	Quantitative Aptitude	2	2	25	75
		Total	30	25		

Non-Major Elective Courses to be offered by the Department of Computer Science to the students other than B.Sc. Computer Science (Artificial Intelligence).

1. **NME1** - Introduction to Computers and Office Automation.

2. **NME2** - Introduction to Internet.

128

Pattern Scheme of Evaluation

Theory Subjects
Internal Evaluation
Parameters

Internal Test	- 10 Marks
Assignment	- 5 Marks
Quiz	- 5 Marks
Peer – Peer/Seminar/Discussion	- 5 Marks
Total	- 25 Marks

External Evaluation Pattern

Question Paper Pattern

Time: 3 Hours   **Max. Marks: 75**

Part – A
Answer all the questions   (10*1=10)

Ten Questions, two questions from each Unit: *Multiple Choice Questions*

Part – B
Answer all the questions   (5*7=35)

Five Questions, one question set from each Unit: *Either …Or…type*

Part – C
Answer any three questions   (3*10=30)

Five Questions, one question from each Unit

Practical Subjects:

A candidate has to prepare Algorithm / Procedure for both the questions covering both the parts. The following list of parameters is taken into account for the evaluation of practical examination.

Total Marks: 100 (Internal: 40 marks, External: 60 Marks)

Parameters

For Internal Marks:

i.	Average of two tests:	25
ii.	Record Work:	10
iii.	Seminar / Quiz /Viva:	5
	Total:	**40**

For External Marks:

i.	Aim, Procedure / Algorithm and Program:	15
ii.	Coding and Compilation:	10
iii.	Debugging:	15
iv.	Results :	10
v.	Viva:	10
	Total:	**60**

Note: The External Examiner can fix other exercises also other than those found in the list *(Syllabus)* in consultation with the Internal Examiner without violating the scope of the prescribed syllabus.

For Project Work:

The combined project shall be undertaken by the students as a team of two. The project should be done in the college lab. The following list of parameters is taken into account for the evaluation of Project work and Viva-voce.

Total Marks: 100 (Internal: 25 marks, External: 75 Marks)

Parameters:

For Internal Marks: Two review meetings: 2 x 7.5 = 15 Marks

Overall Performance	:	= 10 Marks
For External Marks: Project Report	:	= 25 Marks
Project Demo &Presentation	:	= 30 Marks
Viva-Voce	:	= 20 Marks

(Detailed Syllabus)
CS1: Programming in C
(4 Hours - 4 credits)

UNIT-I :

Overview of C: History of C – Importance of C – Basic Structure of C Programs– Programming Style – Character Set – C Tokens – Keywords and Identifiers – Constants, Variables and Data Types – Declaration of Variables – Defining Symbolic Constants – Declaring a variable as a constant – overflow and underflow of data.

Operators and Expressions: Arithmetic, relational, logical, assignment operators – increment and decrement operators, conditional operators, bitwise operators, special operators –**Arithmetic Expressions**- Evaluation of Expressions – Precedence of Arithmetic Operators – Type Conversions in Expressions – Operator Precedence and Associativity – Mathematical functions.

UNIT -II:

Managing I/O Operations**:** Reading and Writing a Character – Formatted Input, Output – Decision Making & Branching: if statement - if else statement - nesting of if else statements - else if ladder – switch statement – the ?: operator – goto statement – the while statement – do statement – the for statement – jumps in loops.

UNIT III:

Arrays: One-Dimensional Arrays – Declaration, Initialization – Two- Dimensional Arrays – Multi-dimensional Arrays – Dynamic Arrays Initialization.

Strings: Declaration, Initialization of string variables – reading and writing strings – string handling functions.

UNIT IV:

User-defined functions: Need – multi-function programs – elements of user defined functions – definition – return values and their types – function calls, declaration, category – all types of arguments and return values – nesting of functions – recursion – passing arrays, strings to functions – scope visibility and life time of variables.

Structures and Unions: Defining a structure – declaring a structure variable – accessing structure members – initialization – copying and comparing – operation on individual members – array of structures – arrays within structures – structures within structures – structures and functions –unions-size of structures – bit fields.

UNIT V:

Pointers : Understanding Pointers, Accessing the address of a variable – declaring, initialization of pointer variables – accessing a variable through its pointer – chain of pointers-pointer increments and scale factors – pointers and character strings – pointers as function arguments – pointers and structures.

Files: Defining, opening, closing a file – IO Operations on files – Error handling during IO operations – command line arguments.

Text Book:

1. Programming in ANSIC, E.Balagurusamy, 7th Edition, Tata Mc Graw Hill Publishing Company, 2017.

Reference Books:

1. Programming with C, Schaum's Outline Series, Gottfried, Tata McGraw Hill, 2006.
2. Programming with ANSI and Turbo C , Ashok N.Kamthane , Pearson Education, 2006.

CS2: Lab 1: Programming in C
(6 Hours - 4 credits)

Section A

1. Write a C Program to find the sum of digits
2. Write a C Program to check whether a given number is Armstrong or not
3. Write a C Program to check whether a given number is Prime or not
4. Write a C Program to generate the Fibonacci series
5. Write a C Program to display the given number is Adam number or not
6. Write a C Program to print reverse of the given number and string
7. Write a C Program to find minimum and maximum of 'n' numbers using array
8. Write a C Program to arrange the given number in ascending order
9. Write a C Program to add, subtract and multiply two matrices
10. Write a C Program to calculate NCR and NPR

Section B

11. Write a C Program to find the grade of a student using else if ladder
12. Write a C Program to implement the various string handling functions
13. Write a C Program to create an integer file and display the even numbers only
14. Write a C Program to calculate quadratic equation using switch-case
15. Write a C Program to implement the various string handling function
16. Write a C Program to generate student mark list using array of structures
17. Write a C Program to create and process the student mark list using file
18. Write a C Program to create and process pay bill using file
19. Write a C Program to create and process inventory control using file
20. Write a C Program to create and process electricity bill using file

AS1: Mathematical Foundations I

(4 Hours – 4 Credits)

UNIT I:

The Foundations: Logic and Proofs: Propositional logic – Applications of Propositional logic – Propositional equivalences – (Exclude Propositional satisfiability, Applications of satisfiability, Solving satisfiability problems, and its related problems) – Predicates and Quantifiers – Rules of inference.

UNIT II:

Relations: Relations and their properties – Representing relations – Closures of relations – Partial orderings (Theorems statement only; Exclude lexicographic ordering - Exclude Lattices)

UNIT III:

Counting: The basic of counting - The pigeonhole principle – Permutation and Combinations – Applications of recurrence relations – Solving recurrence relations – Divide and Conquer algorithms and recurrence relations. (All theorems and Results statement only)

UNIT IV:

Graphs: Graphs and Graphs models, (Excluding Biological networks; Tournaments; all its related examples and problems) – Graph terminology and special types of graphs – Representing graphs and Graph isomorphism – Connectivity (paths – connectedness in undirected graphs – paths and isomorphism – counting paths between vertices) – shortest path problems.

UNIT V:

Matrices: Introduction – operations – inverse – Rank of a matrix, solution of simultaneous linear equations – Eigen values and Eigen Vectors.

Text Books:

1. Discrete Mathematics and its applications, Seventh Edition, Kenneth. H.Rosen, Mc Graw Hill Publishing Company,2012.

2. Discrete Mathematics, M.Venkataraman, N.Sridharan and N.Chandrasekaran, The National Publishing Company,2009.

Unit I	:	Textbook 1	Chapter 1: Sections: 1.1, 1.2, 1.3, 1.4, 1.6
Unit II	:	Textbook 1	Chapter 9: Sections: 9.1, 9.3, 9.4, 9.5, 9.6
Unit III	:	Textbook 1	Chapter 6: Sections: 6.1, 6.2, 6.3
			Chapter 8: Sections: 8.1, 8.2, 8.3
			(Pages: 527 -529only)
			(Exclude algorithms and relations, on page 507 and its related problems)
Unit IV	:	Textbook 1	Chapter 10: Sections: 10.1, 10.2, 10.3, 10.4, 10.6)
Unit V	:	Textbook 2	Chapter 6 :Sections :6.1 to 6.5, and 6.7)

Reference Books:

1. Modern Algebra - S.Arumugam and A. Thangapandi Isaac, Scitech publications, 2005.
2. Invitation to Graph Theory- S.Arumugam and S.Ramachandran, Scitech Publications, 2005, Chennai.
3. Discrete Mathematical Structures with applications to Computer Science - Tremblay and Manohar, McGrawHill, 1997.
4. Mathematical Structure for Compute Sience, Discrete Mathematics and its Appications, Judith L.Gersting, W.H.Freeman and Company, Seventh Edition, 2014.

SBS1: Lab 2: Linux Programming

(2 Hours – 2 Credits)

Section-A

1. Write a Linux script to find the number of users who have logged in.
2. Write a Linux script to see the current date, user name and current directory.
3. Write a Linux script to print the numbers 5,4,3,2,1 using While loop.
4. Write a Linux script to set the attributes of a file.
5. Write a Linux script to convert lowercase to uppercase using trutility.
6. Write a Linux script to copy and rename a file.
7. Write a Linux script to add 5 numbers and find the average.
8. Write a Linux script to convert a decimal number to hexadecimal conversion.
9. Write a Linux script to find the factorial of a number.
10. Write a Linux script to check for palindrome.

Section-B

11. Write a Linux script to display Hello World in Bold, Blink effect and in different colors like red, green etc.
12. Write a Linux script to display a multiplication table.
13. Write a Linux script to perform arithmetic operations using case.
14. Write a Linux script to add two real numbers.
15. Write a Linux script to display the following pattern:1
        22
        333
        4444
        55555
Write a Linux script to find the sum of digits and reversing of a given number.
16. Write a Linux script to display the student mark details.
17. Write a Linux script to prepare electricity bill.
18. Write a Linux script to sort the numbers in ascending order.
19. Write a Linux script
        (i) To create and append a file
        (ii) (ii) To compare two files.

CS3: Object Oriented Programming with C++
(4 Hours - 4 credits)

UNIT I:

Software Crisis – Software Evolution – Basic Concepts of Object-Oriented Programming – Benefits of OOP – Object-Oriented Languages - Applications of OOP – Application of C++ - Structure of a C++ Program – Tokens – Keywords – Identifiers – Basic Data Types – User- defined Data types – Derived data types – Symbolic constants – Type compatibility – Declaration of variables – Dynamic initialization of variables –Reference variables – Operators in C++ - Manipulators

Type cast operator – Expressions and their types-Implicit conversions – Control structures – The main function – Function prototyping – inline functions – Function overloading.

UNIT II:

Specifying a class – Defining member functions – Making an outside function inline – Nesting of member functions – Private member functions – Array within a class – Memory allocation for objects – Static data members – Static member functions – Array of objects - Objects as function arguments –Friendly functions

– Returning objects – Constant member functions – Constructors – Parameterized constructor – Multiple constructors in a class – Constructors with default arguments – Dynamic initialization of objects – Copy constructor – Destructors.

UNIT III:

Defining operator overloading – Overloading unary operators – Overloading binary operators--Overloading binary operators using friend function – Rules for overloading operators - Defining derived classes – Single inheritance – Making a private member inheritable – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance-Virtual base classes – Constructors in derived class – Member classes: Nesting of classes.

UNIT IV:

Pointer to objects – this pointer – Pointers to derived classes – Virtual functions – Pure virtual functions – C++ Stream classes – Unformatted I/O operations – Managing output with manipulators.

UNIT V:

Classes of file stream operations – Opening and Closing files – Detecting end of file – More about open() function – File modes, File pointers and their manipulation – Sequential input and output operations – Command-line arguments- Templates: class templates and function templates.

Text Book:

1. Object Oriented Programming with C++, E. Balagurusamy, Sixth Edition-2013, McGraw Hill Education (India) Private Limited, New Delhi.

Reference Books:

1. C++ - The Complete Reference, Herbert Schildt, TMH, 1998.
2. C++ How to Program, Paul Deitel, Harvey Deitel, PHI, Ninth edition (2014).
3. Ashok N.Kamthane, Object Oriented Programming with ANSI &Turbo C++, Pearson Education, 2006.
4. Object-Oriented Programming With C++, Poornachandra Sarang, 2nd Edition, PHI Learning Private Limited, New Delhi, 2009.
5. Object-Oriented Programming Using C++, Alok Kumar Jagadev, Amiya Kumar Rath and Satchidananda Dehuri, Prentice-Hall of India Private Limited, New Delhi, 2007.

CS4: Lab 3: Object Oriented Programming with C++
(6 Hours - 4 credits)

Section A

1. Printing Prime numbers between two given numbers.
2. Printing 3 digit numbers as a series of words. *(Ex. 543 should be printed out as Five Four Three).*
3. Finding area of geometric shapes using function overloading.
4. Inline functions for simple arithmetic operations.
5. Demonstrating the use of Pre-defined Manipulators.
6. Demonstrating the use of friend function.
7. Creating student mark list using array of objects,
8. Demonstrating constructor overloading.
9. Overloading the unary –operator.
10. Demonstrating single inheritance.
11. Demonstrating the use of **this** pointer.
12. Designing our own manipulator.
13. Illustrating function templates.
14. Illustrating class templates.

Section B

15. Overloading the binary +operator.
16. Demonstrating multiple Inheritance.
17. Demonstrating Multilevel inheritance.
18. Demonstrating Hierarchical inheritance.
19. Demonstrating Virtual functions.
20. Processing mark list using binary file.
21. Count number of objects in a file.
22. Demonstrating the use of Command-linear arguments.

AS2: MATHEMATICAL FOUNDATIONS II
(4 Hours – 4 Credits)

UNIT I:

Introduction to statistics – primary and secondary data – classification, tabulation and Diagrammatic Representation of statistical data – Bar-charts, Pie-diagrams' – Graphical Representation of data – Histograms, Frequency polygon, Ogives.

UNIT II:

Measures of dispersion – characteristics – coefficient of dispersion - Coefficient of variation-Moments – skewness and kurtosis – Pearson's coefficient of skewness - Bowley's coefficient of Skewness – Coefficient of skewness based upon moments.

UNIT III:

Simple correlation – Karl Pearson's coefficient of correlation – correlation coefficient for A bivariate frequency distribution – Rank correlation – Regression lines of regression – Properties of regression coefficient.

UNIT IV:

Events and sets – sample space – concept of probability – addition and multiplications Theorem on probability – conditional probability and independence of evens – Baye's Theorem – concept of random variable – Mathematical Expectation.

UNIT V:

Concept of sampling distributions – standard error – Tests of significance based on t, Chi- square and F distributions with respect to mean, variance.

Text Book:

1. Statistical Methods, S.P.Gupta, Sultan Chand and sons Publications, 4th Edition 2011.

Reference Books:

1. Statistics, Dr. S.Arumugam and A.Thangapandi Issac, New Gamma Publication house, 2002.

2. KishorS. Trivedi - Probability and statistics with reliability queuing and Computer Science Applications - Prentice Hall of India (P) Ltd., New Delhi -1997.

3. Discrete Mathematics - Seymour Lipschutz, Marc Lars Lipson Schaum's Outlines- by, 3rd Edition., Tata McGraw Hill, Education Pvt. Ltd., New Delhi. 5th Reprint, 2012.

SBS2: Design Thinking

(2 Hours – 2 Credits)

UNIT I:

INTRODUCTION TO DESIGN THINKING -Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking, Understanding design thinking and its process model, Design thinking tools. Types of the thinking process.

UNIT II:

EMPATHIZE: Design thinking phases, How to empathize, Role of empathy in design thinking, Understanding empathy tools: Customer Journey Map, Personas.

UNIT III:

IDEATION: Challenges in idea generation, need for systematic method to connect to user, Visualize, Empathize, and Ideate method, Importance of visualizing and empathizing before ideating,

UNIT IV:

PROTOTYPING: What is a prototype? - Prototyping as a mindset, prototype examples, prototyping for products. Process of prototyping- Minimum Viable prototype

UNIT V:

TESTING PROTOTYPES: Prototyping for digital products: What's unique for digital, Preparation; Prototyping for physical products: What's unique for physical products, Preparation.

Text Books:

1. S. Salivahanan, S. Suresh Kumar, D. Praveen Sam, ―Introduction to Design Thinking, Tata Mc Graw Hill, First Edition, 2019.

2. Kathryn McElroy, ―Prototyping for Designers: Developing the best Digital and Physical Products, O'Reilly, 2017.

REFERENCE BOOKS:

1. Michael G. Luchs, Scott Swan, Abbie Griffin, Design Thinking – New Product Essentials from PDMA, Wiley, 2015.

2. Vijay Kumar, ―101 Design Methods: A Structured Approach for Driving Innovation in Your Organization, 2012.

ADDITIONAL LEARNING RESOURCES:

1. https://www.interaction-design.org/literature/article/5-stages-in-the-designthinking-process

2. https://www.ibm.com/design/thinking/page/toolkit

3. https://www.interaction-design.org/literature/article/define-and-frame-your-designchallenge-by-creating-your-point-of-view-and-ask-how-might-we

4. https://www.culturepartnership.eu/en/article/ten-tools-for-design-thinking

5. https://nptel.ac.in/courses/109/104/109104109/

6. https://nptel.ac.in/courses/110106124/

CS5:Data Structures and Computer Algorithms
(4 Hours – 4 Credits)

UNIT I:

Introduction and Overview – Introduction – Basic Terminology; Elementary Data Organization – Data Structure Operations – Complexity of Algorithms – Other Asymptotic Notations for Complexity of Algorithms.

Arrays – Introduction – Linear Arrays – Representation – on Linear Arrays in Memory – Traversing Linear Arrays – Inserting and Deleting – Sorting: Bubble Sort – Searching; Linear Search – Binary Search – Multidimensional Arrays. Linked List – Introduction – Linked Lists – Representation of Linked Lists in Memory – Traversing a Linked List – Memory Allocation; Garbage Collection – Insertion into a Linked List – Deletion from a Linked list.

UNIT II

Stack: Introduction – Stacks – Array Representation of Stacks – Linked Representation of Stacks – Recursion - Tower of Hanoi - Implementation of Recursive Procedures by Stacks - Queue –Linked Representation of Queues – D – Queue

UNIT III

Trees – Introduction – Binary Trees – Representing Binary Trees in memory – Traversal Binary Tree – Traversal algorithms using Stacks – Header Nodes; Threads – Binary Search Trees – Searching and Inserting in Binary Search TreesDeleting in a Binary Search Trees.

Graphs – Introduction – Graph Theory - Terminology – Sequential Representations of Graph-Adjacency Matrix; Path Matrix – Warshall's Algorithm; Shortest Paths.

UNIT IV:

Algorithms: Introduction: What is an Algorithm? – Algorithm Specification – Performance Analysis – Divide and Conquer: General method – Binary Search – Finding the maximum and minimum – Merge Sort – Quick Sort – Selection – Strassen's Matrix Multiplication.

139

UNIT V:

The Greedy Method: General Method – Knapsack problem – Job Sequencing with deadlines – **Minimum cost spanning trees:** Prim's Algorithm – Kruskal Algorithm – Optimal Storage on tapes – Optimal merge patterns – single source shortest path.

Text Books:

1. Data Structures – Seymour Lipschutz –Tata McGraw-Hill -2006

2. Fundamentals of Computer Algorithms, Ellis Horowitz, Sartaj Sahni, Galgotia Publications Pvt. Ltd, New Delhi.

Reference Books:

1. Data Structure and Algorithm Analysis in C – Mark Allen Weiss – Second Edition, Addison Wesley publishing company, 1997.

2. C and C++ Programming Concepts and Data Structures -P.S.Subramanyam - BS Publications, 2013.

3. Data Structures and Algorithms- Alfred V.Aho, John E.Hopcraft and Jeffrey D.Ullman - Pearson Education - Fourteenth Impression -2013

CS6: Lab 4:Data Structures and Computer Algorithms Lab
(4Hours –3 Credits)
Section A
(Programs from Data Structures Using C)

1. Implementing Stack as an array.
2. Implementing Stack as a linked list.
3. Convert Infix expression to Postfix expression using stack.
4. Convert Infix expression to Prefix expression using Stack.
5. Implementing Queue as an Array.
6. Implement Queue as a linked list.
7. Binary tree traversals.
8. Implement Binary Search Tree.

Section B
(Programs from Computer Algorithms Using C++)

1. Linear Search
2. Binary Search
3. Bubble Sort
4. Insertion Sort
5. Merge Sort
6. Quick Sort
7. Selection Sort

CS7: Introduction to Artificial Intelligence
(4 Hours – 4 Credits)

UNIT I:

Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II:

Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems -Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games

UNIT III:

Knowledge Representation First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories -Reasoning with Default Information

UNIT IV:

Software Agents Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

UNIT V:

Applications AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware –Perception – Planning – Moving

Text Books:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2009.

2. Artificial Intelligence: A Modern Approach, 4th Edition, Stuart Russell, peter Norvig University of California at Berkeley, Pearson education, 2020.

3. I. Bratko, ―Prolog: Programming for Artificial Intelligence, Fourth Edition, Addison-Wesley Educational Publishers Inc., 2011.

References:
1. M. Tim Jones, ―Artificial Intelligence: A Systems Approach (Computer Science),
2. Jones and Bartlett Publishers, Inc.; First Edition, 2008
3. Nils J. Nilsson, ―The Quest for Artificial Intelligence, Cambridge University Press, 2009.
4. William F. Clocksin and Christopher S. Mellish, Programming in Prolog: Using the ISO Standard,
5. Fifth Edition, Springer, 2003.
6. Gerhard Weiss, ―Multi Agent Systems, Second Edition, MIT Press, 2013.
7. David L. Poole and Alan K. Mackworth, ― Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.

AS3: Resource Management Techniques
(4 Hours – 4 Credits)

UNIT I:

Development of OR: Definition of OR – Modeling - Characteristics and Phases - Tools, Techniques & Methods - scope of OR.

UNIT II:

Linear Programming Problem: Formulation - Slack & surplus variables

- Graphical solution of LPP.

UNIT III:

Simplex Method: Computational Procedure - Big-M method - Concept of duality in LPP - Definition of primal dual problems - General rules for converting any primal into its dual.

UNIT IV:

Duality Theorems: (without proof) Primal dual correspondence - Duality and Simplex method - Mathematical formulation of assignment problem - Method for solving assignment problem.

UNIT V:

Mathematical formulation of Transportation Problem: Methods for finding IBFS for the Transportation Problems.

Text Book:

1. Operations Research, S.D.Sharma, Kedar Nath Ram Nath & Co.

Reference Books:

1. Operation Research An Introduction, Tenth Edition Global Edition, Hamdy A.Taha, Pearson Publication,2017

2. Operation Research, Nita H.Shah, Ravi M.Gor Hardiksoni, Prentice Hall of India Pvt. Ltd., New Delhi, 2008.

3. Operation Research, R.Sivarethinamohan, Tata McGraw

   Hill, 2005

4. Operations Research – An Introduction b Hamdy A.Taha Ninth Edition, Dorling Kindersley Pvt. Ltd., Noida, India, 2012

SBS3: Lab 5: Python Programming Lab

(2 Hours – 2 Credits)

List of Exercises for Python Programming:

1. Write a Python Program to Print a Multiplication Table for the given number.
2. Write a Python Program to check whether the given number is prime or not.
3. Write a Python Program to display the Fibonacci series for a given number.
4. Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.
5. Write a Python Program to implement List Operations (Nested List, Length, Concatenation, Membership, Iteration, Indexing and slicing).
6. Write a Python Program to Transpose the Matrix.
7. Write a Python Program to implement the simple Calculator.
8. Write a Python Program to Generate the Calendar for the Given Month and Year.
9. Write a Python Program to implement the List Methods (Add, Append, Extend & Delete)
10. Write a Python Program to implement the Breadth first Search Traversal.
11. Write a Python Program to implement the Hangman game.
12. Write a Python Program to sort the sentence in the alphabetical order.
13. Write a Python Program to implement Tic-Tac –Toe game.
14. Write a Python Program to implement the Water jug Problem.
15. Write a Python Program to Find factorial of the given number to implement the simple chat bot.

CS8: Introduction to Machine Learning
(4 Hours – 4 Credits)

UNIT I: Introduction to Machine Learning

Preliminaries, what is machine learning; varieties of machine learning, learning input/output functions, bia, sample application. Boolean functions and their classes, CNF, DNF, decision lists. Version spaces for learning, version graphs, learning search of a version space, candidate elimination methods

UNIT II: Neural Networks

Neural Networks, threshold logic units, linear machines, networks of threshold learning units, Training of feed forward networks by back propagations, neural networks vs. knowledge-based systems

UNIT III: Statistical Learning

Statistical Learning, background and general method, learning belief networks, nearest neighbor. Decision-trees, supervised learning of uni-variance decision trees, network equivalent of decision trees, over fitting and evaluation.

UNIT IV: Logic Programming

Inductive Logic Programming, notation and definitions, introducing recursive programs, inductive logic programming vs decision tree induction.

UNIT V: Computational Theory:

Computational learning theory, fundamental theorem, Vapnik Chernonenkis dimension, linear dichotomies and capacity. Unsupervised learning, clustering methods based on Euclidian distance and probabilities, hierarchical clustering methods. Introduction to reinforcement and explanation-based learning.

Text Books:

1. Introduction to Machine learning, Ethem Alpaydin, Third Edition, MIT Press, 2009.

2. Machine learning for dummies, John Paul Muller, Luca Massaron, Weily, 2nd Edition, 2021.

Reference:

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

CS9: Lab 6: Machine Learning Lab – I
(4 Hours – 3Credits)

List of Exercises for Machine Learning Lab:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV le

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm. Output a description of the set of all hypotheses consistent with the training examples.

3. 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

4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets

5. 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.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library lasses/API.

8. Apply EM algorithm 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. You can add Java/Python ML library lasses/API in the program.

9. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set.

10. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

11. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points.

12. Select appropriate data set for your experiment and draw graphs

CS10: Soft Computing
(4 Hours – 4 Credits)

UNIT I : Introduction
What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.

UNIT II : Neural networks
What is Neural Network, Learning rules and various activation functions, Single layer Perceptrons ,Back Propagation networks, Architecture of Back propagation(BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.

UNIT III : Fuzzy systems
Classical sets – Fuzzy sets – Fuzzy relations – Fuzzification – Defuzzification – Fuzzy rules – Membership function – Knowledge base – Decision-making logic – Introduction to neuro fuzzy system- Adaptive fuzzy system.

UNIT IV : Application of Fuzzy Logic Systems
Fuzzy logic control: Home heating system - liquid level control - aircraft landing-inverted pendulum –fuzzy PID control, Fuzzy based motor control.

UNIT V : Genetic Algorithms
Introduction-Gradient Search – Non-gradient search – Genetic Algorithms: binary and real representation schemes, selection methods, crossover and mutation operators for binary and real coding - constraint handling methods – applications to economic dispatch and unit commitment problems.

Text Books:
1. Laurance Fausett, Englewood cliffs, N.J., 'Fundamentals of Neural Networks', Pearson Education, 1992.
2. James M.Keller, Derong LIU and David b. Fogel "Fundamentals of Computational Intelligence" , Neural Networks, Fuzzy Systems and Evolutionary Computation , IEEE Press,Weily, 2016
3. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Tata McGraw Hill, 1997.
4. Samir Roy, Uditchakraborty, Introduction to soft Computing, Neuro Fuzzy, Genetic algorithms, Pearson Education.

Reference:
1. S.N. Sivanandam and S.N.Deepa, Principles of Soft computing, Wiley India Edition, 2nd Edition, 2013.

AS4: Numerical Methods
(4 Hours – 4 Credits)

UNIT I :

Algebraic and Transcendental Equations: Errors in numerical computation-Iteration method-Bisection method-Regula-Falsi method-Newton-Raphson method-Horner's method.

UNIT II:

Simultaneous Equations: Introduction-Simultaneous equations-Back substitution-Gauss Elimination method-Gauss –Jordan Elimination method- Calculation of Inverse of a matrix- Crout's method-Iterative methods-Gauss- Jacobi Iteration method-Gauss seidal Iteration method-Newton Raphson's method for simultaneous equations.

UNIT III:

Interpolation & Introduction: Newton's interpolation Formulae-Central difference Interpolation formulae-Gauss forward, Gauss backward, Lagrange's interpolation formulae- Divided differences-Newton's divided difference formula-Inverse Interpolation.

UNIT IV:

Numerical Differentiation and Integration: Introduction-Derivates using Newton's forward difference formula-Derivates using Newton's backward difference formula-Numerical Integration-Newton-cotes quadrature formula- Trapezoidal Rule-Simpson's one third rule-Simpson's 3/8 th rule.

UNIT V:

Numerical Solution of Ordinary Differential Equations: Introduction-Taylor series method-Picard's method-Euler's method-Runge-kutta method of second, third, fouth order- Predictor & corrector methods-Mile's method.

Text Book:

1. Numerical Methods, Second Edition, S.Arumugam, A.Thangapandi Issac, A.Somasundaram, SCITECH publications, 2015.

Reference Books:

1. Mathews J.H. Numerical Method for Maths, Science and Engineering; PHI, New Delhi, 2001.

2. Iqbal H. Khan & Q. Hassan Numerical Methods for Engineers and Scientist – Galgotia Publications (P) Ltd., New Delhi, 1997.

3. M.K. Jain, S.R.K. Iyengar & R.K.Jain - Numerical Methods for Scientific and Engineering Computation - New Age International(P) Ltd., New Delhi, 1996.

SBS4: Lab: 7: Open CV Lab

(2 Hours – 2Credits)

List of Exercises for Open CV Lab:

1. Import the Python Laboratories for Numerical and Image processing.
2. Displaying a single image in Open CV.
3. Colour Shapes in Open CV.
4. Using Colour Mask in Open CV.
5. Use Edge Detecting to find the Road Lanes in an Image.
6. Hough Transform Line Detection in Open CV.
7. Converting from RGB To LAB color space in Open CV.
8. Simple Image Thresholding in Open CV.
9. How to set simple blob Detection Params?
10. How we can load the Text File and Extract the First name in Open CV using DNN Model?

CS11:Algorithms in Artificial Intelligence

(5 Hours – 4 Credits)

UNIT I : Introduction to Learning

Algorithmic models of learning, Learning classifiers, functions, relations, grammars, probabilistic models, value functions ,behaviors and programs for experience. Bayesian, maximum some posterior, and minimum description length frameworks.

UNIT II : Computational Learning

Computational Learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting, Dimensionality reduction: Principal component Analysis, feature selection and visualization.

UNIT III : Supervised Learning

Introduction – Types **Supervised Learning Algorithms-**Classification Algorithm: Linear Classification, KNN Classification, Naïve Bayes algorithm, Decision Tree- **Regression Algorithm:**7 Linear Regression, 8 Polynomial Regression- Advantages of supervised Learning.

UNIT IV : Unsupervised Learning

Unsupervised Learning: Clustering, mixture models, k-means clustering, hierarchical clustering, distributional clustering, Reinforcement learning; Learning from heterogeneous, distributed, data and knowledge.

UNIT V : Reinforcement Learning

Definition- Reinforcement Learning Algorithms- characteristics of Reinforcement Learning- Types of Reinforcement Learning - Learning Models of Reinforcement Learning.

Text Books:

1. Bishop, C.(2006).Pattern Recognition and Machine Learning. Berlin:Springer-Verlag

2. Russel, S. And Norving, P. (2003). Artificial Intelligence: A Modern Approach. 2nd Edition, NewYork: Prentice-Hall.

3. Baldi, P., Frasconi, P., Smyth, P.(2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press.

References:

1. Baldi,P., Frasconi, P., Smyth, P.(2003). Modeling the Internet and theWeb–Probabilistic Methods and Algorithms. NewYork:Wiley.

2. Bishop, C.M.Neural Networks for pattern recognition. NewYork: Oxford University press(1995).

4. https://onlinecourses.swayam2.ac.in/aic20_sp06/preview

5. https://onlinecourses.swayam2.ac.in/arp19_ap79/preview

6. https://www.golinuxcloud.com/supervised-learning-algorithms/#Introduction_to_Supervised_Learning_Algorithms

7. https://www.educba.com/supervised-machine-learning-algorithms/

8. https://www.educba.com/supervised-machine-learning-algorithms/

CS12: Machine Learning Techniques
(5 Hours – 4 Credits)

UNIT I : Introduction to Machine Learning

Introduction- overview of machine learning- Different forms of learning- Generative 6 learning- Gaussian parameter estimation- maximum likelihood estimation- MAP estimation- Bayesian estimation- bias and variance of estimators- missing and noisy features- nonparametric density estimation- applications- software tools.

UNIT II : Classification Methods

Classification Methods-Nearest neighbour- Decision trees- Linear Discriminant Analysis - Logistic regression-Perceptrons- large margin classification- Kernel methods- Support Vector Machines. Classification and Regression Trees.

UNIT III : Graphical and sequential models

Graphical and sequential models- Bayesian networks- conditional independence Markov random fields- inference in graphical models- Belief propagation- Markov models- Hidden Markov models- decoding states from observations- learning HMM parameters.

UNIT IV : Clustering Methods

Clustering Methods-Partitioned based Clustering - K-means- K-medoids; Hierarchical Clustering - Agglomerative- Divisive- Distance measures; Density based Clustering - DBScan; Spectral clustering.

UNIT V : Neural networks

Neural networks- the perceptron algorithm- multilayer perceptron's- back propagation nonlinear regression- multiclass discrimination- training procedures- localized network structure- dimensionality reduction interpretation.

Text Books:

1. T. Hastie, R. Tibshirani and J. Friedman, "Elements of Statistical Learning", Springer, 2009.
2. Ethem Alpaydin, "Introduction to Machine Learning", Second Edition, MIT Press, 2010.
3. K. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.

References:

1. C. Bishop, "Pattern Recognition and Machine Learning, Springer", 2006.
2. ShaiShalev-Shwartz, Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2014.
3. John Mueller and Luca Massaron, "Machine Learning For Dummies", John Wiley & Sons, 2016.

CS13: Principles of Deep Learning
(5 Hours – 4 Credits)

UNIT I : Introduction to Learning

TheNeuralNetwork–LimitsofTraditionalComputing–MachineLearning–Neuron–FFNeuralNetworks–TypesofNeurons –Soft max output layers

UNIT II : Deep Learning Models

Tensorflow–Variables–Operations–Placeholders–Sessions–SharingVariables–Graphs–Visualization

UNIT III : CNN

Convolution Neural Network–Feature Selection–Max Pooling–Filters and Feature Maps–Convolution Layer–Applications

UNIT IV : RNN

Recurrent Neural Network–Memory cells–sequence analysis–word 2vec- LSTM—Memory augmented Neural Networks–NTM—Application

UNIT V : Reinforcement Learning

Reinforcement Learning –MDP–Q Learning– Applications

Text Book:

1. Nikhil Buduma, Nicholas Locascio, ‒Fundamentals of Deep Learning: Designing Next Generation Machine Intelligence Algorithms, O'Reilly Media, 2017.

Reference:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning (Adaptive Computation and Machine Learning series", MIT Press, 2017.

CS14: Lab 8: Machine Learning Lab – II
(6 Hours – 4 Credits)

Program List:

1. Exercises to solve the real-world problems using the following machine learning methods:

   Linear Regression
   Logistic Regression
   Multi-Class Classification
   Neural Networks
   Support Vector Machines
   K-Means Clustering & PCA

2. Develop programs to implement Anomaly Detection & Recommendation Systems.

3. Implement GPU computing models to solving some of the problems mentioned in Problem-1.

Text Books:

1. T. Hastie, R. Tibshirani and J. Friedman, "Elements of Statistical Learning", Springer, 2009.

2. E. Alpaydin, "Machine Learning", MIT Press, 2010.

3. K. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.

References:

1. C. Bishop, "Pattern Recognition and Machine Learning, Springer", 2006.

2. ShaiShalev-Shwartz, Shai Ben-David, "Understanding Machine Learning: From Theory to   Algorithms", Cambridge University Press, 2014.

3. https://www.anaconda.com/enterprise-machine-learning-getting-started/

4. https://deepakdvallur.weebly.com/machine-learning-laboratory.html

ES1:1. Ethics And social Implications of AI

(5 Hours – 4 Credits)

UNIT I : Introduction To Ethics Of AI

Role of Artificial Intelligence in Human Life, Understanding Ethics, Why Ethics in AI? Ethical Considerations of AI, Current Initiatives in AI and Ethics, Ethical Issues with our relationship with artificial Entities

UNIT II : Framework And Models

AI Governance by Human-right centered design, Normative models, Role of professional norms, Teaching Machines to be Moral

UNIT III : Concepts And Issues

Accountability in Computer Systems, Transparency, Responsibility and AI. Race and Gender, AI as a moral right-holder

UNIT IV : Perspectives And Approaches

Perspectives on Ethics of AI, Integrating ethical values and economic value, Automating origination, AI a Binary approach, Machine learning values, Artificial Moral Agents

UNIT V : Cases And Application

Ethics of Artificial Intelligence in Transport, Ethical AI in Military, Biomedical research, Patient Care, Public Health, Robot Teaching, Pedagogy, Policy, Smart City Ethics.

Text Book:

1. Paula Boddington, "Towards a Code of Ethics for Artificial Intelligence", Springer, 2017

2. Markus D. Dubber, Frank Pasquale, Sunit Das, "The Oxford Handbook of Ethics of AI", Oxford University Press Edited book, 2020

3. S. Matthew Liao, "Ethics of Artificial Intelligence", Oxford University Press Edited Book, 2020

References Book:

1. Wallach, W., & Allen, C, "Moral machines: ceaching robots right from wrong", Oxford University Press, 2008.

2. Bostrom and E. Yudkowsky. "The ethics of artificial intelligence". In W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, Cambridge, 2014.

ES1: 2.Digital Image Processing
(5 Hours – 4 Credits)

Unit I:

Introduction to Image Processing System: Introduction-Image sampling-Quantization - Resolution - Human Visual system - Classification of digital images. Elements of image processing system.

Unit II:

ImageTransforms: Introduction-Needfortransform-Imagetransforms.**ImageEnhancement:**Introduction–spatialdomainmethods-frequencydomainmethods–pointoperations–Histogrammodeling.

Unit III:

Image restoration and Denoising: Introduction – Image degradation- Types of image blur-classification of image restoration techniques-image restoration model. Image segmentation: Introduction–Classification–Region approach to image segmentation – clustering techniques - Edge based segmentation–classification of edges-Edge detection.

Unit IV:

Object recognition: Introduction – Need for object recognition system – Patterns and pattern classes–Selection of measurement parameters-Relationship between image processing and object recognition Image compression: Introduction–Need for image compression–Redundancy in images–Image compression scheme–Classification.

Unit V:

Binary image processing–Introduction–Binarisation–Mathematical morphology-logical operations- Structure elements – Morphological image processing – Standard binary morphological–operations-dilation and erosion based operations properties of morphological based operations.

Text Books:

1. S.Jayaraman, S.Esakkirajan, T.Veerakumar Digital Image Processing, Tata Mc Graw Hill Publication, 2009
2. Madhuri A. Joshi, Digital Image Processing –An algorithmic approach, PHI Learning Pvt. Ltd, 4th Edition, 2009
3. Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods, 4thEdition, Pearson Education, 2009.
4. Digital Image Processing , S. Jeyaraman S. Esakkirajan T Veera Kumar, Mc Graw Hill,2009.

References:

1. Digital Image Processing using MATLAB Rafael C. Gonzalez, Richard E. Woods,2nd Edition, Prentice Hall of India, 2002.

2. Fundamentals of Digital Image Processing A.Jain, Prentice Hall of India.

3. IRMA International, Image Processing: Concepts, Methodologies, Tools and Applications , Idea Group, U.S, 2013.

ES1: 3. Operating System
(5 Hours – 4 credits)

UNIT I:

Introduction to Operating Systems: Introduction, What is an Operating systems, Operating system components and goals, Operating systems architecture. Process Concepts: Introduction, Process States, Process Management, Interrupts, Inter process Communication.

UNIT II:

Asynchronous Concurrent Execution: Introduction, Mutual Exclusion, Implementing Mutual Exclusion Primitives, Software solutions to the Mutual Exclusion Problem, Hardware solution to the Mutual Exclusion Problem, Semaphores. Concurrent Programming: Introduction, Monitors.

UNIT III:

Deadlock and Indefinite Postponement: Introduction, Examples of Deadlock, Related Problem Indefinite Postponement, Resource concepts, Four Necessary conditions for Deadlock, Deadlock solution, Deadlock Prevention, Deadlock Avoidance with Dijkstra's Banker's algorithm, Deadlock Detection, Deadlock Recovery.

Processor Scheduling: Introduction, Scheduling levels, Preemptive Vs Non-Preemptive Scheduling Priorities, Scheduling objective, Scheduling criteria, Scheduling algorithms.

UNIT IV:

Real Memory Organization and Management: Introduction, Memory organization, Memory Management, Memory Hierarchy, Memory Management Strategies, Contiguous Vs Non-Contiguous Memory allocation, Fixed Partition Multi programmimg, Variable Partition multiprogramming.

Virtual Memory Management: Introduction, Page Replacement, Page Replacement Strategies, Page Fault Frequency (PFF) Page replacement, Page Release, Page Size.

UNIT V:

Disk Performance Optimization: Introduction, Why Disk Scheduling is necessary, Disk Scheduling strategies, Rotational optimization.

File and Database Systems: Introduction, Data Hierarchy, Files, File Systems, File Organization, File Allocation, Free Space Management, File Access control

Text Book:

1. Operating Systems, Deitel & Deitel Choffnes, Pearson education, Third edition, 2009.

2. Operating Systems, A Systematic view, Devis & Rajkumar, Pearson education, sixth edition.

Unit I	:	Chapter 1: 1.1, 1.2, 1.12, 1.13 & Chapter 3: 3.1, 3.2, 3.3, 3.4, 3.5
Unit II	:	Chapter 5: 5.1, 5.2, 5.3, 5.4(up to 5.4.2), 5.5, 5.6 & Chapter 6: 6.1, 6.2
Unit III	:	Chapter 7: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10 Chapter 8: 8.1, 8.2, 8 3, 8.4, 8.5, 8.6, 8.7
Unit IV	:	Chapter 9: 9.1, 9 2, 9.3, 9 4, 9.5, 9.6, 9.8, 9.9 Chapter 11: 11.1, 11.5, 11.6, 11.8, 11.9, 11.10
Unit V	:	Chapter 12: 12.1, 12.4, 12.5, 12.6 Chapter 13: 13.1, 13 2, 13.3, 13.4, 13.5, 13.6, 13.7, 13.8

Reference Books:

1. An introduction to Operating systems concepts and Practice, Pramod Chandra P. Bhatt, PHI, Second Edition, 2008.

2. Operating System Concepts, Abraham Silberschatz Peter Galvin Greg Gagne, 6th edition Windows XP Update, Wiley India edition,2007.

3. Operating Systems Principles and Design, Pal Choudhury, PHI Learning,2011.

NME1: Introduction to Computers and Office Automation
(2 Hours – 2 Credits)

UNIT I:

Introduction to Computer and Information Technology: History, Computer system concepts-Computer system characteristics- Capabilities and limitations- Types of computers- Generations. **Computer organization and working:** Introduction-The Control Unit ALU- Memory-Read only memory (ROM).

UNIT II:

Input Devices: Introduction- Keyboards-Mouse-Joysticks-Optical Recognition input-Scanners-Bar coders-Digital camera-MICR-Card reader-Web Cameras- Light pens-

Trackball- Touch screens-Touch pad-Digitizer-Voice input-Voice recognizers. **Output Devices**: Introduction-Monitors and Displays- Multimedia Projector-Printers-Graphics Output Devices-Plotters-Flatbed Plotters-Drum Plotters. **Storage Devices:** Introduction- Hard Disk Drives –CD-ROMs and DVDs – Magnetic tape –Erasable disks.

UNIT III:

Microsoft Office 2007 and Word Processing: Introduction to Microsoft Office 2007 - Microsoft Word Screen. **Microsoft Word**: Working with Document in Word 2007 – Introduction – saving the file – Formatting, Alignment of text, Applying fonts-Spell checking- Borders and shading – Closing of the file, Editing document, Autocorrect-Auto format-Find and Replace, Page numbering, header and footer- Footnotes and endnotes- splitting panes-Tiling of the documents- using mail merge in Word2007.

UNIT IV:

Microsoft Office   Excel 2007: Understanding Spreadsheets-Creating a Worksheet in Microsoft Excel 2007- Copying formula – Styles –functions in Excel – Using Auto calculate–References –Sum, Average functions.

UNIT V:

Creating Charts in Excel 2007-Auditing a workbook – Comments Inserting – Function wizard-Goal seeking- Typing with Auto fill- Formatting numbers and Labels – changing the size of Rows and columns- Add or Remove a sheet – Protect a worksheet-Applying themes.

Text Book:

1. Learning computer fundamentals, MS Office and Internet & Web technology, Dinesh Maidasani, Firewall Media, Third Edition, 2014.

Unit I:	Section A-1, 2
Unit II:	Section A- 3,4,5
Unit III:	Section B- 2,3
Unit IV:	Section B- 4 (up to Functions in Excel)
Unit V-:	Section B- 4(From Creating Charts in Excel)

Reference Books:

1. A Beginners Guide to Computers – Alexis Leon & Mathews Leon-Vikas Publishing House Pvt. Ltd.,2001.

2. Fundamentals of Computers, P. Mohan, Himalaya Publishing House, Revised Edition,2010.

3. Fundamentals of Computers, V. Rajaraman, PHI Publication, Fifth Edition,2010.

SBS5: Lab 9: Open Source Technology Lab
(Hours- 2 Credits)

SECTION A

Write PHP programs for the following

1. To demonstrate all array operations (array_search(),array_diff(),array_combine(),array_match(),sort()
2. To demonstrate all control statements (find factorial of the given number using IF, While, Do-while.)
3. To display inventory table using Key & value pairs
4. To print student table using key & value pairs and search particular student number(whether it is present or not)
5. To illustrate user defined function (define all function type)
6. Function without input argument and no return value.
7. Function without input argument and return value.
8. Function with input argument and no return value.
9. Function with input argument and return value.
10. Function with default argument.
11. To find factorial of the given number using recursion
12. To calculate nCr using include command to include the factorial function
13. Write a PHP program to store current date-time in a COOKIE and display the 'Last visited on' date-time on the web page upon reopening of the same page. To perform string manipulation
14. To process personal details using File
15. To design an student mark database using HTML Form and process usingPHP

SECTION B
Write SQL programs for the following:

1. 1 Create a table Student-master with the following fields client_no, name, address, city, state, pincode, remarks, bal_due with suitable data types.
2. Create another table supplier_table from client_master. Select all the fields and rename client_no with supplier_no and name with supplier_name.
3. Insert data into client_master
4. Insert data into supplier_master from client_master.
5. Delete the selected row in theclient_master.
6. Create a table sales_order with s_order_no and product_no as primary key. Set other fields to store client number, delivery address, delivery date, order status.

158

7. Add a new column for storing salesman number using ALTER Command.
8. Set the s_order_no as foregin key as column constraints.
9. Set the s_order_no as foreign key as tableconstraints.
10. Enforce the integrity rules usingCHECK.
11. Create a table student_master with the following fields name, regno, dept and year with suitable data types. Use Select command to do thefollowing.
12. Select the student's namecolumn.
13. Eliminate the duplicate entry intable.
14. Sort the table in alphabeticalorder.
15. Select all the Students of a particulardepartment.
16. Create a table sales_order_details with the s_order_no as primary key and with the following fields: product_no, description, qty_ordered, qty_disp,product_rate, profit_percent, sell_price, supplier_name.
    a. Select each row and compute sell_price*.50 and sell_price*1.50 for each rowselected.
    b. Select product_no, profit_percent, Sell_price where profit_per is not between 10 and 20 both inclusive.
    c. Select product_no, description, profit_percent, sell_price where profit_percent is not between 20 and 30.
    d. Select the supplier name and product_no where supplier name has 'r' or 'h'as second character.

CS15: Internet of Things and Robotics
(5 Hours – 4 Credits)

UNIT I:

Internet of things: Overview, technology of the internet of things, enchanted objects, Design principles for connected devices, Privacy, Web thinking for connected devices

UNIT II:

Writing Code: building a program and deploying to a device, writing to Actuators, Blinking Led, Reading from Sensors, Light Switch, Voltage Reader, Device as HTTP Client, HTTP, Push Versus Pull

UNIT III:

Pachube, Netduino, Sending HTTP Requests—the Simple Way, Sending HTTP Requests—the Efficient Way

UNIT IV : Introduction to Robotics

IntroductiontoRobotics:Classification,Components,Characteristics,Applications.

159

UNIT V : Robotics Kinematics

Robotics Kinematics: Position Analysis, Robots as Mechanisms, Matrix Representation, Transformation Matrices, Forward and Inverse Kinematics.

Text Books:

1. Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", John Wiley & Sons, 2013.

2. CunoPfister, "Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud, Maker Media, 2011.

3. Rob Barton, Gonzalo Salgueiro, David Hanes, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Cisco Press, 2017.

4. 5.SaeedB.Niku,IntroductiontoRoboticsAnalysis,Application,PearsonEducationAsia, 2001

References:

1. Radomir Mihajlovic, Muthu Ramachandran, Reinhold Behringer, Petar Kocovic "Emerging Trends and Applications of the Internet of Things", IGI Global, 2017.
2. HwaiyuGeng, "Internet of Things and Data Analytics Handbook", John Wiley & Sons, 2017.
3. Marco Schwartz, "Internet of Things with Arduino Cookbook", Packt Publishing, 2016.

CS16: Natural Language Processing
(5 Hours – 4 Credits)
UNIT I : Introduction to NLP

Introduction: application of NLP techniques and key issues- MT grammer checkers- dictation – document generation- NL interfaces- Natural language processing key issues- the different analysis levelusedforNLP:morpho-lexical-syntactic-semantic-pragmatic-markup(TEI,UNICODE)-finitestateautomata-Recursiveandaugmentedtransitionnetworks

UNIT II : Lexical Level

Lexical level: error tolerant lexical processing(spelling error correction)-transducers for the design of morphologic analyzers features-towards syntax: part-of-speech tagging (BRILL, HMM)- efficient representations for linguistic sources (lexica, grammars,….) tries and finite state automata.

UNIT III : Syntactic Level

Syntactic level: grammars(eg.formal/Chomsky hierarchy, DCSGs, systematic case, unification, stochastic)- parsing (top-down, bottom up, char(early algorithm),CYK algorithm)- automated estimation of probabilistic model parameters(inside-outside algorithm)- data oriented parsing- grammar formalisms and tree banks-efficient patsing for context-free grammars (CFGs).

UNIT IV : Semantic Level

Semantic level: logical forms - ambiguity resolution - semantic network and parsers-procedural semantics - montague semantics- vector space approaches - distributional semantics-**lexical** semantics and word sense disambiguation-compositional semantics semantic role labeling and sematic parsing

UNIT V : Pragmatic Level

Pragmatic level: knowledge representation- reasoning- plan/goal recognition –speech acts/intentions – belief models- discourse- reference. Natural language generation: content determination – sentence planning- surface realization, subjectivity and sentiment analysis: information extraction – automatic summarization- information retrieval and question answering– named entity recognition and relation extraction.

Text Book(s)

1. Danie lJ and JamesH. Martin, An Introduction to natural language processing, computation a linguistics and speech recognition prenticehall,2009.

Reference Book(s)

1. 1.LanH Written and Elbef, Mark A. Hall, datamining: practical machine learning tools and techiniques, Morgan Kaufmann, 2013.

2. Mohamed ZakariaKurdi, Natural Language Processing and Computational Linguistics 1, speech, Morphology, and syntax, wiley, ISTE Ltd, 2016.

CS17:Lab :10:Natural Language ProcessingLab

LIST OF PROGRAMS

1. Implementing word similarity
2. Implementing simple problems related to word disambiguation
3. Simple demonstration of part of speech tagging.
4. Lexical analyzer.
5. Semantic Analyzer.
6. Sentiment Analysis**.**

Text Book(s)

1. Daniel J and James H. Martin, speech and language processing an introduction to natural language processing, computational linguistics & speech recognition, Prentice hall, 2009.

Reference Book(s)

1. Lan H Written and Elbef, Mark A.Hall, Datamining: practical machine learning tools and techniques, Morgan Kaufmann, 2013.

ES2: 1.Data Science with R Programming For AI
(5 Hours - 4 Credits)

UNIT I : Introducing to R

R Data Structures–HelpFunctionsinR–Vectors–Scalars–Declarations–Recycling–CommonVectorOperations–Usingallandany–Vectorizedoperations–NAand   NULL values – Filtering – Vectorised if-then else – Vector Element names.

UNIT II : Matrices

Creating matrices – Matrix Operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns-Vector/Matrix Distinction–Avoiding Dimension Reduction–Higher Dimensional arrays–lists–Creating lists–Generalist operations–Accessing list components and values–applying functionsto lists – recursive lists.

UNIT III : Data Frames

Creating Data Frames – Matrix-like operations in frames – merging Data frames – Applying functions to Data Frames – Factors and Tables – Factors and levels – Common Functions used with factors – Working with tables – Other factors and table related functions – Control statements – Arithmetic and Boolean operators and values – Default Values for arguments – Returning Boolean Values–Functionsareobjects–Environmentandscopeissues–WritingUpstairs–Recursion–Replacementfunctions –Tools for Composing function code–Math and Simulation in R.

UNIT IV : Classes

S3 Classes – S4 Classes – Managing your objects – Input/output – accessing keyboard and monitor – reading and writing files–accessing the internet–String Manipulation–Graphics–Creating   Graphs–Customizing   Graphs–   Saving Graphstofiles– Creating Three-Dimensional plots.

UNIT V : Interfacing R

Interfacing R to other languages – Parallel R–Basic Statistic s– Linear Model–Generalized Linearmodels–Non-linearModels–TimeSeriesandAuto-Correlation–Clustering.

Text Books

1. Norman Matloff,―The Art of R Programming: A Tour of Statistical Software Design, No Starch Press,2011.
2. Jared P. Lander, ―R for Everyone: Advanced Analytics and Graphics, Addison-Wesley Data & Analytics Series,2013.

Reference Books

1. MarkGardner,―BeginningR–TheStatisticalProgrammingLanguage‖,Wiley,2013.

2. RobertKnell,―IntroductoryR:ABeginner'sGuidetoDataVisualisation,StatisticalAnalysis and programming in R‖ , Amazon Digital South Asia Services Inc, 2013. Richard Cotton (2013). Learning R,O'Reilly Media.

3. Garret Grolemund (2014). Hands-onProgrammingwithR.O'ReillyMedia,Inc.

4. Roger D.Peng (2018).R Programming for Data Science. Lean Publishing

ES2:2. Data Mining and Ware Housing
(5 Hours - 4 Credits)

UNIT I:

Introduction: Data mining application – data mining techniques – data mining case studies the future of data mining – data mining software. **Association rules mining:** Introduction -Basics-task and a Naive algorithm- A priori algorithm – improve the efficiency of the A priori algorithm – mining frequent pattern without candidate generation (FP-growth)performance evaluation of algorithms.

UNIT II:

Data warehousing: Introduction – Operational data sources- data warehousing – Data Warehousing design – Guidelines for data warehousing implementation - Data warehousing -Metadata. **Online analytical processing (OLAP):** Introduction – OLAP characteristics of OLAP system – Multidimensional view and data cube - Data cube implementation – Data Cube operations OLAP implementation guidelines.

UNIT III:

Classification: Introduction – decision tree – over fitting and pruning - DT rules – Naïve Bayes method- estimation predictive accuracy of classification methods - other evaluation criteria for classification method – classification software.

UNIT IV:

Cluster analysis: cluster analysis – types of data – computing distances- types of cluster analysis methods - partitioned methods – hierarchical methods – density based methods – Dealing with large databases – quality and validity ofcluster analysis methods – cluster analysis software.

UNIT V:

Web data mining: Introduction- web terminology and characteristics- locality and hierarchy in the web- web content mining-web usage mining- web structure mining – web mining software. **Search engines:** Search engines functionality- search engines architecture – Ranking of web pages.

Text Books:

1. Introduction to Data mining with case studies,3rd Edition G.K. Gupta, PHI Private limited, New Delhi, 2014.

   Unit I : Chapters 1 &2
   Unit II : Chapters 7 & 8
   Unit III : Chapter3
   Unit IV: Chapter4
   Unit V : Chapters 5 & 6

Reference Books

1. Data Warehousing, Data Mining & OLAP, Alex Berson and Stephen J. Smith, Tata McGraw Hill Edition, Tenth Reprint2007

2. Data Mining Concepts and Techniques, Jiawei Han and MichelineKamber, Second Edition, Elsevier,2007

3. Insights into Data Mining K.P. Soman, ShyamDiwakar, V. Ajay, Theory and Practice, PHI Publications Eastern Economy Edition 6th Printing.

ES2: 3.Software Engineering
(5 Hours- 4 Credits)

UNIT I:

Introduction to Software Engineering: Some Definitions – Some Size factors – Quality and Productivity Factors – Managerial Issues. **Planning a Software Project:** Defining the Problem – Developing a Solution Strategy – Planning the Development Process – Planning an Organizational Structure – Other Planning Activities.

UNIT II:

Software Cost Estimation: Software Cost Factors – Software Cost Estimation Techniques – Staffing-Level Estimation – Estimating Software Maintenance Costs.

UNIT III:

Software Requirements Definitions: The Software Requirements Specification – Formal Specification Techniques – Languages and Processors for Requirements Specification.

UNIT IV:

Software Design: Fundamental Design Concepts – Modules and Modularization Criteria – Design Notations – Design Techniques – Detailed Design Considerations – Real-Time and Distributed System Design – Test Plans – Milestones, Walkthroughs, and Inspections - Design Guidelines.

UNIT V:

Verification and Validation Techniques: Quality Assurance – Static Analysis – Symbolic Execution – Unit Testing and Debugging – System Testing – Formal Verification.

Software Maintenance: Enhancing Maintainability During Development – Managerial Aspects of Software Maintenance – Configuration Management – Source-Code Metrics – Other Maintenance Tools and Techniques.

Text book:

Software Engineering Concepts, Richard Fairley, Tata McGraw Hill Publishing Company Limited, NewDelhi, 2017.

        Unit I   : Chapters: 1.1 – 1.4, 2.1-2.5
        Unit II   : Chapters: 3.1 -3.4
        Unit III   : Chapters: 4.1 – 4.3
        Unit IV   : Chapters: 5.1 –5.9
        Unit V   : Chapters: 8.1, 8.3 – 8.7, 9.1 – 9.5

Reference Books:

1. Software Engineering – K.L.James, Prentice Hall of India Pvt. Ltd., New Delhi, 2009.
2. Fundamentals of Software Engineering – Rajib Mall, Prentice Hall of India Pvt. Ltd., New Delhi,2003.
3. Software Engineering (A Practitioner's Approach) - Roger. S.Pressman. McGraw Hill Publication, International Edition, 5th Edition. 2001.

SBS6: Quantitative Aptitude
(2 Hours - 2 Credits)

UNIT I: Numbers - HCF & LCM of numbers – Decimal Fractions

UNIT II: Square roots and Cube roots- Average – Problems on ages.

UNIT III: Percentage – Profit and Loss – Ratio and Proportion.

UNIT IV: Time and Work – Time and Distance.

UNIT V: Simple Interest – Compound Interest.

Text Book:

1. Quantitative Aptitude, R.S. Aggarwal, S. Chand & Company Ltd, New Delhi, Reprint, 2011.

Unit I	:	Page nos. 3-29, 30-45, 46-66
Unit II	:	Page nos. 117-138, 139-160, 182-194
Unit III	:	Page nos.208-250, 251-293, 294-310
Unit IV	:	Page nos.341-370, 384-404
Unit V	:	Page nos.445-465, 466-486

Reference Books:

1. Quantitative Aptitude and reasoning, R.V. Praveen, PHI Learning, 2ndEdition 2013. 2.Magical book on Quicker Maths, M.Tyra, BSC Publishing Co. Pvt.Ltd, Delhi. Reprint,2011.

2. Quantitative Aptitude for Competitive Exams, Abhijit Guha, 4th Edition, Tata McGraw Hill Company, New Delhi.

NME2: Introduction to Internet
(2 Hours – 2 Credits)

UNIT I:

Introduction to internet: Internet- Growth of Internet and ARPANet - Owners of the Internet -Anatomy of Internet – History of WWW - Basic Internet Terminologies – Net etiquette - Internet Applications - Commerce on the Internet

Governance on the Internet - Impact of Internet on Society.**TCP/IP Internet Technology and Protocols:** Packet Switching Technology - Internet Protocols - TCP/IP – Router - Internet Addressing Scheme- Machine Addressing - E-mail Addresses – Resource Addresses.

UNIT II:

Interconnectivity: Connectivity types - Setting up a connection - Hardware requirements- Selection of a modem - Software requirements – Internet accounts by ISP-ISDN-Protocol options-Service options. **Internet Network:** Network Definition-Common terminologies – Node - Host- Workstation -Network Administrator - Network security - Network Components – Servers-client Server- Communication Media - Types of Networks - Addressing in Internet – DNS - Network topologies – Ethernet – FDDI - ATM.

UNIT III:

Browsers and Search engines: Browsers - What is a browser? – Parts of a browser window-Running a browser - working with a Browser. **Search engines**: What is search engine? - Types of search engines - Search and meta search engines.

UNIT IV:

E-mail: E-mail - E-mail Networks and Servers - E-mail Protocols - Structure of E-mail - Attachments – E-mail Clients - E-mail Clients - web based E-mail- Address book – Signature File.

UNIT V:

HTML Programming Basics: Introduction to HTML – HTML browsers - Different versions of HTML-HTML tags - Document overview - Header elements - Section headings - Block headings - Lists-Inline elements – Images - working with Tables, Forms, Frames.

Text book:

1. Internet Technology and Web design, Ramesh Bangia, Firewall Media, (An imprint of Lakshmi Publications Pvt. Ltd.), Third Edition, 2011.

   Unit I   : Chapters 1 and 2
   Unit II   : Chapters 3 and4
   Unit III   : Chapter 5(5.6), Chapter 8(8.11 &8.13)
   Unit IV   : Chapter 5 (5.1) & Chapter6
   Unit V   : Chapter 9

Reference Books:

1. The Internet Book, Douglas E. Comer, Fourth Edition, PHI Learning Pvt. Ltd. , New Delhi, 2009.

2. Using the Internet the Easy Way, Young Kai Seng, Minerva Publications, First Edition, 2000.

3. Fundamentals of Information Technology By Alexis Leon and Mathews sLeon, Vikas Publishing House Pvt. Ltd., Revised Edition.

* * *