NIST UNIVERSITY

Master of Computer Application (MCA)

Syllabus

(2024-2026 Batch)

www.nist.edu

NIST UNIVERSITY

Institute Park, Pallur Hills, Berhampur,
Odisha, India – 761008

4.2.6 Master in Computer Application (MCA)

MCA Course Structure

First - Year Course Structure (I Semester)							
S. No.	Course Category	Course Code	Course Title	L	P	T	Credits
1	CC	MCA-500	Data Structure using C	3	0	4	5
2	CC	MCA-501	Computer Organization and Architecture	3	0	0	3
3	CC	MCA-502	Database Management Systems	3	0	4	5
4	CC	MCA-503	Mathematics – I: (Mathematical Foundation of Computer Science)	3	0	0	3
5	AEC	MCA-504	Communicative English	2	0	4	4
Total Credits							20

First -Year Course Structure (II Semester)							
S. No.	Course Category	Course Code	Course Title	L	P	T	Credits
1	CC	MCA-505	Object Oriented Programming using JAVA	3	0	4	5
2	CC	MCA-506	Computer Networks	3	0	4	5
3	CC	MCA-507	Operating Systems	3	0	4	5
4	CC	MCA-508	Software Engineering	3	0	0	3
5	CC	MCA-509	Mathematics - II (Probability & Statistics)	3	0	0	3
6	AEC	MCA-510	Personality and Soft Skill Development	0	0	4	2
Total Credits							23

Second - Year Course Structure (III Semester)							
S. No.	Course Category	Course Code	Course Title	L	P	T	Credits
1	CC	MCA-600	Design and Analysis of Algorithms	3	0	4	5
2	CC	MCA-601	Data Warehousing and Data Mining	3	0	0	3
3	CC	MCA-602	Python Programming	3	0	4	5
4	CC	MCA-603	Artificial Intelligence	3	0	0	3
5	DSE	MCA-604	Department Specific Elective - I	3	0	0	3
6	PR	xxx-xxx*	Minor Project with Seminar	0	0	8	4
7	PR	MCA-611	Summer Internship	0	0	2	1
Total Credits							24

*Course Code for PE& OE (XXX-XXX) will be one of the following.

Department Specific Elective - I

MCA-605: Computer Graphics and Multimedia

MCA-607: Natural Language Processing

MCA-608: Wireless Sensor Network

MCA-609: Soft Computing Techniques

MCA-610: CBOT (Computer-based optimization techniques)

Second - Year Course Structure (IV Semester)							
S. No.	Course Category	Course Code	Course Title	L	P	T	Credits
1	CC	MCA-604	Machine Learning	3	0	4	5
2	CC	MCA-605	Internet &Web Technology	3	0	4	5
3	DSE	MCA-631	Department Specific Elective - II	3	0	0	3
4	PR	MCA-682	Major Project	0	0	24	12
Total Credits							25

Department Specific Elective – II

MCA-631A: Internet of Things (IoT)

MCA-631B: Computer Network Security

MCA-631C: Web application Development

MCA-631D: Cloud Computing

MCA-631E: Data Science

MCA-631F: Software Testing and Quality Assurance

MCA-631G: Blockchain Technology

SECOND SEMESTER DETAIL SYLLABUS

MCA-505	Object Oriented Programming using JAVA	**5 Credits**

Course Objective

1. Understand the basic object-oriented programming concepts and apply them in problem solving.
2. Illustrate inheritance concepts for reusing the program.
3. Students will able to learn about. Multi-Threading, String Handling and Java I/O.
1. Students will Develop and implement Graphical User Interface(GUI) Applications in Java using AWT and Swing

Course Outcome:

1. Understand and implement various Object Oriented Concepts like inheritance, abstraction and polymorphism.
2. Work with Collection Classes and Files, Multiple Threads, & handle Exceptions.
3. Develop applications to interact with a Database.
4. Design and implement Graphical User Interface(GUI) Applications in Java using AWT and Swing.

Module- I (8 Hours)

Introduction to Java and Java programming environment. Object Oriented Programming Concepts: Encapsulation, Abstraction, Inheritance, Polymorphism.Fundamental Programming Structure: Data Types, variables, keywords, typecasting, Arrays, Operators, and their precedence. Control Flow: Java's Control Statements (if, switch, iteration, statement, while, do-while, for, Nested loop). Objects and Classes: Concept of Objects and Classes, Using Existing Classes building your classes, constructor overloading, static, final, this keyword. Array and String Handling: String constructors, String length, Character Extraction, String Comparison, Modifying a string.

Module - II (12 Hours)

Inheritance: Introduction, types of inheritance, use of super keyword, method overriding, Dynamic method Dispatch, Using Abstract Classes, Using final with inheritance, the object class.Packages & Interfaces: Packages, Access Protection, importing package, Interface, Implementing Interfaces, variables in Interfaces, and Interfaces can be extended. Java I/O: Classes & Interfaces, Stream classes, Byte streams, Character streams, Serialization.

Module –III (12 Hours)

Exception Handling: Fundamentals, Types Checked, Unchecked exceptions, Using try and catch, Multiple catch, throw, throws, and finally, Java's built-in exceptions, and user-defined exceptions.Multi-Threading: Java Thread Life Cycle, Thread Priorities, Synchronization, Creating a thread, Runnable interface, Creating Multiple threads, Using isAlive () and join (), wait () &notify(). Wrapper Classes: Wrapper classes and their methods.

Module IV (8 Hours)

Collection Framework: Introduction, interfaces, List, Set, Map, etc, List interfaces and their classes. Event Handing: Event Delegation Model, Event Classes, Event Listener Interfaces, Adapter classes. AWT: AWT Classes window fundamentals, component, container, panel, Window, Frame, working with Graphics, Control Fundamentals, Layout managers, Handling Events by Extending AWT components. Introduction to Database: Introduction to Database. Driver Types, Registering Driver, Creating Connection, Executing SQL query using Statement, PreparedStatement. ResultSet methods.

Text Books:

1. Java: One Step Ahead by Anita Seth (Author), B.L. Juneja (Author) Oxford University Press.
2. Head First Java 2nd edition Kathy Sierra & Bert Bates 3. JAVA Complete Reference (9th Edition) Herbert Schildt.
4. https://www.udemy.com/java-the-complete-java-developer-course/
5. Java Programming Masterclass for Software Developers Created by Tim Buchalka, Tim Buchalka's Learn Programming Academy, GoranLochert

Course Name	**Object Oriented Programming using JAVA**
Course Link	**https://onlinecourses.nptel.ac.in/noc21_cs03/preview**
Course Instructor	**Prof. DebasisSamanta** **Dept. Computer Science and Engineering from Indian Institute of Technology, Kharagpur**

MCA-506	**Computer Networks**	**5 Credits**

Course Objectives:

1. Understand the concepts of data communication, layered model, wireless devices in computer networks.
2. Students will be able to understand the various techniques used to access a shared channel in the network and IEEE specifications for LANs.
3. Students will learn about different types of networking devices, backbone networks and Internet Protocol (IP)addressing.
4. Understand the responsibilities of network, transport and application layers.

Module – I (12 Hrs)
Overview of Data Communication Networks, Design issues, structure and topology, Protocols and standards, OSI Reference model, TCP/IP Protocol.
Physical Layer: Analog Signals, Digital Signals, Data Rate Limits, Transmission Impairment, Data rate limit, multiplexing: Time Division Multiplexing (TDM), FrequencyDivision Multiplexing (FDM), Wave Division Multiplexing (WDM),
Transmission Media: Guided Media (Twisted-Pair Cable, Coaxial Cable and Fiber OpticCable) and unguided media (wireless), Switching: Circuit Switched Network, packetswitching, Datagram Network, Virtual-Circuit Network, Telephone Network, Dial-upModems and Digital Subscriber Lines.

Module – II (12 Hrs)
Error Detection and correction: Types of Errors, Error Detection mechanism (Linear codes, CRC, Checksum), Error Correction mechanism: Hamming Encoding. Data Link Control and Protocols: Flow and Error Control, Stop-and-Wait ARQ. Go-Back-N ARQ,Selective Repeat ARQ, HDLC and Point-to-Point Protocol Multiple Access: RandomAccess (ALOHA, CSMA, CSMA/CD, CSMA/CA), Controlled Access (Polling, Reservation, Token Passing), Channelization (FDMA, TDMA, and CDMA). WiredLANs(Ethernet): Traditional Ethernet, Fast Ethernet, and Gigabit Ethernet.

Module – III (06 Hrs)
Wireless LANs: IEEE 802.11 and Bluetooth2.0.
Connecting Devices: Passive Hub, Repeater, Active Hub, Bridge, Two layers Switch, Router, Three layers Switch, Gateway.Virtual Circuit Networks: Frame Relay, Architecture & layers, ATM: Design goals,Architecture & layers.

Module – IV (10 Hrs)
Network Layer: IPV4 addresses, IPV6 addresses, Internet Protocol: Internetworking, IPV4datagram, IPV6 packet format and advantages. Network Layer Protocols: ARP, RARP,IGMP and ICMP. Routing: Unicast Routing Protocols and Multicast Routing

Protocols.Transport Layer: Process to Process Delivery, User Datagram Protocol (UDP) andTransmission Control Protocol (TCP).
Domain Name System (DNS): Name Space, Domain Name Space, DNS in Internet,Resolution and Dynamic Domain Name System (DDNS), Remote logging, Electronic Mail(SMTP) and file transfer (FTP), WWW: Architecture & Web document, HTTP: Transaction& Persistent vs. Non-persistent connection. Introduction to Wi-Fi and Li-Fi Technology.Course Outcomes:

1. Understand the layered communication architectures (OSI and TCP/IP) and different transmission techniques for communication over a network.
2. Recognise devices used in 3 lower layers. Understand and apply flow and error control during data tranmission with the associated protocols and mechnism of channel access methods.
3. Understand and apply host addressing logic &subneting concepts with associated protocols of network layer and transport layer.Understand protocols involved in application layer to facilitate high level applications

TEXT BOOKS:

1. Data Communications and Networking, Behrouz A. Forouzan, Tata McGraw-Hill, 5th Edition(2013).
2. Computer Networks, A. S. Tannenbum, D. Wetherall, Pearson Education, **5th Edition(2014).**

REFERENCE BOOKS:

1. Data and Computer Communications, William Stallings, Pearson Education, 10th Edition(2018).
2. Computer Networking, A Top-Down Approach, James F. Kurose, Keith W. Ross, Pearson publication, 6th Edition(2017).

Course Name	**Computer Networks**
Course Link	**https://nptel.ac.in/courses/106105183/**
Course Instructor	**Prof. SoumyaKantiGhosh, IIT, Kharagpur**

MCA-507	Operating Systems	5 Credits

Course Objectives:

1. Student will be able to understand the basic components of a computer operating system, and the interactions among the various components.
2. The course will cover an introduction on the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems.
3. Students will be able to understand the concepts of virtual memory management, file system.
4. Students will be able to understand the concepts of secondary storage structure, protection and case study of Linux operating system.

Module-I: (10 Hrs.)

Overview: Operating System, Simple Batch Processing Systems, Multiprogramming and Time-sharing systems Operating System Structures, Operating System Services and system calls.

Process: Process Concept, Process Scheduling, Operation on Processes, Inter-process communication, Examples of IPC Systems, Multithreading Models, Threading Issues.

Module-II: (10 Hrs.)

Process Scheduling: scheduling criteria, scheduling algorithms

Process Synchronization: Critical section problem, two-process and multi-process solutions, Semaphores, Classical problems of synchronization, Monitors.

Deadlocks: System model, Deadlock Characterization, Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection and recovery from Deadlock.

Module-III: (10 Hrs.)

Memory Management: Memory Management strategies, Logical versus Physical Address space, swapping, contiguous Allocation, Paging, Segmentation.

Virtual Memory: Background, Demand paging, performance of Demand paging, Page Replacement, Page Replacement Algorithms, Allocation of frames, Thrashing and its prevention, Paging with segmentation

Module-IV: (10 Hrs.)

File system: file structure, file operations, file access methods, Directory Structure, Directory Implementation, and Allocation Methods

Mass Storage: Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management

Course Outcome:

1. Understand the different services provided by Operating System at different level and the design structure and learn real life applications of the same.
2. Solve and implement different process scheduling algorithms, synchronization techniques and methods of handling deadlock.

3. Describe different memory management techniques and solve problems related to paging, segmentation, fragmentation and page replacement.
4. Use concepts of file management, disk management and solve problems regarding file allocation methods and disk scheduling.

Suggested Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Concepts, 8th edition, Wiley-India, 2009
2. William Stallings, Operating Systems: Internals and Design principles, 6th Edition, PHI Learning Pvt. Ltd, 2010
3. H.M. Deitel, P. J. Deitel, D. R. Choffnes, Operating Systems, 3rdEdition, Pearson Education, Dec 2003
4. Andrew S. Tanenbaum: Mordern Operating Systems, 4th Edition, Pearson Education, 2014
5. NareshChouhan: Principles of Operating System, Oxford University Press.

Web Courses/Online courses

Course Name	INTRODUCTION TO OPERATING SYSTEMS
Course Link	https://nptel.ac.in/courses/106106144/2
Course Instructor	Prof. Chester Rebeiro, IIT Madras

MCA-508	**Software Engineering**	**3 credit**

Course Objectives:

1. **To understand the rationale for software development process models**
2. **To learn how to develop requirement specification for software development**
3. **To understand the importance of architectural design and software testing methods**
4. **To learn how to manage software development projects, software quality and ensure software reliability**

Module-I: (10 Hrs.)

Introduction to software engineering, keyaspects of SE, SDLC, Software Development process models: Waterfall, V-model, Incremental, RAD, Iterative, Spiral, Prototype, and Agile software development model: Agile methods, Extreme programming, Agile Process models: Adaptive software development, Scrum, Crystal.

Module-II: (10 Hrs.)

Requirements engineering: Functional and non-functional requirements, software requirements specification (SRS), Requirements engineering process, Requirements elicitation and analysis, Requirements validation& management.

Object-oriented design using UML: Object oriented concepts, Dynamic and Functional Modelling, System modelling: Building Context models, Structural models, Behavioural models, and Interaction models using UML.

Module-III: (10 Hrs.)

Architectural design: Architectural views, Architectural patterns, Application architectures, cohesion and coupling, Software measurement and metrics, Software testing methods: Blackbox and Whitebox testing, unit testing, integration testing, system testing, software verification and validation, Software Maintenance.

Module-IV: (10 Hrs.)

Software project management: Risk management, managing people, Project planning, Project scheduling, Software cost estimation, COCOMO model.

Software Quality Management, Configuration management, Software reuse and reliability.

Component based software engineering, Service-oriented Software Engineering

Course Outcome:

1. **To understand the phases of software development**
2. **To be able to develop software requirement specifications for different types of software and also use UML as a design tool**
3. **To understand the architectural design of software systems and various software testing techniques**

TEXT BOOKS

1. Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, PHI, 2018

REFERENCE BOOKS

1. Software Engineering, A Practitioner's Approach, Roger S. Pressman, TMG Hill.
2. Fundamentals of Software Engineering, Rajib Mall, PHI, 2014.
3. Software Engineering, I. Sommerville, 9th Ed., Pearson Education.

Digital Learning Resources

Course Name	SOFTWARE ENGINEERING
Course Link	https://nptel.ac.in/courses/106105182/
Course Instructor	PROF. RAJIB MALL Dept. of Computer Science and Engineering, IIT Kharagpur

MCA-509	**Mathematics - II** **(Probability & Statistics)**	**3 Credits**

CourseObjectives:

1. Enrich the knowledge of probability on single random variables and probability distributions.
2. Understand the foundations for classical inference involving confidence intervals and hypothesis testing.
3. Analyse the given data for appropriate test of hypothesis.
4. Apply the concept of correlation and regression.

Module-I: Probability, Random Variables and Distributions [14 hrs]
Sample Space, Events, Counting sample points, Probability of an event, Additive Rules, Conditional Probability, Multiplicative rules, Baye's Rule. Discrete and continuous random variables, Discrete and continuous probability distributions, Joint probability distribution, Mathematical expectation: mean, variance and standard deviation of a probability distribution. Binomial distribution, Poisson process and Poisson distribution, Normal distribution, Areas under the normal curve, Applications of the normal distribution, Normal approximation to the binomial.

Module-II: Fundamental Sampling and Estimations [10hrs]
Random Sampling, Some important statistics, Sampling distribution: Sampling distribution of mean and variance, t-distribution, Statistical inference, Classical methods of estimation, Single sample: estimating the mean, Standard error of point estimate, Prediction intervals, and estimation of variance.

Module-III: Testing of Hypothesis [8 hrs]
Statistical hypothesis, Testing a statistical hypothesis, One and two tailed tests, Decision making in testing hypothesis, Test concerning a single mean, Goodness of fit test.

Module-IV: Correlation and Regression [8 hrs]
Bivariate distribution, Correlation, Scatter Diagram, Karl Pearson coefficient of correlation, Calculation of the Correlation Coefficient for a Bivariate Frequency Distribution, Probable Error of Correlation Coefficient, Rank Correlation, Regression..

COURSE OUTCOMES
On completion of this course, students are able to:
CO-1: Use the basic probability rules, discrete and continuous probability distributions, including requirements of mean and variance.
CO-2: Identify the characteristics of different discrete and continuous distributions. Identify the type of statistical situation to which different distributions can be applied.
CO-3: Use of continuous distribution and various hypothesis of testing.

CO-4: Employee the principles of linear regression and correlation and significance of the correlation coefficient.

TEXT BOOKS

1. R. E. Walpole, S. L. Myers, and K. Ye, *Probability and statistics for engineers and scientists*, 8th Edition, Pearson. [Chapter- 2, 3(3.1 – 3.4), 4(4.1 – 4.3), 5(5.3 and 5.6), 6(6.1 – 6.5), 8(8.1, 8.2, 8.4 – 8.7), 9(9.1 – 9.6, 9.12), 10(10.1 – 10.7, 10.14)]
2. S. C. Gupta, V. K. Kapoor, *Fundamental of Mathematical Statistics*, 10th revised edition, Sultan Chand & Sons. [Chapter- 10(10.1 – 10.7)]

REFERENCE BOOKS

1. J. E. Freund, *Mathematical Statistics*, 5th Edition, Prentice Hall of India pvt. Ltd., Eastern Economy Edition.
2. D. C. Montgomery and G. C. Runger, *Applied Statistics and Probability for Engineers*, 6th Edition, Wiley.
3. R. C. Johnson, *Probability and Statistics for Engineers*, 6th Edition, Prentice Hall of India pvt. Ltd., Eastern Economy Edition.

MCA-510	SOFT SKILLS AND PERSONALITY DEVELOPMENT 1.	2 credit

UNIT-I Know Your Self: Self Assessment
(LAB 1 & 2)

Understand	Know Your Self: Purpose-Importance and Benefits-How to do Self Assessment
Practice	➢ **SWOC Analysis** ➢ **Big Five Personality Assessment** ➢ **Introduce Yourself**

UNIT-2 Understanding the Dynamics of Communication: The 3Cs
(LAB 3 & 4)

Understand	The language beyond words: Purpose-Importance and Benefits of Kinesics- Listen to Understand- Importance of Listening skill – Purpose- Process- Types- Barriers- Effective Listening. What is Phonetics: Speech Sounds – Vowels and Consonants – Minimal Pairs- Consonant Clusters Structure of Syllables – Word Stress and Rhythm– Weak Forms and Strong Forms in Context. Intonation--Errors in Pronunciation-the Influence of Mother Tongue (MTI) Fundamentals of English Grammar Communicate to Connect: the significance of creating the First Impression using conversation, collaboration and convincing skills
Practice	Understanding Body Language Mastering Active Listening Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms in Context. Common Indian Variants in Pronunciation- Differences in British and American Pronunciation. Writing Flawlessly: Usage of Verbs, Sentence patterns, Use of Different parts of speech

UNIT-3 Communicate to Connect: Creative & Persuasive Communication
(LAB 5-8)

Understand	Communicating in a Group: The Elements of Group Dynamics Speaking to Public: Fundamentals of Public Speaking. How to Design and Deliver Presentations

	How to Express Yourself for communication effectiveness
Practice	**Participating in Mock Group Discussion** **Speaking Extempore/ Impromptu** **Deliver Power Point Presentation** **Script writing and Role play** **JaM** **Mock Press Meet** **Mock Interview** **Expressions in Various Situations** **Making Requests and Seeking Permissions** **Telephone Etiquette** **Writing Professional E-mail** Collage and Poster Making Debate

UNIT-IV Communicating for Career Building

LAB 9 & 10

Understand	The Dynamics of the Job Market: The Skill-Demand-Gap Analysis. Up-skilling and Re-skilling. Making the Move: Building your Personal Brand: Building Professional Social Media Profile. Professional networking. How to face Job Interview.
Practice	Goal Setting Resume Building Mock Job Interview

FINAL LAB

	Object Oriented Programming using JAVA Lab	

Course Objective:

1. Learn and implement Programs with the syntax, semantics and idioms of the Java programming language.
2. Gain confidence in object-oriented programming principles through lots of practical exercises that provide useful exposure to the core Java class libraries.
3. Students will able to learn about. Multi-Threading, String Handling and Java I/O.
4. Students will Develop and implement Graphical User Interface(GUI) Applications in Java using AWT and Swing

Lab Assignments

1Data types & variables, decision control structures: if, nested if etc Loop control structures: do, while, for etc.
2.Classes and objects.
3.Data Abstraction & Data hiding, Inheritance.
4.Interfaces and inner classes, wrapper classes.
5.Exception handlings
6.Threads
7.IO Files
8.Collections
9.Database Connectivity.
10.Applets AWT and Swing.

Course Outcome:

1. Understand and implement various Object-Oriented Concepts like inheritance, abstraction and polymorphism.
2. Work with Collection Classes and Files, Multiple Threads, & handle Exceptions.
3. Develop applications to interact with a Database.
4. Design and implement Graphical User Interface (GUI) Applications in Java using AWT and Swing.

	Computer Network Laboratory	

Course Objective:

1. Understand the concepts of data communication, layered model, wireless devices in computer networks.
2. Students will be able to understand the various techniques used to access a shared channel in the network and IEEE specifications for LANs.
3. Students will learn about different types of networking devices, backbone networks and Internet Protocol (IP)addressing.
4. Understand the responsibilities of network, transport and application layers.

Lab Assignments

1. Introduction to LAN hardware and IP addresses configuration
2. Understanding and use of networking tools: ifconfig, ping, traceroute, arp, dig and nslookup
3. Configuration of CISCO Switches and Routers.
4. Study of network traffic using Wireshark filters.
5. Controlling of network scenario using Netam and tc.

6 to 8 are based on the following experiments:

i. Simulate a three node point to point network with duplex links between them. Set queue size and vary the bandwidth and find number of packets dropped.

ii. Simulate a four node point to point network with the links connected as follows: n0 – n2, n1 – n2 and n2 – n3. Apply TCP agent between n0 – n3 and UDP agent between n1 – n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP / UDP.

iii. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.

iv. Simulate an Ethernet LAN using ‘n’ nodes, change error rate and data rate and compare throughput.

v. Simulate an Ethernet LAN using ‘n’ nodes and set multiple traffic nodes and plot congestion window for different source / destination.

9 to 10 are based on the following experiments to be implemented in C/Java:

i. Implementation of Distance Vector Algorithm to find suitable path for transmission.

ii. Program for ERROR detecting code using CRC-CCITT (16bit).

iii. Using TCP/IP Sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.

iv. Program for CLIENT SERVER communication using message Queues or FIFOs as IPC channels that client sends the file name and the server to send back the contents of the requested file if present.

v. Program for Congestion control using Leaky Bucket Algorithm.

	Operating System Laboratory	

Course Objective:

1. To write UNIX shell scripting.
2. To understand and implement IPC mechanism using named and unnamed pipes.
3. To implement the scheduling algorithms.
4. To develop solutions for synchronization problems using semaphores.
5. To implement Deadlock avoidance algorithms.
6. To implement page replacement algorithms

Lab Assignments

1. Practicing of basic UNIX Commands as well as Linux administrative commands 2. UNIX Shell Programming covering array, string and functions

3. Shell scripting using GREP commands.
4. Shell scripting using AWK commands.
5. Inter Process Communication (IPC) using Pipes.
6. Programs on signals and system calls
7. Implement the algorithms of CPU scheduling algorithms like FCFS, SJF, SRTF, Priority and RR using C/C++.
8. Write C/C++ programs to implement the classical synchronization problems like Dinning Philosopher and reader-writer problems using semaphore.
9. Implementation of deadlock avoidance algorithm using C/C++.
10. Implementation of page replacement algorithms like FIFO, LRU and Optimal.