COURSE STRUCTURE
and
DETAILED SYLLABI

for

Two Year PG Programme

MCA
(Master of Computer Applications)

(Applicable for batches admitted from 2025-26)

Department of Computer Science & Engineering
University College of Engineering Kakinada(A)
JNTUK, Kakinada

VISION OF THE INSTITUTE

To be a premier institute of excellence developing highly talented holistic human capital that contributes to the nation through leadership in technology and innovation through engineering education.

MISSION OF THE INSTITUTE

1. To impart Personnel Skills and Ethical Values for Sustainable Development of the Nation.
2. To create Research & Industry oriented centre of excellence in all engineering disciplines.
3. To be a renowned IPR generator and repository for innovative technologies.
4. To develop Research and Industry oriented technical talent.
5. To benchmark globally the academic & research output.

VISION OF THE DEPARTMENT

Department of Computer Science and Engineering strives rigorously to impart intellectual environment with global standards that fosters the search for new knowledge in a highly dynamic computing-centric society through research & applied efforts.

MISSION OF THE DEPARTMENT

- To provide quality education in both theoretical and applied foundations of computer science and train the students to solve the real world problems effectively thus enhancing their potential for high quality careers.
- To facilitate the students and faculty to inculcate the research culture to advance the state art of computer science and integrate research innovations in multidisciplinary fields.
- To equip student / faculty with excellent teaching learning capabilities through advanced learning tools and technologies.
- To produce students with critical thinking and lifelong learning capabilities to apply their knowledge to uplift the living standards of the society.
- To produce students with enriched skill set, professional behavior, strong ethical values and leadership capabilities so as to work with commitment for the progress of the nation.

Programme Educational Objectives (PEOs)

After 2 years of graduation the graduate shall be able to

PEO 1 To produce IT professionals with in depth knowledge in software design, programming and analytical skills to cater the challenging industrial and societal needs in an effective manner with ethics and human values.

PEO 2 To produce Sustained learner to bring out creative and innovative ideas by addressing the research issues/ to serve as faculty for IT education.

PEO 3 To produce entrepreneurs in IT with good interpersonal and managerial skills to survive in multidisciplinary fields.

Programme Outcomes (POs)

After completion of MCA course students will attain the following programme outcomes:

PO1 **(Foundation Knowledge):** Apply the knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.

PO2 **(Problem Analysis):** Identify, review, formulate and analyse problems primarily focusing on customer requirements using critical thinking frameworks.

PO3 **(Development of Solutions):** Design, Develop and investigate problems with an innovative approach for solutions incorporating ESG / SDG goals.

PO4 **(Modern Tool Usage):** Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.

PO5 **(Individual and Teamwork):** Function and Communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.

PO6 **(Project Management and Finance):** Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management.

PO7 **(Ethics):** Commit to professional ethics in managing software projects with financial aspects. Learn to use the new technologies for cyber security and insulate customers from malware.

PO8 **(Life –long learning):** Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

Programme Specific Outcomes (PSOs)

PSO1 Design, develop and implement interdisciplinary application software projects to meet the demands of industry requirements using modern tools and technologies.

PSO2 Analyze the societal needs to provide novel solutions through technological based research.

PSO3 Inculcate employability and entrepreneur skills among students who can develop customized solutions for small to large Enterprises

REVISED Bloom's Taxonomy Action Verbs

Definitions	I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Bloom's Definition	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.
Verbs	• Choose • Define • Find • How • Label • List • Match • Name • Omit • Recall • Relate • Select • Show • Spell • Tell • What • When • Where • Which • Who • Why	• Classify • Compare • Contrast • Demonstrate • Explain • Extend • Illustrate • Infer • Interpret • Outline • Relate • Rephrase • Show • Summarize • Translate	• Apply • Build • Choose • Construct • Develop • Experiment with • Identify • Interview • Make use of • Model • Organize • Plan • Select • Solve • Utilize	• Analyze • Assume • Categorize • Classify • Compare • Conclusion • Contrast • Discover • Dissect • Distinguish • Divide • Examine • Function • Inference • Inspect • List • Motive • Relationships • Simplify • Survey • Take part in • Test for • Theme	• Agree • Appraise • Assess • Award • Choose • Compare • Conclude • Criteria • Criticize • Decide • Deduct • Defend • Determine • Disprove • Estimate • Evaluate • Explain • Importance • Influence • Interpret • Judge • Justify • Mark • Measure • Opinion • Perceive • Prioritize • Prove • Rate • Recommend • Rule on • Select • Support • Value	• Adapt • Build • Change • Choose • Combine • Compile • Compose • Construct • Create • Delete • Design • Develop • Discuss • Elaborate • Estimate • Formulate • Happen • Imagine • Improve • Invent • Make up • Maximize • Minimize • Modify • Original • Originate • Plan • Predict • Propose • Solution • Solve • Suppose • Test • Theory

COURSE STRUCTURE

and

DETAILED SYLLABI

Master of Computer Applications

(Applicable for batches admitted from 2025-26)

I Semester

S.No	Course Code	Course Name	Category	L	T	P	C	Assessment	
								Internal	External
1	MCA1101	Data Structures	PC	3	0	0	3	40	60
2	MCA1102	Computer Organization	PC	3	0	0	3	40	60
3	MCA1103	Database Management Systems	PC	3	0	0	3	40	60
4	MCA1104	Operating Systems	PC	3	0	0	3	40	60
5	MCA1105	Mathematical and Statistical Foundations	BS&H	3	1	0	4	40	60
6	MCA1106	Database Management Systems Lab	PC	0	0	3	1.5	40	60
7	MCA1107	Data Structures using C Lab	PC	0	0	4	2	40	60
8	MCA1108	Operating Systems and Linux Lab	PC	0	0	3	1.5	40	60
			Total	15	1	10	21		

II Semester

S.No	Course Code	Course Name	Category	L	T	P	C	Assessment	
								Internal	External
1	MCA1201	Computer Networks	PC	3	0	0	3	40	60
2	MCA1202	Network Security and Cyber Security	PC	3	0	0	3	40	60
3	MCA1203	Object Oriented Programming Using JAVA	PC	3	0	0	3	40	60
4	MCA1204	Software Engineering	PC	3	0	0	3	40	60
5	MCA1205	Artificial Intelligence	PC	3	0	0	3	40	60
6	MCA1206	**Program Elective-1** 1. Design and Analysis of Algorithms 2. Advanced Unix Programming 3. Data Warehousing and Data mining 4. MOOCS-1(NPTEL /SWAYAM) Course with prior approval of BoS (Recommended minimum 12 week course with 3 credits)	PE	3	0	0	3	40	60
7	MCA1207	Object Oriented Programming Using JAVA Lab	PC	0	0	3	1.5	40	60
8	MCA1208	Networks and Security Lab	PC	0	0	3	1.5	40	60
9	MCA1209	Employability Skills-1[$]	AC	1	0	0	0	40	--
			Total	19	0	6	21		

[$]Internal Evaluation

Note: Internship / Industry Oriented Mini Project can be done during *Year break (II sem to III Sem)* and evaluated during III Sem.

III Semester

S.No	Course Code	Course Name	Category	L	T	P	C	Assessment	
								Internal	External
1	MCA2101	Machine Learning using Python	PC	3	0	0	3	40	60
2	MCA2102	Full Stack Development	PC	3	0	0	3	40	60
3	MCA2103	Big Data Technologies	PC	3	0	0	3	40	60
4	MCA2104	**Program Elective-2** 1. Cloud Computing 2. Image Processing 3. Internet of Things 4. MOOCS-2(NPTEL /SWAYAM) Course with prior approval of BoS (Recommended minimum 12 week course with 3 credits)	PE	3	0	0	3	40	60
5	MCA2105	Human Resource Management	BS &H	3	0	0	3	40	60
6	MCA2106	Full Stack Development Lab	PC	0	0	3	1.5	40	60
7	MCA2107	Machine Learning with Python Lab	PC	0	0	4	2	40	60
8	MCA2108	Big Data Technologies Lab	PC	0	0	3	1.5	40	60
9	MCA2109	Employability Skills–2[$]	AC	1	0	0	0	40	--
10	MCA2110	Internship / Industry Oriented Mini Project	PR	-	-	-	2	50	--
			Total	16	-	10	22		

[$]Internal Evaluation

IV Semester

S.No	Course Code	Course Name	Category	L	T	P	C	Assessment	
								Internal	External
1	MCA2201	**Program Elective-3** 1. Generative AI 2. Blockchain Technologies 3. Digital Marketing 4. MOOCs-3 (NPTEL/ SWAYAM) Course with prior approval of BoS (Recommended minimum 12 week course with 3 credits)	PE	3	0	0	3	40	60
2	MCA2202	**Program Elective-4** 1. Mobile Adhoc Networks 2. Quantum Computing 3. Agile Methodologies 4. MOOCs-4 (NPTEL / SWAYAM) Course with prior approval of BoS (Recommended minimum 12 week course with 3 credits)	PE	3	0	0	3	40	60
3		Project Work/Dissertation	PR	-	-	-	10	50	100
			Total	6	0	0	16		

Note: Students going for Industrial Project will complete these courses through MOOCs (NPTEL/ SWAYAM) in the current semester or in earlier semester.

MCA I Sem	DATA STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:
The objective of this course is to explore basic data structures such as stacks and queues, introduce a variety of data structures such as hash tables, search trees, tries, heaps, graphs, sorting and pattern matching algorithms

UNIT-I:
Introduction to C: Constants and variables, Operators and Expressions, Managing Input and Output operators, Decision making-branching and looping, Arrays

UNIT-II:
Functions, Structures and Unions, Pointers, File handling in C.

UNIT–III:
Data structure: Definition, types of data structures Recursion Definition, Design Methodology and Implementation of recursive algorithms, Linear and binary recursion. Preliminaries of algorithms, analysis and complexity. **Linear list**–singly linked list, Double linked list and circular linked list -implementation, insertion, deletion and searching operations on linear list.

UNIT-IV:
Stacks-Operations, array and linked representations of stacks, stack applications, **Queues**-operations, array and linked representations. **Hash Table Representation:** hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing and rehashing, extendible hashing.

UNIT-V:
Sorting Techniques: Insertion sort, selection sort, exchange-bubble sort, quick sort and merge sort Algorithms. **Trees:** Binary Trees, terminology, representation and traversals- pre, posts in order traversals. **Search Trees:** Binary Search Trees, Definition, Implementation, Operations-Searching, Insertion and Deletion, AVL Trees, Red-Black Trees

Text Books:

1. Programming in ANSI C,5e, E.Balagurusamy,TMH
2. Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press.
3. Data Structures using C – A. S. Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education.

Reference Books:

1. Data Structures: A Pseudocode Approach with C,2nd Edition, R.F.Gilberg and B. A. Forouzan, Cengage Learning.

Web Resources:

1. https://archive.nptel.ac.in/courses/106/102/106102064/
2. https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/video_galleries/lecture-videos/
3. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
4. https://visualgo.net/en
5. https://elearn.daffodilvarsity.edu.bd/course/view.php?id=11771

MCA I Sem	COMPUTER ORGANIZATION	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course are to

- Conceptualize the basics of organizational and architectural issues of a digital computer.
- Learn the function of each element of a memory hierarchy.
- Study various data transfer techniques in digital computers.

UNIT I:

Basic Structure of Computers: Computer: Types, Functional units, Basic Operational concepts, Bus structures, Software, Performance, multiprocessor and multi computers, Historical perspective.

UNIT II:

Machine Instructions and Programs: Numbers, Arithmetic Operations, and Characters, Memory locations and addresses, Memory operations, Instructions and Instruction sequencing, Addressing Modes, Assembly Languages, stacks and Queues Basic Input/output Operations, role of Stacks and Queues Additional Instructions

UNIT III:

Input/ Output Organization: Accessing I/O Devices, Interrupts, Processor examples, Direct Memory Access, Buses, Interface Circuits, and Standard I/O Interfaces

UNIT IV:

The Memory Systems: Some Basic concepts, Semiconductor RAM memories, Memory System Consideration, Read-Only Memories**,** Speed, Size, and cost, Cache Memories, Performance considerations, Virtual Memories, Memory Management Requirements, Secondary Storage

UNIT V:

Parallel Processing: Basic concepts, Pipeline Processors, Multiprocessors

Text Books:

1. Computer Organization, Carl Hamacher, ZvonksVranesic, Safea Zaky,5th Edition, McGraw Hill.
2. Computer Architecture and Organization, John P. Hayes,3rdEdition, McGraw Hill

Reference Books:

1. Computer Organization and Architecture, William Stallings Sixth Edition, Pearson/PHI

2. Structured Computer Organization, Andrew S. Tanenbaum, 4th Edition PHI/Pearson
3. Fundamentals of Computer Organization and Design, Siva ramaDandamudi Springer Int. Edition.

Web Resources:

1. https://nptelvideos.com/course.php?id=396
2. https://onlinecourses.nptel.ac.in/noc20_cs64/preview
3. https://www.learncomputerscienceonline.com/computer-organization-and-architecture/
4. http://williamstallings.com/COA/COA8e-student/index.html

MCA I Sem	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

This Course will enable students to

- Explain the concept of data bases, database management systems, database structures and how they work.
- Make use of Entity-Relationship Modeling and Relational Modeling for creating simple databases from the real world scenarios.
- Write relational algebra and structured query language(SQL)statements.
- Normalize a database using Normalization Rules.
- Discuss the issues associated with Transaction Management and Recovery, Tree Structured and Hash-Based Indexing

UNIT – I:

Overview of Database System: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems. [Text Book -2]

Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design with the ER Model, Extended ER features [Text Book -1]

UNIT – II:

Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity Constraints, Querying Relational Data, Logical Database Design: ER to Relational, Introduction to Views, Destroying/Altering Tables and Views [Text Book -1]

Relational Algebra: Selection and Projection, Set Operations, Renaming, Joins, Division, More Examples of Algebra Queries, **Relational Calculus:** Tuple Relational Calculus, Domain Relational Calculus [Text Book -1]

UNIT – III:

SQL: Queries, Constraints, Triggers: The Form of a Basic SQL Query, UNION, INTERSECT and EXCEPT, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers, Exceptions, Procedures, Functions [Text Book -1]**Normal Forms:** Introduction to Schema Refinement, Functional Dependencies, Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization. [Text Book -1]

UNIT – IV:

Schema Refinement: Multivalued dependencies, Fourth Normal form, Join Dependencies, Fifth Normal Form, Lossless join, dependency preservation.[Text Book -1] **Transaction**

Management: Transaction Concepts, Transaction state, Implementation of Atomicity and Durability, Concurrent Execution, Serializability, Recoverability. [Text Book -2] **Concurrency Control**: Lock-based Protocols: Locks, Granting of Locks, Two Phase Locking Protocol, Implementation of locking; Timestamp-Based Protocols: Time Stamps, Time Stamp Ordering protocol, Thomas Write Rule, Validation-Based Protocols [Text Book -2]

UNIT – V:

Overview of Storage and Indexing: Data on External Storage, File organization and indexing: Clustered Indexes, Primary and Secondary Indexes; Index Data Structures: Hash and Tree based indexing; Comparison of File organizations. [Text Book -1] **Tree Structured Indexing**: Intuitions for Tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete, Duplicates, B+ Trees in Practice [Text Book -1]

Text Books:

1. Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, McGraw-Hill
2. Database System Concepts, 6/e, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill
3. DatabaseSystems,9/e, Carlos Coronel, Steven Morris, PeterRob, Cengage

Reference Books:

1. Introduction to Database Systems,8/e, CJ Date, Pearson
2. Database Systems,6/e RamezElmasri, ShamkantB.Navathe, Pearson

Web Resources:

1. https://nptel.ac.in/courses/106105175
2. https://onlinecourses.swayam2.ac.in/cec22_cs18/preview
3. https://cs186berkeley.net/
4. https://www.youtube.com/playlist?list=PL52484DF04A264E59
5. https://courses.cs.washington.edu/courses/cse414/17au/calendar/lecturelist.html
6. https://www.db-book.com/slides-dir/index.html

MCA I Sem	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

This course enables the student to

- Introduce different types of operating systems.
- Learn process management techniques.
- Learn various memory management techniques.
- Introducing the architecture of the Linux operating system.
- Learn multiple operating systems like Unix and Windows.

UNIT–I:

Introduction to Operating System Concept: Types of Operating Systems, Operating Systems Concepts, Operating System Operations. Operating Systems Structures- Operating System Services, User Operating-System Interface, Introduction to System calls, Types of System Calls.

UNIT–II:

Process Management: Process concept, Process State Diagram, Process control block, Process Scheduling, Inter process Communication, Threads-Threading Issues, Scheduling-Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

UNIT-III:

Process Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, **Principles of deadlock:** System Model, Deadlock characterization, Deadlock handling, Deadlock Prevention, Detection and Avoidance, Recovery Starvation, Critical Regions form Deadlock

UNIT–IV:

Memory Management: Swapping, Contiguous Memory Allocation, Paging, structure of the Page Table, Segmentation Virtual Memory Management- Demand Paging, Page-Replacement Algorithms, Thrashing. **File-System Interface:** File Concept, Access Methods, Directory structure, File-System mounting, Files Sharing, Protection. File-System implementation- File-System Structure, Allocation Methods, Free-Space Management, Disk Structure, Disk Scheduling

UNIT-V:

Case Studies: Linux System: Design Principles, kernel Modules, Process Management, File Systems, Input and Output, Interprocess Communication, Network Structure, Security. **Windows 7:** Design Principles, System Components, Terminal Services and Fast User, File System, Networking, Programmer Interface.

Text Books:

1. Operating System concepts, Abraham Siliberschatz, Peter Baer Galvin, Greg Gagne, John Wiley &Sons,Inc., Edition 9,2011
2. Introduction to UNIX and Shell Programming, M.G.VenkateshMurhty, Pearson, 2005
3. UNIX & Shell Programming, B.M.Harwani, OXFORD University Press,2013

Reference Books:

1. Advanced Programming in the UNIX Environment, W.Richard Stevens, Stephen Rago, Wesley Professional, 2013
2. UNIX Network Programming, W.Richard Stevens,1990
3. Operating Systems, William stallings, PHI/Pearson,6/E,2009
4. Operating Systems, Dietal, Dietal, Pearson,3/e,2007
5. Operating Systems,Dhamdhere,TMH,2/e,2009

Web References:

1. https://onlinecourses.swayam2.ac.in/cec20_cs06/preview
2. https://www.cse.iitb.ac.in/~mythili/os/
3. https://onlinecourses.nptel.ac.in/noc21_cs72/preview
4. https://web.stanford.edu/~ouster/cgi-bin/cs140-spring20/lectures.php
5. https://oscourse.org/
6. https://www.cs.jhu.edu/~huang/cs318/fall21/schedule.html

MCA I Sem	MATHEMATICAL AND STATISTICAL FOUNDATIONS	L	T	P	C
		3	1	0	4

Course Objectives:

This course is aimed at enabling the students to

- Understand the mathematical fundamentals that are prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems bioinformatics, Machine learning.
- Develop the understanding of the mathematical and logical basis to many modern techniques in computer science technology like machine learning, programming language design, and concurrency.
- Study various sampling and classification problems.

UNIT- I:

Basic Probability and Random Variables: Random Experiments, Sample Spaces Events, the Concept of Probability the Axioms of Probability, Some Important Theorems on Probability Assignment of Probabilities, Conditional Probability Theorems on Conditional Probability, Independent Events, Bayes Theorem or Rule. Random Variables, Discrete Probability Distributions, Distribution Functions for Random Variables, Distribution Functions for Discrete Random Variables, Continuous Random Variables

UNIT -II:

Sampling and Estimation Theory: Population and Sample, Statistical Inference Sampling With and Without Replacement Random Samples, Random Numbers Population Parameters Sample Statistics Sampling Distributions, Frequency Distributions, Relative Frequency Distributions, Computation of Mean, Variance, and Moments for Grouped Data. Unbiased Estimates and Efficient Estimates Point Estimates and Interval Estimates. Reliability Confidence Interval Estimates of Population Parameters, Maximum Likelihood Estimates

UNIT -III:

Tests of Hypothesis and Significance: Statistical Decisions Statistical Hypotheses. Null Hypotheses Tests of Hypotheses and Significance Type I and Type II Errors Level of Significance Tests Involving the Normal Distribution One-Tailed and Two-Tailed Tests P Value Special Tests of Significance for Large Samples Special Tests of Significance for Small Samples Relationship between Estimation Theory and Hypothesis Testing Operating Characteristic Curves. Power of a Test Quality Control Charts Fitting Theoretical Distributions to Sample Frequency Distributions, The Chi- Square Test for Goodness of Fit Contingency Tables Yates' Correction for Continuity Coefficient of Contingency.

UNIT-IV:

Algebraic Structures and Number Theory: Algebraic Systems, Examples, General

Properties, Semi Groups and Monoids, Homomorphism of Semi Groups Semi Groups and Monoids, Group, Subgroup, Abelian Group, Homomorphism, Isomorphism. Properties of Integers, Division Theorem, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem)

UNIT-V:

Graph Theory: Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Planar Graphs, Euler's Formula, Graph Coloring and Covering, Chromatic Number, Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs).

Text Books:

1. Foundation Mathematics for Computer Science, 1st Edition, John Vince, Springer,2015
2. Probability & Statistics,3rd Edition, Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan, Schaum's Outline Series, Tata McGraw-HillPublishers,2018
3. Probability and Statistics with Reliability,2ndEdition,K.Trivedi,Wiley,2011
4. Discrete Mathematics and its Applications with Combinatorics and Graph Theory,7thEdition, H. Rosen, Tata McGraw Hill, 2003

Reference Books:

1. Probability and Computing: Randomized Algorithms and Probabilistic Analysis,1stEdition, M. Mitzenmacher and E. Upfal, 2005
2. Applied Combinatorics,6thEdition, Alan Tucker, Wiley, 2012

Web Resources:

1. https://archive.nptel.ac.in/courses/106/102/106102064/
2. https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring 2020/ video_galleries/ lecture-videos/
3. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
4. https://visualgo.net/en
5. https://elearn.daffodilvarsity.edu.bd/course/view.php?id=11771

MCA I Sem	DATABASE MANAGEMENT SYSTEMS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands.
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers

List of Experiments:

1. Execute all DDL, DML and DCL commands on sample tables.
2. Implementation of different types of operators and built-in functions with Suitable examples.
3. Implementation of different types of joins with suitable examples.
4. Create views, partitions, Sequences for a particular DB
5. Implement different types of constraints on relations.
6. Implementation of subqueries and nested queries.
7. Implement Queries on Group By& Having Clauses, ALIAS, Sequence By, Order by Control Structure
   a) Write a PL/SQL block for Addition of Two Numbers
   b) Write a PL/SQL block for IF, IF and else condition
   c) Write a PL/SQL block for implementation of loops
   d) Write a PL/SQL block for greatest of three numbers using IF AND ELSEIF
8. Exception Handling- Implement the following with respect to exception handling. Raising Exceptions, User Defined Exceptions, Pre-Defined Exceptions
9. Procedures
   a) Write a PL/SQL Procedure using Positional Parameters
   b) Write a PL/SQL Procedure using notational parameters
   c) Write a PL/SQL Procedure for GCD Numbers
   d) Write a PL/SQL Procedures for cursor implementation (explicit and implicit cursors)
10. Functions:
    a) Write a PL/SQL block to implement factorial using functions
    b) Write a PL/SQL function to search an address from the given database
11. Write a DBMS program to prepare Pl/SQL reports for an application using functions.
12. Triggers:
    a) Write a Trigger to pop-up the DML operations
    b) Write a Trigger to check the age valid or not Using Message Alert.
    c) Create a Trigger on a table so that it will update another table while inserting values
13. Write PL/SQL block for an application using cursors and all types of triggers.
14. Write a PL/SQL block for transaction operations of a typical application using package

Text Books / Suggested Readings:

1. Oracle: The Complete Reference by Oracle Press
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

Web Resources:

1. https://moodle.sit.ac.in/blog/database-management-system-lab-component-bcs403/#P01
2. https://elearn.daffodilvarsity.edu.bd/course/view.php?id=10250
3. https://cs50.harvard.edu/x/2024/weeks/7/
4. https://courses.cs.washington.edu/courses/cse414/17au/calendar/hwlist.html
5. http://db.lcs.mit.edu/6.5830/2021/assign.php

MCA I Sem	DATA STRUCTURES USING C LAB	L	T	P	C
		0	0	4	2

Course Objectives:

This Course will enable students to

- Design and implement various data structures.
- Implement operations like searching, insertion, and deletion, traversing mechanism
- Develop applications using data structure algorithms.

Experiment 1:

a) Write a program in C to display the n terms of even natural numbers and their sum.

b) Write a program in C to display the n terms of harmonic series and their sum.
1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms.

c) Write a C program to check whether a given number is an Armstrong number or not

d) Write a C program to calculate the factorial of a given number.

Experiment 2:

a) Write a program in C for multiplication of two square Matrices.

b) Write a program in C to find the transpose of a given matrix.

Experiment 3:

a) Write a program in C to check whether a number is a prime number or not using the function.

b) Write a recursive program which computes the nth Fibonacci number, for appropriate values of n.

c) Write a program in C to add numbers using call by reference.

Experiment 4:

a) Write a program in C to append multiple lines at the end of a text file.

b) Write a program in C to copy a file in another name

Experiment 5:

Write recursive program for the following

a) Write recursive and non recursive C program for calculation of Factorial of an integer.

b) Write recursive and non recursive C program for calculation of GCD (n, m)

c) Write recursive and non recursive C program for Towers of Hanoi: N disks are to be transferred from peg S to peg D with Peg I as the intermediate peg.

Experiment 6:

a) Write a C program that uses both recursive and non recursive functions to perform Linear search for a Key value in a given list.

b) Write a C program that uses both recursive and non recursive functions to perform Binary search for a Key value in a given list.

Experiment 7:

a) Write a C program that implements stack (its operations) using arrays.
b) Write a C program that implements stack (its operations) using Linked list.

Experiment 8:

a) Write a C program that uses Stack operations to convert infix expressions into postfix expressions.
b) Write a C program that implements Queue (its operations) using arrays.
c) Write a C program that implements Queue (its operations) using linked lists.

Experiment 9:

Write a C program that uses functions to create a singly linked list and perform various operations on it.

Experiment 10:

Write a C program to store a polynomial expression in memory using a linked list and perform polynomial addition.

Experiment 11:

a) Write a recursive C program for traversing a binary tree in preorder, in order and post order.
b) Write a non recursive C program for traversing a binary tree in preorder, in order and post order.

Experiment 12:

Implementation of Hash table using double hashing as collision resolution function.

Experiment 13:

Implementation of Binary Search trees- Insertion and deletion..

Experiment 14:

Implementation of AVL Tree – Insertion and Deletion

Experiment 15:

a) Write a C program that implements Bubble sort, to sort a given list of integers in ascending order.
b) Write a C program that implements Quick sort, to sort a given list of integers in ascending order.
c) Write C program that implement Merge sort, to sort a given list of integers in ascending order

Web resources:

1. https://ds1-iiith.vlabs.ac.in/
2. https://profile.iiita.ac.in/bibhas.ghoshal/teaching_ds_lab.html
3. https://moodle.sit.ac.in/blog/data-structures-laboratory/
4. https://dsalab.netlify.app/
5. https://www.vtuloop.com/data-structure-lab-programs-all/

MCA I Sem	OPERATING SYSTEMS AND LINUX LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

This Course will enable students to implement CPU scheduling algorithms, Disk scheduling algorithms, Execute different types of Linux commands and Write shell scripts

List of Experiments:

UNIX Lab-Introduction to Unix

1. Study of Unix/Linux general purpose utility commands
2. Study of Bash shell, Bourne shell and C shell in Unix/Linux operating system .
3. Study of UNIX/LINUX File System(tree structure).
4. C program to emulate the UNIX ls –l command
5. C program that illustrates how to execute two commands concurrently with a command pipe. Ex: - ls –l | sort
6. Multiprogramming-Memory management-Implementation of fork (), wait (), exec() and exit (), System calls

Operating Systems Lab

1.Simulate the Following CPU Scheduling Algorithms

A) FCFS B)SJF C)Priority D)Round Robin

2.Multiprogramming-Memory Management- Implementation of fork(), wait(), exec() and exit()

3. Simulate The Following
   a. Multiprogramming with A Fixed Number Of Tasks (MFT
   b. Multiprogramming with A Variable Number Of Tasks (MVT)
4. Write a program to implement first fit, best fit and worst fit algorithm for memory management.
5. Simulate Bankers Algorithm for Deadlock Avoidance
6. Simulate Bankers Algorithm for DeadLock Prevention.
7. Simulate The Following Page Replacement Algorithms.
   a) FIFO b) LRU c) LFU
8. Simulate the Following File Allocation Strategies
   a) Sequenced b) Indexed c) Linked

Linux Lab

1. Write a Shell program to check whether a given number is prime or not.
2. Write a shell script which will display Fibonacci series up to the given range.
3. Write a shell script to check whether the given number is Armstrong or not.
4. Write a shell script to accept student number, name, marks in 5 subjects.
5. Find total, average and grade using the following rules:
   Avg>=80 then grade A

Avg<80 &&Avg>=70 then grade B
Avg<70 &&Avg>=60 then grade C
Avg<60 &&Avg>=50 then grade D
Avg<50 &&Avg>=40 then grade E

6. Write a shell script to find minimum and maximum elements in the given list of elements.
7. Write a shell program to check whether the given string is palindrome or not.
8. Write an awk program to print sum, avg of students marks list
9. Write a shell script to compute no. of characters and words in each line of given file

Web Resources:

1. https://profile.iiita.ac.in/bibhas.ghoshal/teaching_os_lab.html
2. https://profile.iiita.ac.in/bibhas.ghoshal/OS_2019/teaching_os_lab.html
3. https://dextutor.com/courses/operating-system-programs/
4. https://oscourse.org/labs/
5. https://labex.io/courses/linux-practice-labs
6. https://www.101labs.net/courses/101-labs-linux-lpic1/

MCA II Sem	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:

At the end of the course, the students will be able to:

- Understand the fundamental concepts of computer networking and OSI Reference model.
- Familiarize the student with the basic taxonomy and terminology of the computer networking area.
- Learn and understand the advanced networking concepts, preparing the student for entry advanced courses in computer networking.
- Develop and gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

UNIT–I

Introduction: Network Topologies WAN, LAN, MAN. Reference models, The OSI Reference Model, the TCP/ IP Reference Model, A Comparison of the OSI and TCP/IP Reference Models. **Physical Layer:** Introduction to physical layer, Data and Signals, Periodic analog signals, digital signals, transmission impairment, Data rate limits, performance, Introduction to Guided Media, Twisted-pair cable, Coaxial cable and Fiber optic cable and Unguided media: Wireless-Radio waves, microwaves, infrared.

Unit-II

The Data Link Layer: Services Provided to the Network Layer, Framing, Error Control, Flow Control, Error Detection and Correction, Error-Correcting Codes, Error Detecting Codes. **Elementary Data Link Protocols:** Simplex Protocol, A Simplex Stop and Wait Protocol for an Error free channel, A Simplex Stop and Wait Protocol for a Noisy Channel, Sliding Window Protocols, A One Bit Sliding Window Protocol, Go-Back-N, Selective Repeat.

UNIT-III

The Medium Access Control Sublayer-The Channel Allocation Problem, Static Channel Allocation, Assumptions for Dynamic Channel Allocation, Multiple Access Protocols, Aloha, Pure aloha, slotted aloha, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited Contention Protocols. **Wireless LAN Protocols-** Ethernet, Classic Ethernet Physical Layer, Classic Ethernet MAC Sublayer Protocol, Ethernet Performance, Fast Ethernet, Wireless LANs, The 802.11 Architecture and Protocol Stack, 802.11 Physical Layer, 802.11 MAC Sublayer Protocol, 805.11 Frame Structure, Services.

Unit-IV

The Network Layer Design Issues: Store and Forward Packet Switching, Services Provided to Transport layer, Implementation of Connection less Service, Implementation of Connection Oriented Service, Comparison of Virtual Circuit and Datagram Networks,

Routing Algorithms, Optimality principle, Shortest path, Flooding, Distance vector, Link state, Hierarchical. **Congestion Control algorithms:** General principles of congestion control, Congestion prevention policies, Approaches to Congestion Control, Traffic Aware Routing, Admission Control, Traffic Throttling, Load Shedding. **Internet Working:** How networks differ, How networks can be connected, Tunneling, internetwork routing, Fragmentation, network layer in the internet, IP protocols, IPV4 protocol, IP addresses, Subnets, IP Version6- The main IPV6 header, Internet control protocols- ICMP, ARP, DHCP.

UNIT-V:

The Transport Layer: Transport layer protocols: Introduction, services, port number, User datagram protocol, User datagram, UDP services, UDP applications, Transmission control protocol: TCP services- TCP features- Segment- A TCP connection, windows in TCP, flow control, Error control. **Application Layer:** World Wide Web: HTTP, FTP, Two connections, control connection, Data connection, security of FTP, Electronic mail, Architecture, web based mail, email security, TELENET, local versus remote Logging. **Domain Name System:** Name Space, DNS in Internet, Resolution, Caching, Resource Records, DNS messages, Registrars, security of DNS Name Servers.

Text Books:

1. Computer Networks: Andrew S Tanenbaum David J. Wetherall, 5/e, Pearson
2. Data communications and networking: BehrouzForouzan, 5/e, McGraw Hill

Reference Books

1. Computer Networks – A System Approach, Peterson, Bruce Davie,2/e , Harcourt Asia
2. Compute communications and networking technologies, Gallo, Hancock, Cengage
3. An Engineering approach to compute networking, Kesha, Pearson

Web Resources:

1. https://onlinecourses.swayam2.ac.in/cec23_cs07/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs18/preview
3. https://ocw.mit.edu/courses/6-829-computer-networks-fall-2002/pages/lecture-notes/
4. https://www.sanfoundry.com/computer-network-basics/
5. https://www.cisco.com/c/en_in/solutions/enterprise-networks/what-is-computer-networking.html
6. https://www.cs.vu.nl/~ast/CN5/

MCA II Sem	NETWORK SECURITY AND CYBER SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn various cryptographic algorithms including secret key cryptography, hashes and message digests, public key algorithms,
- To Familiar in design issues and working principles of various authentication protocols and various secure communication standards
- To understand the cybercrime fundamentals and preventive steps

UNIT I:

Basic Principles: Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography. Symmetric Encryption: Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard, Advanced Encryption Standard.

UNIT II:

Asymmetric Encryption: Mathematics of Asymmetric Key Cryptography-Primes, primality Testing, Factorization, Asymmetric Key Cryptography-RSA Cryptosystem, Rabin Cryptosystem, ElGamal Cryptosystem, Elliptic Curve Cryptosystem

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions Requirements and Security Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3

UNIT III:

Digital Signatures: Elgamal Digital Signature Scheme, Schnorr Digital Signature, NIST Digital Signature Algorithm

Electronic Mail Security: Internet Mail Architecture, Email Formats, Email Threats and Comprehensive Email Security, S/MIME. IP Security: IP Security Policy, Encapsulating Security Payload, Combining Security Associations Internet Key Exchange

Unit IV:

Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrime, Cyber stalking, Cyber cafe and Cybercrimes, Botnets. Attack Vector, Proliferation of Mobile and Wireless Devices, Security Challenges Posed by Mobile Devices, Attacks on Mobile/Cell Phones

Unit V:

Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Sniffers, Spoofing, Session Hijacking Buffer overflow, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identify theft, FootPrinting and Social Engineering, Port

Scanning, EMailInvestigation, E-Mail Tracking, IP Tracking, EMail Recovery, Password Cracking,

Text Books:

1. Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill,2015
2. Sunit Belapure Nina Godbole "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", WILEY, 2011.

Reference Books:

1. Network Security and Cryptography, First Edition, Bernard Meneges, Cengage Learning, 2018
2. Cryptography and Network Security, William Stallings, Global Edition, 7e Pearson, 2017

Web Resources:

1. https://archive.nptel.ac.in/courses/106/105/106105162/
2. https://ebooks.inflibnet.ac.in/csp11/chapter/introduction-to-network-security/
3. https://www.fortinet.com/resources/cyberglossary/what-is-cryptography
4. https://ischoolonline.berkeley.edu/cybersecurity/curriculum/cryptography/
5. https://www.mitel.com/articles/web-communication-cryptography-and-network-security
6. https://www.nist.gov/cybersecurity
7. https://www.codecademy.com/learn/introduction-to-cybersecurity

MCA II Sem	OBJECT ORIENTED PROGRAMMING USING JAVA	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the basic concepts of object oriented programming concepts.
- To introduce the principles of inheritance and polymorphism and demonstrate how they are related to the design of abstract classes
- To understand the implementation of packages and interfaces
- To introduce the concept of multithreading and exception handling
- To learn and understand the design of Graphical User Interface using swing controls

UNIT–I:

Basics of Object Oriented Programming (OOP): Need for OO paradigm , A way of viewing world- Agents, responsibility, messages, methods, classes and instances, class hierarchies (Inheritance), method binding, overriding and exceptions, summary of OOP concepts, coping with complexity, abstraction mechanisms. **Java Basics:** Data types, variables, scope and lifetime of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, classes and objects- concepts of classes, objects, constructors methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, string handling.

UNIT–II:

Inheritance: Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism, abstract classes.**Packages and Interfaces:** Defining, Creating and Accessing a package, Understanding CLASSPATH, Importing packages, differences between classes and interfaces, defining an interface, Implementing interface, applying interfaces variables in interface and extending interfaces.

UNIT–III:

Exception handling and Multithreading: Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throws and finally, built in exceptions, creating own exception subclasses. Differences between multithreading and multitasking, thread lifecycle, creating threads, synchronizing threads, daemon threads, thread groups.

UNIT–IV:

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes. The AWT class hierarchy, user-interface components- labels, button, canvas, scrollbars, text components, check box, checkbox groups, choices, list panes, scroll pane, dialogs, menu bar, graphics,

layout manager, layout manager types- boarder, grid, flow, card and grid bag.

UNIT-V:

Swings: Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JFrame and JComponent, Icons and Labels, text fields, buttons-The JButton class, Check boxes, Radio Buttons, Combo boxes, Tabbed panes, Scroll panes, Trees and Tables.

Text Books:

1. Java-The Complete Reference,7/e, Herbert schildt, TMH

Reference Books:

1. JAVA: How to program,8/e, Dietal, Dietal, PHI
2. Introduction of programming with JAVA, S.Dean, TMH
3. Introduction to JAVA programming, 6/e, Y.Daniel Liang, Pearson
4. Core Java2, Vol1(Vol2) Fundamentals (Advanced),7/e, Cay.S.Horstmann, Gary Cornell, Pearson
5. Big Java 2,3/e, Cay.S.Horstmann,Wiley
6. Object Oriented Programming through Java, P.Radha Krishna, University Press

Web resources:

1. https://onlinecourses.nptel.ac.in/noc20_cs58/preview
2. https://www.iitk.ac.in/esc101/05Aug/tutorial/information/resources.html
3. https://docs.oracle.com/javase/tutorial/index.html
4. https://www.javacodegeeks.com/best-java-programming-resources

MCA II Sem	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the nature of software development and software life cycle models.
- To understand methods of capturing, specifying, visualizing and analyzing software requirements.
- To know the basics of testing and understanding the concept of software quality assurance and software configuration management process.
- To learn to provide correctness proofs for algorithms.

UNIT–I:

Introduction: Software Engineering and its history, Software crisis, Evolving of a Programming System Product, Characteristics of Software, Brooks' No Silver Bullet, and Software Myths. **Software Development Life Cycles :** Software Development Process, Code-and-Fix model, Waterfall model, Evolutionary Model, Incremental Implementation, Prototyping, Spiral Model, Software Reuse, Critical Comparisons of SDLC models. **An Introduction to Non-Traditional Software Development Process:** Rational Unified Process, Rapid Application Development, Agile Development Process- Introduction, Agile-SCRUM(Sprint, Review, Retrospective, Planning) , XP, KANBAN, SAFE agile

UNIT–II:

Requirements: Importance of Requirement Analysis, User needs, Software Features and Software Requirements. **Classes of User Requirements:** Enduring and Volatile, Sub phases of Requirement Analysis, Functional and Non-functional requirements, Barriers to Eliciting User requirements, The software requirements document and SRS standards, Requirements Engineering, Case Study of SRS for a Real Time System. **Tools for Requirements Gathering:** Document Flow Chart, Decision Table, Decision Tree, Introduction to non-traditional Requirements.

UNIT-III:

Software Design: Goals of good software design, Design strategies and methodologies, Data oriented software design. **Structured Design:** Structure chart, Coupling, Cohesion, Modular structure, Packaging, Object oriented design, Top-down and bottom-up approach, Design patterns. **Structured Analysis:** DFD, Data Dictionary, Software Measurement and Metrics: Various Size Oriented Measures: Halstead's software science, Function Point (FP) based measures, Cyclomatic Complexity Measures: Control flow graphs Development: Selecting a language, Coding guidelines, Writing code, Code documentation.

UNIT–IV:

Software Testing : Testing process, Design of test cases, Functional Testing : Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path testing, Data flow and mutation testing, Unit testing, Integration and

system testing, Debugging, Alpha & beta testing, testing tools & standards.

UNIT-V:

Software Maintenance: Management of maintenance, Maintenance process, Maintenance models, Regression testing, Reverse engineering, Software reengineering, Configuration management, documentation.

Text Books:

1. Software Engineering: A Practitioner's Approach, R. S. Pressman, McGraw Hill, 9th Edition, Sept 2019

Reference Books:

1. Software Engineering K.K.Aggarwal, Yogesh Singh, New Age International Publishers, Third Edition, 2007
2. Software Engineering, Ian Sommerville, Addison Welsley, 9th Edition, 2010.
3. An Integrated Approach to Software Engineering, PankajJalote, Narosa Publishing House, 3rd Edition, 2007

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs122/preview
2. https://nptelvideos.com/course.php?id=444
3. https://softengbook.org/
4. https://www.coursera.org/learn/introduction-to-software-engineering?msockid=39a584c9c8ac6773281697f5c91e6633

MCA II Sem	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn the basic State space representation. Intelligent Systems Categorization of Intelligent concepts and techniques of AI and machine learning
- To explore the various mechanisms of Knowledge and Reasoning used for building an expert system.
- To become familiar with supervised and unsupervised learning models
- To design and develop AI and machine learning solutions using modern tools.

UNIT–I

Introduction to AI: Definition, Problem, System, Components of AI Program, Foundations of AI, Applications of AI, Current trends in AI, Intelligent Agents: Anatomy, structure, Types.

UNIT–II

Problem solving- Solving problems by Searching: Problem Solving Agent, Formulating Problems. Uninformed Search Methods: Breadth First Search (BFS), Depth First Search (DFS), Depth First Iterative Deepening (DFID), Informed Search Methods-Greedy best first Search, A* Search, Memory bounded heuristic Search. Local Search Algorithms and Optimization Problems- Hill climbing search Simulated annealing and local beam search.

UNIT –III

Knowledge and Reasoning-Knowledge based Agents, The Wumpus World, and Propositional logic**. First Order Logic** –Syntax and Semantic, Inference in FOL, Forward chaining, backward Chaining, Knowledge Engineering in First-Order Logic, Unification and Resolution.

UNIT–IV

Agents: Definition of agents, Agent architectures (e.g., reactive, layered, cognitive), Multi-agent systems- Collaborating agents, Competitive agents, Swarm ~~s~~ystems and biologically inspired models. Expert Systems: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

UNIT–V

Expert Systems: Architecture of expert systems, Roles of expert systems, Knowledge Acquisition, Meta knowledge, Heuristics. Expert systems- MYCIN, DART, XOON, Expert systems shells.

Text Books:

1. Artificial Intelligence, Sarojkaushik, Cengage Learning India, 2011
2. Artificial Intelligence and Machine Learning, Vinod Chandra S.S., Anand

Hareendran S
3. Stuart J.Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach“ Second Edition, Pearson.

Reference Books:

1. Ivan Bratko "PROLOG Programming for Artificial Intelligence", Pearson Education, Third Edition.
2. Elaine Rich and Kevin Knight "Artificial Intelligence ", Third Edition
3. Han Kamber, “Data Mining Concepts and Techniques”, Morgan Kaufmann Publishers
4. G. Luger, W. A. Stubblefield, "Artificial Intelligence", Third Edition, AddisoWesley Longman, 1998

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs56/preview
2. https://openlearning.mit.edu/news/explore-world-artificial-intelligence-online-courses-mit
3. https://cse.iitk.ac.in/users/cs365/2015/resources.html
4. https://microsoft.github.io/AI-For-Beginners/
5. https://artint.info/3e/resources/index.html
6. https://web.dev/explore/ai

MCA II Sem	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

Course Objectives:

- To analyze the asymptotic performance of algorithms.
- To understand and write rigorous correctness proofs for algorithms.
- To familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

UNIT-I:

Introduction: Algorithm, Pseudo code for expressing algorithms, performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation, probabilistic analysis, Amortized analysis. Disjoint Sets- disjoint set operations, union and find algorithms, spanning trees.

UNIT-II:

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Stassen's matrix multiplication. Greedy method: General method, applications-Job sequencing with deadlines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

UNIT-III:

Dynamic Programming: General method, applications-Multi stage Graphs, Optimal binary search trees, 0/1 knapsack problem, Traveling salesperson problem, Reliability design, String editing**.**

UNIT-IV:

Dynamic Programming: All pairs shortest path problem, Single- Source shortest paths: general weights.

Backtracking: General method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.

UNIT-V:

Branch and Bound: General method, applications - Travelling salesperson problem, 0/1 knapsack problem-LC Branch and Bound solution, FIFO Branch and Bound solution. NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP Complete classes, Cook's theorem.

Text Books:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, SatrajSahni and Rajasekaran, Universities Press

2. The Algorithm Design Manual, 2nd edition, Steven S. Skiena, Springer
3. Introduction to Algorithms, second edition, T.H. Cormen, C.E. Leiserson, R.L. Rivest and C.Stein, PHI Pvt. Ltd

Reference Books:

1. Introduction to the Design and Analysis of Algorithms, AnanyLevitin, PEA
2. Design and Analysis of Algorithms, Pearson Education, ParagHimanshu Dave, HimansuBalachandra Dave
3. Introduction to Design and Analysis of Algorithms A strategic approach, R.C.T. Lee, S.S.Tseng, R.C.Chang and T.Tsai, Mcgraw Hill
4. Design and Analysis of algorithms, Pearson education, Aho, Ullman and Hopcroft

Web Resources:

1. https://nptel.ac.in/courses/106106131
2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
3. https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/resources/lecture-notes/
4. https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/resources/lecture-notes/
5. https://aofa.cs.princeton.edu/home/

MCA II Sem	ADVANCED UNIX PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the fundamental design of the unix Programming
- To become fluent with the systems calls provided in the unix environment
- To be able to design and build an application/service over the unix operating system

UNIT-I:

Review of Unix Utilities and Shell Programming:-File handling utilities, security by file permissions, process utilities, disk utilities, networking commands, backup utilities, text processing utilities. **Shell Programming:** shell, shell responsibilities, pipes and input redirection, output redirection, here documents, the shell as a programming language, shell metacharacters, shell variables, shell commands, the environment, control structures, shell script examples.

UNIT-II:

Unix Files: Unix file structure, directories, files and devices, System calls, library functions, low level file access, usage of open, create, read, write, close, lseek, stat, fstat, octl, umask, dup, dup2, Differences between system call and library functions. File and directory maintenance: chmod, chown, unlink, link, symlink, mkdir, rmdir, chdir, getcwd. **Directory handling system calls:** opendir, readdir, closedir, rewinddir, seekdir, telldir

UNIT-III:

Unix Process: Threads and Signals: process, process structure, starting new process, waiting for a process, zombie process, orphan process, process control, process identifiers, system call interface for process management, - fork, vfork, exit, wait, waitpid, exec, system. **Signals**: Signal functions, unreliable signals, interrupted system calls, kill and raise functions, alarm, pause functions, abort, sleep functions.

UNIT-IV:

Inter process Communication: Introduction to IPC, IPC between processes on a single computer system, IPC between processes on different systems, pipes, FIFOs, message queues, semaphores and shared memory. Differences between pipes and FIFOs.Implementing a client server program using pipes and FIFOs.**Message Queues-**:IPC, permission issues, Access permission modes, message structure, working with message queues, client/server example. **Semaphores:** Creating semaphore sets, Unix kernel support for semaphores, Unix APIs for semaphores, file locking using semaphores.

UNIT-V

Shared Memory: Working with shared memory segments, Unix kernel support for shared memory, client/server example.

Sockets: Berkeley sockets, socket structure, socket system calls for connection oriented protocol and connectionless protocol, implementing client server programs using TCP and UDP sockets.

Text Books:

1. Advanced programming in the unix environment, w- Richard Stevens, 2nd Edition Pearson education
2. Unix Concepts and Applications, 3/e, Sumitabha Das, TMH

Reference Books:

1. Unix and shell Programming, Sumitabha Das, TMH
2. A Beginner's Guide to Unix, N.P.Gopalan, B.SivaSelva, PHI
3. Unix Shell Programming, Stephen G.Kochan, Patrick Wood,
4. Unix Shell Programming, Lowell Jay Arthus& Ted Burns,3/e,GalGotia

Web Resources:

1. https://archive.nptel.ac.in/courses/117/106/117106113/
2. https://stevens.netmeister.org/631/
3. https://www.cs.fsu.edu/~asriniva/courses/aup02/lectures.html

MCA II Sem	DATA WAREHOUSING AND DATA MINING	L	T	P	C
		3	0	0	3

Course Objectives:

- Be familiar with mathematical foundations of data mining tools..
- Understand and implement classical models and algorithms in data warehouses and data mining
- Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
- Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

UNIT-1:

Introduction to Data mining, types of Data, Data Quality, Data Processing, Measures of Similarity and Dissimilarity, Exploring Data: Data Set, Summary Statistics, Visualization, Data Warehouse, OLAP and multidimensional data analysis.

UNIT-II:

Classification: Basic Concepts, Decision Trees and model evaluation: General approach for solving a classification problem, Decision Tree induction, Model overfitting: due to presence of noise, due to lack of representation samples, Evaluating the performance of classifier. Nearest Neighbor classifier, Bayesian Classifier, Support vector Machines: Linear SVM, Separable and Non Separable case.

UNIT-III:

Association Analysis: Problem Definition, Frequent Item-set generation, rule generation, compact representation of frequent item sets, FP-Growth Algorithms. Handling Categorical, Continuous attributes, Concept hierarchy, Sequential, Subgraph patterns

UNIT-IV:

Clustering: Overview, K-means, Agglomerative Hierarchical clustering, DBSCAN, Cluster evaluation: overview, Unsupervised Cluster Evaluation using cohesion and separation, using proximity matrix, Scalable Clustering algorithm

UNIT-V:

Web data mining: Introduction, Web terminology and characteristics, Web content mining, Web usage mining, web structure mining, Search Engines: Characteristics, Functionality, Architecture, Ranking of Web Pages, Enterprise search

Text Books:

1. Introduction to Data Mining, Tan, Steinbach and Vipin Kumar, Pearson Education, 2016

2. Data Mining: Concepts and Techniques, 2nd Edition, Jiawei Han and Micheline Kamber, ELSEVIER
3. Data Mining, Vikram Pudi and P Radha Krishna, Oxford University Press

Reference Books:

1. Data Mining: The Textbook, Springer, May 2015,Charu C.Aggarwal.

Web resources:

1. https://nptel.ac.in/courses/106/105/106105174/
2. https://www.saedsayad.com/data_mining.htm
3. https://ocw.mit.edu/courses/15-062-data-mining-spring-2003/pages/lecture- notes/
4. https://www2.cs.uh.edu/~arjun/courses/dm/
5. https://www.rdatamining.com/resources/online-documents-books-and- tutorials
6. https://dataminingbook.info/book_html/

MCA II Sem	OBJECT ORIENTED PROGRAMMING USING JAVA LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To understand how to design, implement, test, debug, and document programs that use basic data types and computation, simple I/O, conditional and control structures, string handling and functions.
- To understand the importance of Classes & objects along with constructors, Arrays and Vectors.
- Discuss the principles of inheritance, interface and packages and demonstrate through problem analysis assignments how they relate to the design of methods, abstract classes and interfaces and packages.
- To understand the importance of Multi-threading & different exception handling mechanisms.
- To learn experience of designing, implementing, testing, and debugging graphical user interfaces in Java using applet and AWT that respond to different user events.
- To understand Java Swings for designing GUI applications based on MVC architecture

List of Experiments:

1. The Fibonacci sequence is defined by the following rule. The first 2 values in the sequence are 1, 1. Every subsequent value is the sum of the 2 values preceding it. Write a Java Program that uses both recursive and non recursive functions to print the nth value of the Fibonacci sequence.
2. Write a Java Program that prompts the user for an integer and then prints out all the prime numbers up to that Integer.
3. Write a Java Program that checks whether a given string is a palindrome or not. Ex. MALAYALAM is a palindrome
4. Write a Java Program for sorting a given list of names in ascending order.
5. Write a Java Program that illustrates how runtime polymorphism is achieved.
6. Write a Java Program to create and demonstrate packages.
7. Write a Java Program, using StringTokenizer class, which reads a line of integers and then displays each integer and the sum of all integers.
8. Write a Java Program that reads a file name form the user then displays information about whether the file exists, whether the file is readable/ writable, the type of file and the length of the file in bytes and display the contents using File Input Stream class.
9. Write a Java Program that displays the number of characters, lines and words in a text/text file.
10. Write a Java Program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +-*?% operations. Add a text field to display the result.
11. Write a Java Program for handling mouse events.

12. Write a Java Program demonstrating the life cycle of a thread.
13. Write a Java Program that lets users create Pie charts. Design your own user interface (with Swings & AWT).
14. Write a Java Program to implement a Queue, using user defined Exception Handling (also make use of throw, throws).

Web Resources:

1. https://www.iitk.ac.in/esc101/05Aug/tutorial/information/resources.html
2. https://labex.io/skilltrees/java
3. https://docs.oracle.com/javase/tutorial/index.html
4. https://introcs.cs.princeton.edu/java/home/

MCA II Sem	NETWORKS AND SECURITY LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To learn basic understanding of cryptography, how it has evolved, and some key encryption techniques used today..
- To understand and implement encryption and decryption using Caesar Cipher, Substitution Cipher, Hill Cipher.

List of Experiments:

1. Implement the data link layer farming methods such as character stuffing and bit stuffing.
2. Implement on a data set of characters the three CRC polynomials – CRC12, CRC 16 and CRC CCIP.
3. Implement Dijkstra‘s algorithm to compute the Shortest path thru a graph.
4. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm
5. Take an example subnet of hosts. Obtain a broadcast tree for it.
6. Write a C program that contains a string (char pointer) with a value ‘Hello World’. The program should XOR each character in this string with 0 and display the result.
7. Write a C program that contains a string (char pointer) with a value ‘Hello World’. The program should AND or and XOR each character in this string with 127 and display the result
8. Write a Java program to perform encryption and decryption using the following algorithms:
   a) Caesar Cipher
   b) Substitution Cipher
   c) Hill Cipher
9. Write a Java program to implement the DES algorithm logic
10. Write a C/JAVA program to implement the BlowFish algorithm logic
11. Write a C/JAVA program to implement the Rijndael algorithm logic.
12. Using Java Cryptography, encrypt the text “Hello world” using BlowFish.
13. Create your own key using Java key tool.
    a) Write a Java program to implement RSA Algorithm
    b) Write a Java program to implement Public key Algorithm like El Gamal
    c) Implement the Diffie-Hellman Key Exchange mechanism using HTML

Web Resources:

1. https://csrc.nist.rip/publications/nistpubs/800-12/800-12-html/chapter19.html
2. http://vlabs.iitkgp.ac.in/ant/
3. https://networklessons.com/labs/network-fundamentals-lab-1
4. https://elearn.daffodilvarsity.edu.bd/course/view.php?id=10230

5. https://www.cybrary.it/practice-lab/cryptography-basics
6. https://www.infosecinstitute.com/resources/cryptography/cryptographic-algorithms-lab/

MCA II Sem	EMPLOYABILITY SKILLS-I	L	T	P	C
		1	0	0	0

Course Objectives:

Employability skills course objectives focus on preparing individuals for the workforce by developing communication, problem-solving, teamwork, and critical thinking skills, while fostering positive workplace attitudes, adaptability, professional ethics, and the ability to manage personal and professional development to enhance career prospects

UNIT – I:

Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - A Talk by AzimPremji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

Communication Skills: Verbal Communication; Non Verbal Communication (Body Language)

UNIT – II:

Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

Etiquette: Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

UNIT – III:

Standard Operation Methods: Note Making, Note Taking, Minutes Preparation, Email & Letter Writing

Verbal Ability: Synonyms, Antonyms, One Word Substitutes-Correction of Sentences-Analogies, Spotting Errors, Sentence Completion, Course of Action -Sentences Assumptions, Sentence Arguments, Reading Comprehension, Practice work

UNIT-IV:

Job-Oriented Skills –I: Group Discussion, Mock Group Discussions

UNIT-V:

Job-Oriented Skills –II: Resume Preparation, Interview Skills, Mock Interviews

Text books and Reference books:

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.
3. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& Company Ltd., 2018.
4. Raman, Meenakshi& Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

Web References:

1. www. Indiabix.com
2. www.freshersworld.com

MCA III Sem	MACHINE LEARNING USING PYTHON	L	T	P	C
		3	0	0	3

Course Objectives:

From the course the student will

- Design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- Explore supervised and unsupervised learning paradigms of machine learning.
- Explore Deep learning technique and various feature extraction strategies.

UNIT-I:

Introduction to Machine Learning with Python: Introduction to Machine Learning, basic terminology, Types of Machine Learning and Applications, Using Python for Machine Learning: Installing Python and packages from the Python Package Index, Introduction to NumPy, SciPy, matplotlib and scikit-learn, Tiny application of Machine Learning.

UNIT-II:

Supervised Learning: Types of Supervised Learning, Supervised Machine Learning Algorithms: k-Nearest Neighbors, Linear Models, Naive Bayes Classifiers, Decision Trees, Ensembles of Decision Trees, Kernelized Support Vector Machines, Uncertainty Estimates from Classifiers.

UNIT-III:

Unsupervised Learning: Types of Unsupervised Learning, challenges, Preprocessing and scaling, Dimensionality Reduction, Feature Extraction, Manifold Learning, Clustering: K-Means Clustering, Agglomerative Clustering, DBSCAN, Comparing and Evaluating Clustering Algorithms.

UNIT-IV:

Representing Data and Engineering Features: Categorical Variables, Binning, Discretization, Linear Models, Trees, Interactions and Polynomials, Univariate Nonlinear Transformations, Automatic Feature Selection. Parameter Selection with Preprocessing, Building Pipelines, The General Pipeline Interface

UNIT-V:

Working with Text Data (Data Visualization) : Types of Data Represented as Strings, Example Application: Sentiment Analysis of Movie Reviews, Representing Text Data as a Bag of Words, Stop Words, Rescaling the Data with tf-idf, Investigating Model Coefficients, Approaching a Machine Learning Problem, Testing Production Systems, Ranking, Recommender Systems and Other kinds of Learning.

Text Books:

1. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Muller & Sarah Guido, Orielly Publications, 2019.

2. Python Machine Learning, Sebastian Raschka&VahidMirjalili, 3rd Edition, 2019.
3. Building Machine Learning Systems with Python, Luis Pedro Coelho, Willi Richert, 2nd Edition, 2015.

Reference Books:

1. Machine Learning, Tom M. Mitchell, Mc Graw-Hill Publication, 2017

MCA III Sem	FULL STACK DEVELOPMENT	L	T	P	C
		3	0	0	3

Course objectives:
The main objective of the course is to provide understanding on the essential javascript, bootstrap, ReactJS concepts for web development and to store and model data in a no sql database.

UNIT I:
Basic JavaScript Instructions, Statements, Comments, Variables, Data Types, Arrays, Strings, Functions, Methods & Objects, Decisions & Loops.
Text Book 1: Chapter 2, 3, 4

UNIT II:
Document Object Model: DOM Manipulation, Selecting Elements, Working with DOM Nodes, Updating Element Content & Attributes, Events, Different Types of Events, How to Bind an Event to an Element, Event Delegation, Event Listeners.
Text Book 1: Chapter: 5, 6, 13

UNIT III:
Form enhancement and validation. Introduction to MERN: MERN components, Server less Hello world. React Components: Issue Tracker, React Classes, Composing Components, Passing Data Using Properties, Passing Data Using Children, Dynamic Composition.
Text Book 2: Chapter 1, 2, 3

UNIT IV:
React State: Initial State, Async State Initialization, Updating State, Lifting State Up, Event Handling, Stateless Components, Designing Components, State vs. Props, Component Hierarchy, Communication, Stateless Components. Express, REST API, GraphQL, Field Specification, Graph Based, Single Endpoint, Strongly Typed, Introspection, Libraries, The About API GraphQL Schema File, The List API, List API Integration, Custom Scalar types, The Create API, Create API Integration, Query Variables, Input Validations, Displaying Errors.
Text Book 2: Chapter 4, 5

UNIT V;
MongoDB: Basics, Documents, Collections, Databases, Query Language, Installation, The Mongo Shell, MongoDB CRUD Operations, Create, Read, Projection, Update, Delete, Aggregate, MongoDB Node.js Driver, Schema Initialization, Reading from MongoDB, Writing to MongoDB. Modularization and Webpack ,Back-End Modules Front-End Modules and Webpack Transform and Bundle, Libraries Bundle ,Hot Module Replacement, Debugging
DefinePlugin: Build Configuration, Production Optimization.
Text Book 2: Chapter 6, 7

Text Books:

1. Jon Duckett, "JavaScript & jQuery: Interactive Front-End Web Development", Wiley, 2014.
2. Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node. Apress, 2019.

e-Resources:

- https://github.com/vasansr/pro-mern-stack
- https://nptel.ac.in/courses/106106156
- https://archive.nptel.ac.in/courses/106/105/106105084/

MCA III Sem	BIG DATA TECHNOLOGIES	L	T	P	C
		3	0	0	3

Course objectives:
The main objective of this course is to implement MapReduce programs for processing big data, realize storage and processing of big data using MongoDB, Pig, Hive and Spark and analyze big data using machine learning techniques.

UNIT I:
Classification of data, Characteristics, Evolution and definition of Big data, What is Big data, Why Big data, Traditional Business Intelligence Vs Big Data,Typical data warehouse and Hadoop environment. Big Data Analytics: What is Big data Analytics, Classification of Analytics, Importance of Big Data Analytics, Technologies used in Big data Environments, Few Top Analytical Tools , NoSQL, Hadoop.
TB1: Ch 1: 1.1, Ch2: 2.1-2.5,2.7,2.9-2.11, Ch3: 3.2,3.5,3.8,3.12, Ch4: 4.1,4.2

UNIT II:
Introduction to Hadoop: Introducing hadoop, Why hadoop, Why not RDBMS, RDBMS Vs Hadoop, History of Hadoop, Hadoop overview, Use case of Hadoop, HDFS (Hadoop Distributed File System),Processing data with Hadoop, Managing resources and applications with Hadoop YARN(Yet Another Resource Negotiator). Introduction to Map Reduce Programming: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression.
TB1: Ch 5: 5.1-,5.8, 5.10-5.12, Ch 8: 8.1 - 8.8

UNIT III:
Introduction to MongoDB: What is MongoDB, Why MongoDB, Terms used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.
TB1: Ch 6: 6.1-6.5

UNIT IV:
Introduction to Hive: What is Hive, Hive Architecture, Hive data types, Hive file formats, Hive Query Language (HQL), RC File implementation, User Defined Function (UDF). Introduction to Pig: What is Pig, Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use case for Pig, Pig Latin Overview, Data types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User Defined Function, Pig Vs Hive.
TB1: Ch 9: 9.1-9.6,9.8, Ch 10: 10.1 - 10.15, 10.22

UNIT V:
Spark and Big Data Analytics: Spark, Introduction to Data Analysis with Spark. Text, Web Content and Link Analytics: Introduction, Text Mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and Analyzing a Web Graph.
TB2: Ch5: 5.2,5.3, Ch 9: 9.1-9.4

Text Books:

1. SeemaAcharya, SubhashiniChellappan "Big data and Analytics" Wiley India Publishers, 2nd Edition, 2019.
2. Rajkamal, PreetiSaxena, "Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning" , McGraw Hill Publication, 2019

Reference Books:

1. Adam Shook and Donald Mine, "MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems" - O'Reilly 2012
2. Tom White, "Hadoop: The Definitive Guide" 4th Edition, O'reilly Media, 2015.
3. Thomas Erl, WajidKhattak, and Paul Buhler, Big Data Fundamentals: Concepts, Drivers & Techniques, Pearson India Education Service Pvt. Ltd., 1st Edition, 2016
4. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy -Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, MIT Press 2020, 2nd Edition

e-Resources:

- https://www.kaggle.com/datasets/grouplens/movielens-20m-dataset
- https://www.youtube.com/watch?v=bAyrObl7TYE&list=PLEiEAq2VkUUJqp1k-g5W1mo37urJQOdCZ
- https://www.youtube.com/watch?v=VmO0QgPCbZY&list=PLEiEAq2VkUUJqp1kg5W1mo37urJQOdCZ&in dex=4
- https://www.youtube.com/watch?v=GG-VRm6XnNk
- https://www.youtube.com/watch?v=JglO2Nv_92A

MCA III Sem	CLOUD COMPUTING (PROGRAM ELECTIVE-2)	L	T	P	C
		3	0	0	3

Course Objectives:

- To explain the evolving computer model caned cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.
- To motivate students to do programming and experiment with the various cloud computing environments.

UNIT–I:

Systems modeling, Clustering and virtualization: Scalable Computing over the Internet, Technologies for Network based systems, System models for Distributed and Cloud Computing, Software environments for distributed systems and clouds, Performance, Security And Energy Efficiency.

UNIT–II:

Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structures/ Tools and mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data Centre Automation.

UNIT–III:

Cloud Platform Architecture: Cloud Computing and service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, Inter Cloud Resource Management, Cloud Security and Trust Management. Service Oriented Architecture, Message Oriented Middleware.

UNIT–IV:

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel & Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments. **Storage Systems**: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system., Apache Hadoop, BigTable, Megastore, Amazon Simple Storage Service(S3).

UNIT-V:

Cloud Resource Management and Scheduling : Policies and Mechanisms for Resource Management Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds, Fair Queuing, Start Time Fair Queuing, Borrowed Virtual Time, Cloud Scheduling Subject to Deadlines, Scheduling MapReduce Applications Subject to Deadlines.

Text Books:

1. Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
2. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
3. Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madisetti, University Press

Reference Books:

1. Cloud Computing: A Practical Approach. Anthony T.Velte. Toby J.VeFte, Robert Elsenpeter. Tata McGraw Hill. rp2Oll.
2. Enterprise Cloud Computing GautamShroif, Cambridge University Press. 2010.
3. Cloud Computing: Implementation, Management and Security, John W. Rittinouse, James F Ransome. CRC Press, rp2012.
4. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud. George Reese, O'Really SPD, rp2Oll.
5. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Ktriaraswamy, Shahed Latif, O'Redç SPD, rp2Oll.

MCA III Sem	IMAGE PROCESSING (PROGRAM ELECTIVE-2)	L	T	P	C
		3	0	0	3

Course Objectives:

- To comprehend the relation between human visual system and machine perception and processing of digital images.
- To provide a detailed approach towards image processing applications like enhancement, segmentation, and compression.

UNIT – I:

Image Formation and Coordinate Transformations Camera Matrix, Motion, Stereo Pin-hole model, Human eye, cognitive aspects of colour, 3D space; illumination; Sampling and Quantization Coordinate transformations and camera parameters

UNIT – II:

Image Processing - Noise Removal, Blurring, Edge Detection: Canny, Gaussian, Gabor, Texture Edges, Curvature, Corner Detection.

UNIT – III:

Segmentation - Concept of Figure vs. Ground, Watershed, Change Detection, Background Subtraction, Texture Segmentation, Gaussian Mixture Models, Applications in Color, Motion based Image Segmentation, Background Modeling and Shape Clustering

UNIT – IV:

Machine Learning techniques in Vision, Bayesian Classification, Maximum Likelihood Methods, Neural Networks; Non-parametric models; Manifold estimation Support Vector Machines ; Temporal sequence learning.

UNIT – V:

Introduction to Object Tracking, Exhaustive vs. Stochastic Search Shapes, Contours, Appearance Models. Mean-shifttracking; Contour-based models, Object Modeling and Recognition Fundamental matrix, Epipolar geometry Adaboost approaches: Face Detection, Recognition Large Datasets; Attention models.

Text Books:

1. David Forsyth and Jean Ponce, Computer Vision: A modern Approach, PHI.
2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2008.

Reference Books:

1. E.R. Davies, Machine Vision, Theory Algorithms Practicalities, Elsevier 2005
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, Image Processing, Analysis, and Machine Vision. Brooks, Cole, Thomson 1999
3. Russell, Norvig: AI: A modern Approach, Prentice Hall 2000.

4. Richard Hartley, Andrew Zisserman, Multiple View Geometry in Computer Vision, Cambridge Univ Press 2000
5. Richard O. Duda, Peter E. Hart, David G. Stork, Pattern Classification, 2nd ed., Wiley Asia, 2002

MCA III Sem	INTERNET OF THINGS (PROGRAM ELECTIVE-2)	L	T	P	C
		3	0	0	3

Course Objectives:

- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
- Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).
- Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

UNIT I:

The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind Io TsSources of the Io Ts, M2M Communication, Examples of IoTs, Design Principles For Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP,Telnet.

UNIT II:

Business Models for Business Processes in the Internet of Things,IoT/M2M systems LAYERS AND designs standardizations ,Modified OSI Stack for the IoT/M2M Systems ETSI M2M domains and High-level capabilities,Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability

UNIT III:

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

UNIT IV:

Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services/Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

UNIT V:

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively
(Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology,Sensing the World.

Text Books:

1. Internet of Things: Architecture, Design Principles and Applications, 1st ed, Rajkamal,McGraw Hill Higher Education, 2017.
2. Internet of Things, 1st ed, A.Bahgya and V.Madisetti, Univesity Press, 2014

Reference Books:

1. Designing the Internet of Things, 1st ed, Adrian McEwen and Hakim Cassimally, Wiley, 2013.
2. Getting Started with the Internet of Things, 1st ed,CunoPfister, Oreilly, 2011.

MCA III Sem	HUMAN RESOURCE MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

- Contribute to the development, implementation, and evaluation of employee recruitment, selection, and retention plans and processes.
- Administer and contribute to the design and evaluation of the performance management program.
- Develop, implement, and evaluate employee orientation, training, and development programs.
- Facilitate and support effective employee and labour relations in both non-union and union environments.

UNIT I:

HRM: Significance, Definition and Functions, evolution of HRM, Principles, Ethical Aspects of HRM, HR policies, Strategies to increase firm performance, Role and position of HR department, aligning HR strategy with organizational strategy, HRM at global perspective challenges, cross-cultural problems, emerging trends in HRM.

UNIT II:

Investment perspectives of HRM: HR Planning, Demand and Supply forecasting, Recruitment and Selection, Sources of recruitment, Tests and Interview Techniques, Training and Development, Methods and techniques, Training evaluation, retention, Job Analysis, job description and specifications, Management development, HRD concepts.

UNIT III:

Wage and Salary Administration: Concept, Wage Structure, Wage and Salary Policies, Legal Frame Work, Determinants of Payment of Wages, Wage Differentials, Job design and Evaluation, Incentive Payment Systems. Welfare management: Nature and concepts, statutory and non-statutory welfare measures, incentive mechanisms.

UNIT IV:

Performance Evaluation: Importance, Methods, Traditional and Modern methods, Latest trends in performance appraisal, Career Development and Counseling- Compensation, Concepts and Principles, Influencing Factors, Current Trends in Compensation, Methods of Payments, compensation mechanisms at international level.

UNIT V:

Managing Industrial Relations: Trade Unions, Employee Participation Schemes, Collective Bargaining, Grievances and disputes resolution mechanisms, Safety at work, nature and importance, work hazards, safety mechanisms, Managing work place stress.

Text Books:

1. K Aswathappa: “Human Resource and Personnel Management”, Tata McGraw Hill, New Delhi, 2013
2. N.Sambasiva Rao and Dr. Nirmal Kumar: “Human Resource Management and Industrial Relations”, Himalaya Publishing House, Mumbai
3. Mathis, Jackson,Tripathy:“Human Resource Management:Asouth-Asin Perspective”, Cengage Learning, New Delhi, 2013
4. Subba Rao P: “Personnel and Human Resource Management-Text and Cases”, Himalaya Publications, Mumbai, 2013.
5. MadhurimaLall, Sakina QasimZasidi: “Human Resource Management”, Excel Books, New Delhi, 2010

MCA III Sem	FULL STACK DEVELOPMENT LAB	L	T	P	C
		0	0	3	1.5

Course objectives:

- To understand the essential javascript concepts for web development.
- To style Web applications using bootstrap.
- To utilize React JS to build front end User Interface.
- To understand the usage of API's to create web applications using Express JS.
- To store and model data in a no sql database.

List of Experiments:

1. a. Write a script that Logs "Hello, World!" to the console. Create a script that calculates the sum of two numbers and displays the result in an alert box.
   b. Create an array of 5 cities and perform the following operations:
   Log the total number of cities. Add a new city at the end. Remove the first city. Find and log the index of a specific city.

2. a. Read a string from the user, Find its length. Extract the word "JavaScript" using substring() or slice(). Replace one word with another word and log the new string. Write a function isPalindrome(str) that checks if a given string is a palindrome (reads the same backward).

3. Create an object student with properties: name (string), grade (number), subjects (array), displayInfo() (method to log the student's details)
   Write a script to dynamically add a passed property to the student object, with a value of true or false based on their grade. Create a loop to log all keys and values of the student object.

4. Create a button in your HTML with the text "Click Me". Add an event listener to log "Button clicked!" to the console when the button is clicked. Select an image and add a mouseover event listener to change its border color. Add an event listener to the document that logs the key pressed by the user.

5. Build a React application to track issues. Display a list of issues (use static data). Each issue should have a title, description, and status (e.g., Open/Closed). Render the list using a functional component.

6. Create a component Counter with A state variable count initialized to 0. Create Buttons to increment and decrement the count. Simulate fetching initial data for the Counter component using useEffect (functional component) or componentDidMount (class component). Extend the Counter component to Double the count value when a button is clicked. Reset the count to 0 using another button.

7. Install Express (npm install express).
   Set up a basic server that responds with "Hello, Express!" at the root endpoint (GET /).
   Create a REST API. Implement endpoints for a Product resource: GET : Returns a list of products. POST: Adds a new product. GET /:id: Returns details of a specific product. PUT /:id: Updates an existing product. DELETE /:id: Deletes a product. Add middleware to log requests to the console. Use express.json() to parse incoming JSON payloads.

8. Install the MongoDB driver for Node.js. Create a Node.js script to connect to the shop database. Implement insert, find, update, and delete operations using the Node.js MongoDB driver. Define a product schema using Mongoose. Insert data into the products collection using Mongoose. Create an Express API with a /products endpoint to fetch all products. Use fetch in React to call the /products endpoint and display the list of products. Add a POST /products endpoint in Express to insert a new product. Update the Product List, After adding a product, update the list of products displayed in React.

MCA III Sem	MACHINE LEARNING WITH PYTHON LAB	L	T	P	C
		0	0	4	2

Course Objectives:

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.
- Design Python programs for various Learning algorithms.

Experiment 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 file

Experiment 2:
For a given set of training data examples stored in a .csv file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples

Experiment 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.

Experiment 4:
Write a Python program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.

Experiment 5:
Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

Experiment 6:
Write a program to implement the naive Bayesian classifier for a sample training data set stored as a .csv file. Compute the accuracy of the classifier, considering few test data sets.

Experiment 7:
Write a Python 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.

Experiment 8:
Assuming a set of documents that need to be classified, use the naive 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.

Experiment 9:
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 using Python Programming.

Experiment 10:
Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

MCA III Sem	BIG DATA TECHNOLOGIES LAB	L	T	P	C
		0	0	3	1.5

Course objectives:

1. To implement MapReduce programs for processing big data.
2. To realize storage and processing of big data using MongoDB, Pig, Hive and Spark.
3. To analyze big data using machine learning techniques.

List of Experiments:

1. Install Hadoop and Implement the following file management tasks in Hadoop: Adding files and directories Retrieving files Deleting files and directories. Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.

2. Develop a MapReduce program to implement Matrix Multiplication

3. Develop a Map Reduce program that mines weather data and displays appropriate messages indicating the weather conditions of the day.

4. Develop a MapReduce program to find the tags associated with each movie by analyzing movie lens data.

5. Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB

6. Write Pig Latin scripts to sort, group, join, project, and filter the data.

7. Use Hive to create, alter, and drop databases, tables, views, functions, and indexes.

8. Implement a word count program in Hadoop and Spark.

9. Use CDH (Cloudera Distribution for Hadoop) and HUE (Hadoop User Interface) to analyze data and generate reports for sample datasets

MCA III Sem	EMPLOYABILITY SKILLS–2	L	T	P	C
		1	0	0	0

Course Objectives:
The main objective of the course is to to develop a range of skills and attributes essential for success in the workplace

UNIT I :
Numerical ability l: Number system, HCF & LCM, Average, Simplification, Problems on numbers
Numerical ability II: Ratio & Proportion, Partnership, Percentages, Profit & Loss

UNIT II :
Arithmetical ability l: Problems on ages, Time & Work, Pipes & Cistern, Chain Rule.
Arithmetical ability ll: Time & Distance, Problems on boats &Steams, Problems on Trains

UNIT III
Arithmetical ability lll: Allegation, Simple interest and compound interest, Races & Games of skills, Calendar and Clock,
Logical ability: Permutations and Combination and Probability.

UNIT IV
Mensuration: Geometry, Areas, Volumes,

UNIT V
Data interpretation: Tabulation, Bar graphs, Pie charts, line graphs

Text books:

1. R. S. Aggarwal “Quantitative Aptitude”, Revised ed., S Chand publication, 2017 ISBN:8121924987

E-resources:

1. https://blog.feedspot.com/aptitude_youtube_channels/
2. https://www.tutorialspoint.com/quantitative_aptitude/
3. https://www.careerbless.com/aptitude/qa/home.php

MCA IV Sem	GENERATIVE AI (PROGRAM ELECTIVE-3)	L	T	P	C
		3	0	0	3

Course Objectives: The objectives of the course are to

- Understand the basics of Generative AI, Text Generation. and the process of generating videos.
- Know about GAN and its variants.

UNIT I :

Introduction To Gen AI: Historical Overview of Generative modeling, Difference between Gen AI and Discriminative Modeling, Importance of generative models in AI and Machine Learning, Types of Generative models, GANs, VAEs, autoregressive models and Vector quantized Diffusion models, Understanding if probabilistic modeling and generative process, Challenges of Generative Modeling, Future of Gen AI, Ethical Aspects of AI, Responsible AI, Use Cases.

UNIT II:

Generative Models For Text: Language Models Basics, Building blocks of Language models, Transformer Architecture, Encoder and Decoder, Attention mechanisms, Generation of Text, Models like BERT and GPT models, Generation of Text, Autoencoding, Regression Models, Exploring ChatGPT, Prompt Engineering: Designing Prompts, Revising Prompts using Reinforcement Learning from Human Feedback (RLHF), Retrieval Augmented Generation, Multimodal LLM, Issues of LLM like hallucination.

UNIT III:

Generation of Images: Introduction to Generative Adversarial Networks, Adversarial Training Process, Nash Equilibrium, Variational Autoencoders, Encoder-Decoder Architectures, Stable Diffusion Models, Introduction to Transformer-based Image Generation, CLIP, Visual Transformers ViT- Dall-E2 and Dall-E3, GPT-4V, Issues of Image Generation models like Mode Collapse and Stability.

UNIT IV:

Generation of Painting, Music, and Play: Variants of GAN, Types of GAN, Cyclic GAN, Using Cyclic GAN to Generate Paintings, Neural Style Transfer, Style Transfer, Music Generating RNN, MuseGAN, Autonomous agents, Deep Q Algorithm, Actor-critic Network.

UNIT V:

Open Source Models And Programming Frameworks: Training and Fine tuning of Generative models, GPT 4 All, Transfer learning and Pretrained models, Training vision models, Google Copilot, Programming LLM, LangChain, Open Source Models, Llama, Programming for TimeSformer, Deployment, Hugging Face.

Text Books:

1. Denis Rothman, “Transformers for Natural Language Processing and Computer Vision”, Third Edition , Packt Books, 2024

Reference Books:

1. David Foster, ”Generative Deep Learning”, O’Reily Books, 2024.
2. Altaf Rehmani, “Generative AI for Everyone”, BlueRose One, 2024.

MCA IV Sem	BLOCKCHAIN TECHNOLOGIES (PROGRAM ELECTIVE-3)	L	T	P	C
		3	0	0	3

Course Objectives: The objectives of the course are to

1. Learn the fundamentals of Block Chain and various types of block chain and consensus mechanism.
2. Understand public block chain system, Private block chain system and consortium block chain.
3. Know the security issues of blockchain technology.

UNIT – I:

Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future.

Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol.

Cryptocurrency: Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

UNIT – II:

Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, EthereumBlockchain.

Smart Contracts: Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

UNIT – III:

Private Blockchain System: Introduction, Key Characteristics of Private Blockchain, Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E-commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain.

Consortium Blockchain: Introduction, Key Characteristics of Consortium Blockchain, Need of Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda.

Initial Coin Offering: Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

UNIT – IV:

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate,

Blockchain in Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.

UNIT – V:

Blockchain Case Studies:
Case Study 1 – Retail,
Case Study 2 – Banking and Financial Services,
Case Study 3 – Healthcare,
Case Study 4 – Energy and Utilities.
Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.
Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyperledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

Text book:

1. "Blockchain Technology", Chandramouli Subramanian, Asha A.George, Abhilasj K A, MeenaKarthikeyan , Universities Press.

Reference Books:

1. Blockchain Blue print for Economy, Melanie Swan, SPDOreilly.
2. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gauar, Pearson Addition Wesley

MCA IV Sem	DIGITAL MARKETING (PROGRAM ELECTIVE-3)	L	T	P	C
		3	0	0	3

Course Objectives: The main objectives of the course are to

- Understand about the Social Media and its importance for marketing success.
- Understand the process of integration of different digital media and create marketingcontent.
- Understand planning &control activities to effectively deliver goods and services.
- Learn principles of marketing, economics, accounting, operations management, andfinance.
- Develop and implement social media strategies for B2B and B2C marketing forpenetration, growth, and development

Unit I:

Digital marketing overview- what is Digital Marketing , traditional marketing vs. DigitalMarketing, understanding traffic, categorization of digital marketing for the business, Legaland Ethical issues, Search Engine Optimization (SEO)- on page optimization, off pageoptimization.

Unit II:

Social Mediaoverview- Social Media features, social media tools and platforms, Social Mediamonitoring, Hashtag, viral content. **Social media marketing -** SMM vs. SMO benefits of usingSMM social media strategy, Email marketing,

Unit III:

Social media marketing - Facebook marketing-profiles and pages, business categories,Facebook page custom URL, invite page likes, scheduling posts, Facebook events, Facebookinsights reports, competitor's Facebook page, connect with twitter. Facebook ad campaigns- adobjective, performance matrix, ad components, Facebook ad structure, Facebook insights,Facebook page promotion, video promotion.

Unit IV:

Google Ads- Introduction to Ad words, keyword planner, Pay-Per-Click(PPC), PPC terminology, PPC AD on Google Facebook.

Unit V:

Content Marketing and security, Security for SMM, Social Media Privacy, Secure Paymentsand Website Encryption, Cookies, VPN, Digital Certificate, E-Governance, E-wallet.

Text Books:

1. Ryan Deiss, Russ Henneberry (2017) Digital Marketing for Dummies, John Wiley& Sons.
2. Ahuja Vandana (2015) Digital Marketing, Oxford University Press.

Reference Books:

1. Ira Kaufman, Chris Horton (2014) Digital Marketing: Integrating Strategy and Tacticswith Values, A Guidebook for Executives, Managers, and Students, Routledge,
2. Matt Chiera (2018) Digital Marketers Sound Off: Tips, Tactics, Tools, andPredictions from 101 Digital Marketing Specialists, Matt Chiera,
3. Puneet Bhatia (2017) Fundamentals of Digital Marketing, Pearson India, ISBN9352861418, 9789352861415
4. Dan Zarrella (2011) The Social Media Marketing Book, O'Reilly Media.
5. Krista Neher (2013) Visual Social Media Marketing: Harnessing Images,Instagram,Infographics and Pinterest to Grow Your Business Online, Boot Camp Digital

MCA IV Sem	MOBILE ADHOC NETWORKS (PROGRAM ELECTIVE-4)	L	T	P	C
		3	0	0	3

Course Objectives:

From the course the student will learn

- Architect sensor networks for various application setups.
- Devise appropriate data dissemination protocols and model links cost.
- Understanding of the fundamental concepts of wireless sensor networks and has a basic knowledge of the various protocols at various layers.
- Evaluate the performance of sensor networks and identify bottlenecks.

UNIT I: Introduction to Ad Hoc Wireless Networks- Cellular and Ad Hoc Wireless Networks, Characteristics of MANETs, Applications of MANETs, Issues and Challenges of MANETs, Ad Hoc Wireless Internet, MAC protocols for Ad hoc Wireless Networks-Issues, Design Goals and Classifications of the MAC Protocols.

UNIT II: Routing Protocols for Ad Hoc Wireless Networks- Issues in Designing a Routing Protocol, Classifications of Routing Protocols, Topology-based versus Position-based Approaches, Issues and design goals of a Transport layer protocol, Classification of Transport layer solutions, TCP over Ad hoc Wireless Networks, Solutions for TCP over Ad Hoc Wireless Networks, Other Transport layer protocols.

UNIT III: Security protocols for Ad hoc Wireless Networks- Security in Ad hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad hoc Wireless Networks, Cooperation in MANETs, Intrusion Detection Systems.

UNIT IV: Basics of Wireless Sensors and Applications- The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clustering of Sensors, Applications, Data Retrieval in Sensor Networks-Classification of WSNs, MAC layer, Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

UNIT V: Security in WSNs- Security in WSNs, Key Management in WSNs, Secure Data Aggregation in WSNs, Sensor Network Hardware-Components of Sensor Mote, Sensor Network Operating Systems–TinyOS, LA-TinyOS, SOS, RETOS, Imperative Language-nesC, **Dataflow Style Language-**TinyGALS, Node-Level Simulators, NS-2 and its sensor network extension, TOSSIM.

Text Books:

1. Ad Hoc Wireless Networks – Architectures and Protocols, 1st edition, *C. Siva Ram Murthy, B. S. Murthy*, Pearson Education, 2004
2. Wireless Sensor Networks - A Modern approach, *GarimellaRama murthy*, 1st edition, Universities Publishers, 2025

3. Ad Hoc and Sensor Networks – Theory and Applications, 2nd edition *Carlos Corderio Dharma P.Aggarwal*, World Scientific Publications / Cambridge University Press, 2006

Reference Books:

1. Wireless Sensor Networks: An Information Processing Approach, 1st edition, *Feng Zhao, Leonidas Guibas*, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009
2. Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, 1st edition, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008
3. Ad hoc Networking, 1stedition,*CharlesE.Perkins*, Pearson Education, 2001
4. Wireless Ad hoc Networking, 1st edition, *Shih-Lin Wu, Yu-Chee Tseng*, Auerbach Publications, Taylor & Francis Group, 2007
5. Wireless Sensor Networks – Principles and Practice, 1st edition, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010

MCA IV Sem	QUANTUM COMPUTING (PROGRAM ELECTIVE-4)	L	T	P	C
		3	0	0	3

Course Objectives:
To introduce the fundamentals of quantum computing, the problem-solving approach using finite dimensional mathematics

UNIT - I
History of Quantum Computing: Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations

UNIT - II
Background Mathematics: Basics of Linear Algebra, Hilbert space, Probabilities and measurements.
Background Physics: Paul's exclusion Principle, Superposition, Entanglement and super-symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)

UNIT - III
Qubit: Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.

UNIT - IV
Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.

UNIT - V
Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation

Text Books:
1. Quantum Computation and Quantum Information, Nielsen M. A.,Cambridge
2. Programming Quantum Computers, Essential Algorithms and Code Samples, Eric R Johnson, NicHarrigan, Mercedes Ginemo, Segovia, Oreilly

Reference Books:

1. Quantum Computing for Computer Scientists, Noson S. Yanofsk, Mirco A. Mannucci
2. Principles of Quantum Computation and Information,Benenti G., Casati G. and Strini G., Vol.I: Basic Concepts, Vol II
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms

MCA IV Sem	AGILE METHODOLOGIES (PROGRAM ELECTIVE-4)	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of this course are to

- Introduce the important concepts of Agile software development Process
- Emphasize the role of stand-up meetings in software collaboration
- Impart the knowledge on values and principles in understanding agility

UNIT I :

Learning Agile: Agile, Getting Agile into your brain, Understanding Agile values, No Silver Bullet, Agile to the Rescue. A fractured perspective, The Agile Manifesto, Understanding the Elephant, Where to Start with a New Methodology.

UNIT II :

The Agile Principles: The 12 Principles of Agile Software, The Customer Is Always Right, Delivering the Project, Better Project Delivery for the Ebook Reader Project. Communicating and Working Together, Project Execution—Moving the Project Along, Constantly Improving the Project and the Team. The Agile Project: Bringing All the Principles Together

UNIT III :

SCRUM and Self-Organizing Teams: The Rules of Scrum, Act I: I Can Haz Scrum, Everyone on a Scrum Team owns the Project, Status Updates Are for Social Networks!, The Whole Team Uses the Daily Scrum, Feedback and the Visibility-Inspection-Adaptation Cycle, The Last Responsible Moment, Sprinting into a Wall, Sprints, Planning, and Retrospectives.

Scrum Planning And Collective Commitment: Not Quite Expecting the Unexpected, User Stories, Velocity, and Generally Accepted Scrum Practices, Victory Lap, Scrum Values Revisited.

UNIT IV :

XP And Embracing Change: Going into Overtime, The Primary Practices of XP, The Game Plan Changed, but We're Still Losing, The XP Values Help the Team Change Their Mindset, An Effective Mindset Starts with the XP Values, The Momentum Shifts, Understanding the XP Principles Helps You Embrace Change.

XP, Simplicity, and Incremental Design: Code and Design, Make Code and Design Decisions at the Last Responsible Moment, Final Score.

UNIT V:

Lean, Eliminating Waste, and Seeing the whole: Lean Thinking, Creating Heroes and Magical Thinking. Eliminate Waste, Gain a Deeper Understanding of the Product, Deliver As Fast As Possible.

Kanban, Flow, and Constantly Improving: The Principles of Kanban, Improving Your

Process with Kanban, Measure and Manage Flow, Emergent Behavior with Kanban.
The Agile Coach: Coaches Understand Why People Don't Always Want to Change. The Principles of Coaching.

Text Books :

1. Andrew Stellman, Jill Alison Hart, Learning Agile, O'Reilly, 2015.

Reference Books:

1. Andrew Stellman, Jennifer Green, Head first Agile, O'Reilly, 2017.
2. Rubin K , Essential Scrum : A Practical Guide To The Most Popular Agile Process, Addison-Wesley, 2013