SHIVAJI UNIVERSITY,KOLHAPUR

NAAC "A++" Grade with CGPA 3.52

(NEP-2020)

Syllabus for

Master of Computer Application

(Under Faculty of Science and Technology)

PART- I SEMESTER- I & II

(Syllabus to be implemented from Academic year 2023-24)

Choice Based Credit System
(NEP-2020)
M.C.A. Program Structure
M.C.A. Part – I (Level-6)

Sr. No.	Course Code	Teaching Scheme Theory and Practical			Examination Scheme University Assessment (UA)			Internal Assessment (IA)		
		Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
1	CC-101: Advanced Data Structures	4	4	4	80	32	3	20	8	
2	CC -102: Database Management System	4	4	4	80	32	3	20	8	
3	CCPR -103: Practical-I	--	6	4	80	32	3	20	8	
4	CC-104: Cyber security	2	2	2	40	16	2	10	4	
5	CCS-105: **1.** Computer Networks **2.** Computer Architecture	4	4	4	80	32	3	20	8	
6	CC -106: Research Methodology	4	4	4	80	32	3	20	8	--
	Total (A)	18 24		22	440			110		

SEMESTER-I (Duration- Six Month)

		SEMESTER-II (Duration- Six Month)								
Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
		Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
		Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
1	CC-201: Advanced operating system	4	4	4	80	32	3	20	8	--
2	CC -202: Java Programming	4	4	4	80	32	3	20	8	--
3	CCPR -203: Practical-II	---	6	4	80	32	3	20	8	--
4	CC-204: Web Technology	2	2	2	40	16	2	10	4	--
5	CCS-205: 1. Network Security 2. Software Engineering	4	4	4	80	32	3	20	8	--
6	OJT 206: Internship	---	---	4	100	40	--	--	--	--
	Total (B)	14	20	22	460			90		
	Total (A+B)			44	900			200		

• Student contact hours per week : **24** Hours (Min.)	• Total M.C.A : **1100** Marks for -I
• Theory and Practical Lectures : **60** Minutes Each	• Total M.C.A (Semester I : **44** Credits for -I & II)
• CC-Core Course • CCPR-Core Course Practical • RM: Research Methodology • OJT: On job training Internship: Student must complete on job training/ Internship during Semester break.	• Practical Examination is **Semester wise before theory Examination**. • Examination for CCPR -103shall be based on Semester-I Practical. • Examination for CCPR -203 shall be based on Semester-II Practical. • *Duration of Practical Examination as per respective BOS guidelines • *Separate passing is mandatory for Theory, Internal and PracticalExamination*
• **Requirement for Entry at Level 6:** **Completed all requirements of the Bachelor's degree (Level- 5).**	
• **Exit Option at Level 6:** Students can exit after Level 6 with **Post Graduate Diploma in Computer Programming** if he/she completes the coursesequivalent to minimum of **40-44** credits.	

Choice Based Credit System
(NEP-2020)
M.C.A. Program Structure
M.C.A. Part – II (Level-6.5)

| Sr. No. | Course Code | Teaching Scheme | | | Examination Scheme | | | | | |
| | | Theory and Practical | | | University Assessment (UA) | | | Internal Assessment (IA) | | |
		Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
	SEMESTER-III (Duration- Six Month)									
1	CC-301: Artificial Intelligence	4	4	4	80	32	3	20	8	
2	CC -302: Front End Development	4	4	4	80	32	3	20	8	
3	CCPR -303: Practical-III	---	6	4	80	32	3	20	8	
4	CC-304: PHP	2	2	2	40	16	2	10	4	
5	CCS-305: 1. Cloud Computing 2. Data Science	4	4	4	80	32	3	20	8	
6	CC -306: Research Project	---	6	4	80	32	3	20	8	--
	Total (C)	14	26	22	440			110		

		SEMESTER-IV (Duration- Six Month)								
Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
		Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
		Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam Hours	Maximum Marks	Minimum Marks	Exam. Hours
1	CC-401: Mobile App Development	4	4	4	80	32	3	20	8	
2	CC -402: Back End Development	4	4	4	80	32	3	20	8	
3	CCPR -403: Practical -IV	---	6	4	80	32	3	20	8	
4	CCS-404: 1. Block chain Technology 2. Machine Learning	4	4	4	80	32	3	20	8	
5	CC -405: Research Project	---	10	6	100	40	3	50	20	--
	Total (D)	12	28	22	420			130		
	Total (C+D)			44	860			240		

• Student contact hours per week : **26** Hours (Min.)	• Total Marks for M.C.A.-II : **1100**
• Theory and Practical Lectures : **60** Minutes Each	• Total Credits for M.C.A.-II (Semester III & IV) : **44**
• CC-Core Course • CCS- Core Course Specialization • CCPR-Core Course Practical • RP: Research Project	• **Practical Examination is Semester wise before theory examination**. • Examination for CCPR -303shall be based on Semester III Practical. • Examination for CCPR-403 shall be based on Semester IV Practical. • *Duration of Practical Examination as per respective BOS guidelines • *Separate passing is mandatory for Theory, Internal and PracticalExamination*
• **Requirement for Entry at Level 6.5:** **Completed all requirements of the relevant Post Graduate Diploma in Computer Programming (Level 6)**	
• **Exit at Level 6.5:** Students will exit after Level 6.5 with **Master's Degree in Computer Application** if he/she completes the courses equivalent toMinimum of 88 credits.	

	M.C.A.-I	M.C.A.-II	Total
Marks	1100	1100	2200
Credits	44	44	88

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Shivaji University, Kolhapur

Master of Computer Application (MCA)

(Under faculty of Science and Technology)

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Program Outcomes

Upon successful completion of the MCA, the student should have met the following StudentLearning Outcomes:

1. Nurture knowledgeable and skilled human resources, employable in Information and Communication Technology (ICT) and Information Technology Enable Services (ITES).

2. Ability to identify and formulate research problem.

3. Impart knowledge required for planning, designing and building complex Application Software Systems as well as provide support to automated systems or application.

4. Produce entrepreneurs who can develop customized software solutions for small to large Enterprises.

5. Ability to apply modern IT tools and computational knowledge for developing solutions in context to societal, environmental and sustainable development with ethical andprofessional responsibility.

6. Ability to function as an effective communicator and team member through essential skills in multidisciplinary projects.

1. Introduction

1. The name of the programme shall be Master of Computer Application (**MCA**).

2. The knowledge and skills required planning; designing and to build Complex Application Software Systems which are highly valued in all industry sectors including business, health, education and the arts. The basic objective of the education in Masters Programme as Computer Application (MCA) is to provide to the country a steady stream of the necessary knowledge, skills and foundation for acquiring a wide range of rewardingcareers into the rapidly expanding world of the Information Technology.

3. Job Opportunities: The program addresses the job requirements in many upcoming domains such as cyber security, mobile computing, cloud computing, IoT, Robotics, ERP and the one involving assortment of hardware and software. Many graduates begin their career as a junior programmer and, after some experience, are promoted as system analysts. Other seek entrepreneurial role in the Information Technology world as independent business owners, software authors, consultants, or suppliers of systems and

equipment. Career opportunities exist in such areas as management software and hardware sales, technical writing, training others on computer, consulting, software development and technical support. Application areas in the Information Technology world as independent business owners, software authors, consultants, or suppliers of systems and equipment's. Career opportunities exist in such areas as management software and hardware sales, technical writing, training others on computer, consulting, software development and technical support. Application areas include transaction processing, accounting functions, sales analysis, games, forecasting and simulation, database management, decision support and data communications.

4. Specific elective courses to be offered in functional areas depend on student preferences and needs of the user systems in the region in which the educational institution is located. The University Department/affiliated institute offering MCA program shall decide the number of electives based on considerations such as infrastructure including laboratory resources, students intake and faculty availability. Decision of the University Department/affiliated institute shall be final in this regard.

5. The MCA programme is a mixture of computer-related and courses. The computer related courses includes standard techniques of programming, the use of software packages, databases and system analysis and design tools. Inclusion of projects in MCA program in with the intention to improve student's technical orientation, understanding of IT environment and domain knowledge. It will build right platform for students to become a successful Software professional. This would emphasize on domain knowledge of various areas, which would help the students to build software applications on it. The students are exposed to system development in the information-processing environment with special emphasis on Management Information Systems and Software Engineering for small and medium computer systems. Subjects such as Data engineering, Information Security and Data science will work as new application domains. Major focus is also given on Mobile technologies so that student can choose Mobile Technologies as their career options. Also, exposure to microcomputer technology, micro-based systems design and micro applications software, including network and graphical user interface systems is also provided. Advanced Internet and Web technology includes full stack development. Soft skills techniques are covered in first four semesters, which will lead to overall personality development of the student and that will help them in their placement activities and to sustain in the organization successfully. The projects shall also address the upcoming fields such as Mobile app development, IoT, cloud computing and Web development.

6. The present curricula focus on learning aspect from three dimensions viz. Conceptual Learning, Skills Learning and Practical / Hands on.

7. The inclusion of projects at second year ensures the focus on applying the skills learnt at

respective levels. It will enhance student's capability to work on various technologies. It will make appropriate platform for students to work in IT Industry. It will also improve documentation, Coding and Design standards in students. Inclusion of project for subject such as Data Science and IoT will definitely improve student's innovativeness and creativity. Student's technical orientation, eagerness will be enhanced.

2. Duration of the Course:

The MCA programme will be a full-time TWO years i.e. 4 semesters.

Pattern of examination will be Semester System.

3. Medium of Instruction:

The medium of Instruction will be English only.

4. Admission Procedure

1. Eligibility: Passed minimum three year duration Bachelor's Degree awarded by HEI recognized by University Grants Commission or Association of Indian Universities in any discipline with at least 50% marks in aggregate or equivalent (at least 45% in case of candidates of backward class categories belonging to Maharashtra state only. 45% is also applicable to differently abled students)
2. Reservation of Seats As per rules of Government of Maharashtra.

5. Course Structure:

Lectures and Practical should be conducted as per the scheme of lectures and practical indicated in the course structure.

6. Teaching and Practical Scheme

1. Each contact session for teaching or practical should be of 60 minutes each.
2. Minimum 48 periods should be conducted for each subject of 100 Marks.
3. Minimum 24 periods should be conducted for each subject of 50 Marks.
4. One Practical Batch should be of 30 students.
5. Practical evaluation should be conducted before the commencement of University examination

7. Project Work:

1. Project work may be done individually or in groups in case of bigger projects. However if project is done in groups, each student must be given a responsibility for a distinct module and care should be taken to see the progress of individual modules is

independent of others.

2. Students should take guidance from assigned guide and prepare a Project Report on "Project Work" in two copies to be submitted to the Director of the Institute/Head of the Department.

3. The project report will be duly accessed by the assigned guide and internal marks will be communicated by the Director of the Institute/Head of the Department.

4. The project report should be prepared in a format prescribed by the University. IEEE Computer Society templates are recommended in this regard.

5. The external viva shall be conducted by a panel of minimum two examiners out of which one will be external and other will be internal examiner.

OR

The student shall be allowed to formulate a research project proposal. A problem statement with significance, objectives and research methodology shall be part of the evaluation criteria.

8. Assessment:

1. The final total assessment of the candidate is made in terms of an internal assessmentand an external assessment for each course.

   1) For each theory paper, 20% marks will be based on internal assessment and 80%marks for semester examination (external assessment), unless otherwise stated.

   2) The division of the 20 marks allotted to internal assessment of theory papers is as
   follows.
   Two tests should be conducted of MCQ type questions. Each test will be of 10marks

   3) The division of the 10 marks allotted to internal assessment of theory papers is as
   follows.
   Test of 10 marks should be conducted of MCQ type questions.

2. The project will be evaluated by the university appointed examiners both internal as well as external.

3. The final practical examination will be conducted by the university appointed examiners both internal as well as external at the end of semester for each lab course and marks will be submitted to the university by the panel. The pattern of final Practical Examination will be as follows;

1	Coding and Execution of Program	60 Marks

2	Viva-voce	20 Marks
3	Journal	20 Marks
4	Total	100 Marks

The practical examination will be conducted semester wise in order to maintain the relevance of the respective theory course with laboratory course.

4. The internal marks will be communicated to the University at the end of each semester, but before the semester end examinations. These marks will be considered for the declaration of the results.

5. The final Examinations shall be conducted at the end of the semester.

6. Nature of question paper:

Nature of question paper is as follows for University end semester examination

a. Theory Examination (80 marks):

For 80 marks:

1. There will be seven (7) questions of 16 Marks each.
2. Question No.1 is compulsory and is of multiple choice questions. There will be 8 multiple choice question each carries 2 marks
3. Out of question no 2 to 7 attempt any four (4)
4. Question No.2 to Question No. 6 should consist 2 sub question each carries 8marks
5. Question No. 7 should be a short note, where 4 questions will be given, out of which two questions should be attempted

For 40 marks:

1. There will be six (6) questions of 10 Marks each.
2. Question No.1 is compulsory and is of multiple choice questions. There will be 5 multiple choice question each carries 2 marks
3. From Question no. 2 to Question no. 6 attempt any three (3).

b. Practical Examination:

1. Duration of Practical Examination: 3 Hrs
2. Nature of Question paper: There will be three questions out of which any two questions to be attempted and each question carries 30 Marks.

9.Standard of Passing:

Internal as well as external examination will be held at the end of semester. The candidate must score 40% marks in each head of internal as well as external Examination

10. Board of Paper Setters /Examiners:

For each Semester end examination there will be a board of Paper setters and examiners for every course. While appointing paper setter /examiners, care should be taken to see thatthere is at least one person specialized in each unit of the course.

11. Award of Class:

There will be numerical marking on each question. At the time of declaration of the result the marks obtained by the candidate is converted into grade point as shown below;

Grade Point Table

Range of Marks obtained out of 100 or any fractions	Grade Points
0	0 To 5
1	6 To 10
1.5	11 To 15
2	16 To 20
2.5	21 To 25
3	26 To 30
3.5	31 To 35
4	36 To 40
4.5	41 To 45
5	46 To 50
5.5	51 To 55
6	56 To 60
6.5	61 To 65
7	66 To 70
7.5	71 To 75
8	76 To 80
8.5	81 To 85
9	86 To 90
9.5	91 To 95
10	96 To 100

Grading: Shivaji University has introduced a Seven-point grading system as follows:

Grades	CGPA Credit Points
O	8.60 To 10
A+	7.00 To 8.59
A	6.00 To 6.99
B+	5.50 To 5.99
B	4.50 To 5.49
C	4.00 To 4.49
D	0.00 To 3.99

Overall Final Grades	Class		Grade
8.60 To 10	Higher Distinction Level	Extraordinary	O
7.00 To 8.59	Distinction Level	Excellent	A+
6.00 To 6.99	First Class	Very Good	A
5.50 To 5.99	Higher Second Class	Good	B+
4.50 To 5.49	Second Class	Satisfactory	B
4.00 To 4.49	Pass	Fair	C
0.00 To 3.99	Fail	Unsatisfactory	D

12. Credit system implementation:

As per the University norms and NEP-2020

13. Clarification of Syllabus:

The syllabus Committee should meet at least once in a year to study and clarify any difficulties from the Institutes. The Workshop on syllabi should be organized at the beginning of every semester on request from Institutes.

14. Eligibility of Faculty:

MCA(under Science and Technology) with first class or equivalent with two years relevant experience.

15. Revision of Syllabus:

As the computer technology experience rapid rate of obsolescence of knowledge, revisionof the syllabus should be considered every two/three years.

16. Backlog

Students should not have more than FOUR (4) backlogs for second year admission.

Course Code: CC-101, Title of Course: Advanced Data
Structures

Internal Marks: 20   External Marks: 80   Theory: 04 hours/week

Course Outcomes:
1. Analyze the asymptotic performance of algorithms.
2. Compare algorithms based on time & space complexity.
3. To learn how data structure concepts are useful in problem solving..
4. To implement different ways of data structures such as stacks, linked lists and trees
5. Understand different algorithm design approaches.

UNIT -1   (15 hrs)

Algorithm Analysis: Introduction to algorithms, analyzing and designing algorithms, Growth functions, asymptotic notations, Recursive algorithm complexity, solving recurrences: Substitution method, recursion tree method, master method. **Searching**: Binary search, **Hashing**: Hashing, Hash tables, Hash functions, collision resolution techniques. **Sorting**: Quick sort, Counting sort, Radix sort, Merge sort, Heap sort, Insertion sort and selection sort.

UNIT- II   (15 hrs)

Linear Data Structures: Linked Lists: Linked Representation in memory, traversing and searching a linked list, insertion and deletion from a linked list, singly, doubly and circular linked list. Stack: Definition, array and linked representation of stacks, arithmetic expression: polish notation, application of stack, Queue: Definition, array and linked representation of Queue, priority queues.

UNIT- III   (15 hrs)

Non-Linear Data Structures:

Trees, General tree, Binary tree, binary search tree, operations on binary search tree, AVL Trees, Single rotation, Double rotation, Red-Black Trees, B-Trees: Definition of B-trees, Basic operations on B-trees, deleting a key from a B-tree. **Graphs**: Representations of graph, Traversing Graphs, Breadth-first search, Depth-First Search, topological sort, Minimum Spanning trees, Single source shortest path, All pairs shortest path.

UNIT- IV   (15 hrs)

Algorithm design approaches:

Greedy Algorithm: General Characteristics of greedy algorithms, Problem solving using Greedy Algorithm - Activity selection problem, Elements of Greedy Strategy, Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm), Shortest paths, The Knapsack Problem,

Job Scheduling Problem, Huffman code.

Backtracking: Introduction,N Queen Problem, Subset Sum, Hamiltonian Cycle
Branch and Bound – Introduction, 0/1 Knapsack, Travelling Salesman problem
Dynamic programming: Introduction, Tabulation, memoization, Optimal Substructure Property in Dynamic Programming

References:

1. Introduction to algorithms, Third Edition. by Thomas H. Cormen, Charles E. Leiserson,Ronald L. Rivest, Clifford Stein, PHI

2. Fundamentals of Computer Algorithms, Second edition. By Ellis Horowitz, SartajSahani,Sanguthevar Rajasekaran, University Press.

3. Data structures and algorithm analysis in C, Second edition. By Mark Allen weiss

4. Fundamental algorithms by Donald E. Knuth, Pearson Education.

5. Data and file structure by A. Tanenbaum by PHI

Internal Marks: 20   External Marks: 80   Theory: 04 hours/week

Course Outcomes:

1. Learn and practice data modeling using the entity-relationship and developing databasedesigns.

2. Understand the use of Structured Query Language (SQL) and learn SQL syntax.

3. Apply normalization techniques to normalize the database

4. Understand the needs of database processing and learn techniques for controlling the consequences of concurrent data access.

UNIT-I   (15 hrs)

Basics of DBMS: Database Concept, Characteristics and architecture of DBMS, Database users, 3-tier architecture of DBMS-its advantages over 2-tier, Introduction of Parallel, Distributed Databases, Mobile databases and Cloud databases. Data independence. Physical data organization,Indexing-introduction and types of indexing.

UNIT- II   (15 hrs)

Introduction to RDBMS:-Entity introduction, characteristics, Comparison between DBMS, RDBMS, Generalization and Aggregation Normalization- Functional dependency, types of normalization(1NF,2NF,3NF,BCNF),Data constraint- primary key, foreign key, unique key, null, not null, default key etc.

Relational Algebra Concepts; introduction, Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra;

UNIT- III   (15 hrs)

SQL: Introduction to SQL, Features of SQL, Basic data types, SQL statements/commands, Set operations in SQL, order by and group by clause, like between, in, like, create index , view and

join command Nested queries, GRANT and REVOKE, Commit, Rollback, Save point. Join concept: Simple, Equi, non-equi, Self, Outer join. View.

Introduction to PL /SQL: Introduction,Difference between SQL AND PL/SQL, Block definition structure and Data types, Block Functions, cursor, trigger, procedures, exception handling. **No SQL Database** - Introduction, Need& Advantages ,Types of No SQL Database , No SQL database vs RDBMS

UNIT- IV   (15 hrs)

Concurrency Control and Transaction Management: Transaction processing

Concurrency - Concept of transaction processing, ACID properties, States of transaction, Serializibility, Concurrency control, schemes , Locking techniques , Timestamp based protocols , Granularity of data items ,Deadlocks. Database recovery and Backup.

References:

1. Introduction to database systems C. J. Date Pearsons Education 8th

2. Database system concept Korth, Silberschatz and Sudarshan MGH 5th

3. Fundamentals of Database Systems Elmasri Navathe PearsonEducation5th

4. SQL /PL SQL For Oracle 11G BlackBook Dr.Deshpande WileyDreamtech2012

5. ORACLE PL/SQL Programming Scott Ulman TMH 9th

6. SQL, PL/SQL the programming language of Oracle Ivan Bayross BPB 4th

7. Advance Database Management System hakrabharati/DasguptaWileyDreamtech2011

8. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence MartinFowler

9. Database Management systems Ramakrishnan&Gehrke, McGraw-Hill,3rd Ed.

Master of Computer Application (MCA) Part I Semester I
(NEP-2020)
To be implemented from the academic year 2023-2024

Course Code: CCPR-103,   **Title of Course:** Practical-I

Internal Marks: 20   **External Marks: 80**   **Practical: 06 hours/week**

Course Outcomes:

1. To become familiar with programming environment.
2. To implement linear data structures.
3. Able to create tables and generate queries
4. Apply data structures in real life problems.

Lab work is based on Advanced data structure and Database Management System. This laboratory course should consist of 10 to 12 programming exercises with focus on coveringthe hands-on aspects covered in theory course.

Internal Marks: 10   **External Marks: 40**   **Theory: 02 hours/week**

Course Outcomes:
1) Realize the need for Cyber Security
2) Understand the vulnerabilities in the Network and Computer System
3) Understand social media forensics.

Unit-I   **(15 hr)**

Introduction to Cyber Security: Overview of Cyber Security, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Cyber Security Vulnerabilities and Cyber Security Safeguards: Cyber Security Vulnerabilities -Overview, vulnerabilities in software, System administration, Weak Authentication, Poor Cyber Security Awareness. Passive attacks: Network Analysis; eavesdropping; Traffic control Active attacks: Phishing, Sniffing, spoofing, Denial of service attack. Hackers, Crackers Authentication, Biometrics, Cryptography.

Unit-II   **(15 hr)**

Ethical Hacking, Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Digital certificate, Applications of Cryptography, Social media forensics: Types of social networking platforms, social media crimes: hacking, photo morphing, offer & shopping scams, Dating scams, Cyberbullying, Link Baiting. Evidence Collection in Social Media Forensics: Evidence Identification, Collection, Examination

References:
1. Preston Gralla, How Personal and Internet Security Work, Que Publications
2. Alfred Basta and Wolf Halton, Computer Security Concepts, Issues and Implementation, Cengage Learning
3. Digital Defense: A Cyber security Primer by Joseph Pelton , Indu B. Singh
4. Cryptography and Network Security: Principles and Practice by William Stallings
5. Cyber Warfare: Techniques, Tactics and Tools for Security Practitioners 2nd Edition
by Jason Andress (Author), Steve Winterfeld (Author).

Internal Marks: 20   **External Marks: 80**   **Theory: 04 hours/week**

Course Outcomes:

1. Analyze the basics of data communications and network architecture.

2. Analyze functions of each layer of a computer network.

3. Evaluate essential features of specific protocols in the common protocol suite.

4. Analyze the methodology and the rationale behind addressing, routing, and congestion control.

5. Understand various multiplexing and switching methods used in networks.

6. Compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems.

7. Identify some of the factors driving the need for network security

UNIT-I   **(15 hrs)**
Data communication-analog and digital signal transmission, Data transmission-serial and parallel transmission, communication and transmission modes (synchronous, asynchronous), error control(forward, backward) error detection(parity, block sum check, CRC), transmission media (twisted pair, coaxial cable, optical fibers), unguided transmission media(radio waves, microwaves, infrared), classification of computer network- geographical spread (LAN,WAN, MAN), topology-(bus, star, ring, mesh, tree), ownership (private, public, VAN), switching circuit, packet, message and routing, multiplexing-FDM,TDM, concentrator, components of computer networks-files server, workstation, network interface unit, transmission media, hub, repeater, bridge, router, gateway, mode. Case study- Prepare/ present report on network components used in any selected organization/Institute/Company.

UNIT-II   **(15 hrs)**
Data Link Layer: Error detection and control code- Error Control -Hamming Code and CRC Flow Control -Stop and Wait protocol, sliding window protocol, Random Access Protocols - ALOHA – pure and slotted. Network Layer: Store-and-forward packet switching, Services Provided to the Transport Layer, Implementation of Connectionless and Connection Oriented

Service, concept of routing, optimality principle, routing algorithms-shortest path, distance vector, link state, hierarchical, broadcast, multicasting. Congestion control & congestion control algorithm.

UNIT-III   **(15 hrs)**
Transport Layer- Introduction, transport service primitives, multiplexing, UDP, TCP. Application Layer-Domain name system (DNS), Telnet, File transfer protocol (FTP), Simple mail transport protocol (SMTP), Hyper text transfer protocol (HTTP), Network file system (NFS).

UNIT-IV   **(15 hrs)**
Network Security- Introduction, concept of cryptography, authentication protocols, firewall, virtual private networks (VPN), wireless security, email security, web security- SSL. Case Study –Implementation of LAN, Configuration of various connecting devices.

References:
1. Computer Networks Andrew Tanenbaum Pearson Education
2. Computer Networks Fundamentals and applications, R S Rajesh, K S Easwarakumar, R Balasubramanian, VIKAS Publishing House Pvt. Ltd.
3. Data Communication and Networks James Irvin, David Harle Wiley
4. Computer Networks protocols, Standards and Interface Black C. Prentice Hall of India
5. Computer Communication Networks William Stalling Prentice Hall of India

Master of Computer Application (MCA) Part I Semester I
(NEP-2020)
To be implemented from the academic year 2023-2024
Course Code: CCS-105:2, **Title of Course:** Computer Architecture

Internal Marks: 20   **External Marks: 80**   **Theory: 04 hours/week**

Course Objectives:

1. Understand the basic components and organization of a computer system.
2. Gain knowledge of the fundamental principles of computer architecture.
3. Learn the different instruction set architectures (ISAs) and their impact on system performance.
4. Understand memory systems, including cache organization and virtual memory.
5. Study input/output (I/O) devices and their interaction with the system.
6. Learn about the role and design of system buses and interconnects.

Unit -I   **(15 Hrs)**
Introduction to computer architecture: basic concepts and components, Von Neumann architecture and its limitations, Functional Units, Basic Operational Concepts, Performance, Instructions: Language of the Computer, Operations, Operands, Instruction representation, Logical operations, decision making, MIPS Addressing, Instruction set architecture (ISA) and its importance, Performance metrics and measurement techniques in computer architecture, Instruction-level parallelism (ILP) and its impact on performance

Unit-II   **(15 Hrs)**
Pipelining: principles and challenges, Pipeline hazards and techniques for their resolution, Superscalar and out-of-order execution techniques, Branch prediction and control flow handling, Memory hierarchy: cache organization and principles, Cache mapping techniques and replacement policies, Virtual memory, paging, and address translation, TLB (Translation Lookaside Buffer) and its role in virtual memory

Unit-III   **(15 Hrs)**
Input/output (I/O) devices and controllers, I/O interfaces and protocols, System buses and interconnects, Bus protocols and arbitration techniques, Parallel processing: principles and classifications, SIMD and MIMD architectures, Introduction to multiprocessor and multicore

architectures, Cache coherence protocols in multiprocessor systems, Performance evaluation and benchmarking of computer architectures

Unit -IV   **(15 Hrs)**
Memory Hierarchy, memory technologies, cache memory, measuring and improving cache performance, virtual memory, TLBs, Accessing I/O Devices, Interrupts, Direct Memory Access, Bus structure, Bus operation, Arbitration, Interface circuits, A Basic MIPS implementation, Building a Datapath, Control Implementation Scheme, Pipelining, Pipelined datapath and control, Handling Data Hazards & Control Hazards

References

1. Computer Fundamentals Architecture and Organization by Ram B
2. Fundamental of Computer Organization and Design by Sivarama P Dandamudi
3. Fundamentals of Computer Organization and Architecture by Jyotsna Sengupta
4. Computer System Architecture by M Morris R Mano
5. Computer Organization and Design:The Hardware/Software Interface by David A Patterson and John L Hennessy

Master of Computer Application (MCA) Part I Semester I
(NEP-2020)
To be implemented from the academic year 2023-2024

Course Code: CC-106, **Title of Course: Research Methodology**

Internal Marks: 20   **External Marks: 80**   **Theory: 04 hours/week**

Course Objectives:

1. Understand the fundamental concepts and principles of research methodology in computer science

2. Identify and select appropriate research methodologies based on the research problem

3. Formulate research questions and hypotheses in the context of computer science research

4. Design and execute research studies using quantitative and qualitative approaches

5. Apply ethical considerations in conducting computer science research

6. Develop critical thinking and problem-solving skills required for computer science research

Unit -I   **(15 Hours)**

Meaning of Research, objectives of Research, motivation in Research, Types of Research, Significance of Research, Research and Scientific Method, Criteria of good Research, Current trends in Research,   Survey research, Data collection techniques, problems encountered by Researchers in Data Collection, Statistical Data analysis and interpretation, Triangulation in research design, Sequential and concurrent mixed methods design, Sampling Techniques in Computer Science Research.

Unit -II   **(15 Hours)**

Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline, Use of tools / techniques for Research: methods to search required information effectively, study and implementation of various databases like Google scholar, Scopus index, web of science, research gate etc. Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office.

Unit -III   **(15 Hours)**

Nature of Intellectual properties like patents, trade and copyright, Common rules of IPR practice, types and features of IPR agreement, Population and sample selection, Probability and non-probability sampling, Sample size determination, Observation methods, Questionnaire design, Descriptive statistics, Inferential statistics, Qualitative data analysis techniques (thematic analysis, content analysis), Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Impact factor of Journals, H-index of the researcher, various citation styles, Ethical issues related to publishing, Plagiarism and Self-Plagiarism, Software for detection of Plagiarism

Unit -IV   **(15 Hours)**

Research reports: Writing preliminaries, main body of research, references and bibliography; Meaning and importance of workshop, seminar, conference, symposium etc. in research, Report format and style. Review of related literature its implications at various stages of research, Significance of Report Writing, Steps in Writing Report, Layout of the Research Report, Types of Reports. Writing a research proposal.

References

1. Research Methodology in Computer Science by Ryhan Ebad, Centrum Press.
2. Research Methodology by C.R.Kothari
3. Research Methods by Rashmi Agrawal
4. Qualitative Research for Education by Bogdan & Biklen
5. Methods of Educational Research by Max Engelhart
6. Business Research Methods by Alan Bryman & Emma Bell, Oxford University Press

Master of Computer Application (MCA) Part I Semester II
(NEP-2020)
To be implemented from the academic year 2023-2024

Course Code: CC-201, **Title of Course:** Advanced Operating System

Internal Marks: 20   **External Marks: 80**   **Theory: 04 hours/week**

Course outcomes:

1. To study the characteristics of OS for Multiprocessor and Multicomputer
2. To learn the issues related to designing OS
3. To learn the latest trends in building Mobile OS
4. The aim of this module is to study, learn, and understand the main concepts of advanced operating systems

Unit-I   **(15 Hrs)**

Overview of operating system design principles, Historical perspective and evolution of operating systems, Challenges in modern operating systems, Basics of process scheduling, Scheduling algorithms: FCFS, SJF, Round Robin, Priority Scheduling, Multilevel feedback queues and lottery scheduling, Real-time scheduling algorithms, Address spaces and memory hierarchy, Paging and segmentation, Virtual memory management, Page replacement algorithms, Memory allocation and deallocation

Unit-II   **(15 Hrs)**

Multiprocessor Operating Systems: System Architectures- Structures of OS , OS design issues, Process synchronization, Process Scheduling and Allocation- memory management, Distributed Operating Systems: System Architectures, Design issues, Communication models, clock synchronization, mutual exclusion, election algorithms, Distributed Deadlock detection, Distributed scheduling - Distributed shared memory, Distributed File system , Multimedia file systems, File placement, Caching

Unit-III   **(15 Hrs)**

File system design principles, File organization and access methods, File system implementation techniques, Directory structures and file metadata, File system reliability and recovery, Introduction to distributed systems, Networked file systems, Distributed process management,

Distributed synchronization and consistency, Distributed fault tolerance and recovery, Threat models and security principles, User authentication and access control, Secure communication and encryption, Security vulnerabilities and countermeasures, Intrusion detection and prevention

Unit-IV **(15 Hrs)**

Database Operating Systems: Requirements of Database OS – Transaction process model – Synchronization primitives - Concurrency control algorithms, Mobile Operating Systems: ARM and Intel architectures - Power Management - Mobile OS Architectures - Underlying OS - Kernel structure and native level programming - Runtime issues- Approaches to power management

References

1. Advanced Concepts in Operating Systems, by M Singhal and NG Shivaratri, Tata McGraw Hill Inc
2. Distributed Operating Systems by A S Tanenbaum, Pearson Education Asia
3. Operating Systems: A Concept-Based Approach by D M Dhamdhere
4. Operating Systems: Internals and Design Principles by William Stallings

Master of Computer Application (MCA) Part I Semester II
(NEP-2020)
To be implemented from the academic year 2023-2024

Course Code: CC-202,   **Title of Course:** Java Programming

Internal Marks: 20   **External Marks: 80**   **Theory: 04 hours/week**

Course Outcomes:

1. To become familiar with the features of Java Language.
2. To become comfortable with concepts such as Classes, Objects, Inheritance, Polymorphism and Interfaces.
3. Develop Java client/server applications.
4. Understand distributed applications using RMI
5. Understand Spring and Spring Boot Framework.

Unit -I   **(15 Hrs)**

Introduction: Architecture and its components, Introduction to java programming environment:Java Class File, Java Runtime Environment, The Java Virtual Machine(JVM), JVM Components, The Java API, java platform, java development kit , java compiler, java interpreter, Understanding Class path, Features of Java, Byte Code, Control Flow Statements: The If…Else If… Else Statement, the Switch…Case Statement , Iterations: The While Loop, The Do … While Loop, The For Loop, The For each Loop, Labelled Statements, The Break And Continue Statements.

Unit -II   **(15 Hrs)**

OOP in Java ,Objects and classes, Inheritance, Polymorphism , Interfaces, inner classes, Constructor, Garbage collector , Method Overloading Method Overriding, this key word, super keyword, Packages., data types in java primitive data type and non primitive data type. Introduction: Comments, Types of comments. Classes: Types of Classes, Scope Rules, Access Modifier. Introduction to Java Utility classes and collection classes Date, DateFormat and Gregorian calendar classes.java package, A Simple Java Program, Object Creation, Using Java.lang. Object class in program, programs using inheritance, using packages in java program.

Unit -III   **(15 Hrs)**

Java Servlets: Servlet basics, servlet life cycle , Generic and HTTP servlets, The Servlet API, javax.servlet and javax.servlet.http package, session tracking using session and cookies, web deployment descriptor, web.xml. Remote Method Invocation–Introduction, architecture, defining remote objects, creating stubs and skeleton, object serialization, dynamically loaded classes, RMI activation, registering remote objects, marshaled objects. Java Server Pages (JSP): Introduction to JSP tags and directive, Request String, User Sessions, Cookies, Session objects.

Unit-IV   **(15 Hrs)**

Java Database Connectivity, JDBC overview, Architecture, Types of JDBC Drivers, Driver Manager class, database connection statements, Resultset, transaction, Metadata and Aggregate functions , callable statements, Connection to various back ends. Spring and Hibernate: Spring API libraries, Introduction to Spring Boot, Features of Spring Boot Spring Boot Architecture.

References:-
1. JDBC, Servlet and JSP, Black Book, Santosh Kumar K. Dremtech publication
2. Java 2 Complete Reference - (Tata McGraw Hill)
3. Spring and Hibernate, Santosh Kumar K. Mc.Graw Hill Education
4. Developing Java Servlets James Goodwill, Techmedia Pub.
5. Java 2 Black Book –(DreamTech)

Course Code: CCPR-203,   **Title of Course:** Practical-II

Internal Marks: 20   **External Marks: 80**   **Practical: 06 hours/week**

Course Outcomes:

1. To understand and implement Java programming environment.
2. Develop Java client/server applications.
3. Develop ASP.NET application

4. Utilize SQL Server with ASP.NET

Lab work is based on Java Programming and Web Technology. This
laboratory course should consist of 10 to 12 programming exercises with focus
on coveringthe hands-on aspects covered in theory course.

Course Code: CC-204,   **Title of Course:** Web Technology

Internal Marks: 10   **External Marks: 40**   **Theory: 02 hours/week**

Course Outcomes:

1. Understand the basics of web design
2. Develop ASP.NET application
3. Utilize SQL Server with ASP.NET

Unit -I   **(15 Hrs)**

ASP.NET Introduction, First ASP.NET Application, Page Life cycle, various server controls, Validation controls, State management, caching, Web services, Introduction to AJAX, AJAX Extenders, ADO.NET Overview, ADO.NET architecture, .NET Data Providers, Data Controls And Data Binding, Navigating between Pages, Using SiteMapPath, Using TreeView, Using Menu

Unit-II   **(15 Hrs)**

Implementation of DDL, DML command withh ASP.NET application, Creating Tables and Relationships and constraints, SQL Fundamentals, Stored Procedures, views, joins, subqueries, Introduction to MasterPage, What is Authentication and Authorization Types of Authentication, Forms Authentication, Role based Authentication, Windows and Basic Authentication

References

1. Web Application Development : Asp.Net with C# by Himali Patel
2. Beginning ASP.NET for Visual Studio 2015 by William Penberthy

Master of Computer Application (MCA) Part I Semester II
(NEP-2020)
To be implemented from the academic year 2023-2024

Course Code: CC-205:1, **Title of Course:** Network Security

Internal Marks: 20   **External Marks: 80**   **Theory: 04 hours/week**

Course Outcomes:

Course Outcomes:
1. Understand the fundamental principles of access control models and techniques, authentication and secure system design.
2. Understand the basics of cryptography and encryption systems.
3. Understand principles and practice of different encryption techniques.
4. Identify and mitigate different network security systems

Unit- I   **(15 hrs)**
Introduction of Network Security

Introduction, need of network security, web security, Security attacks-active attacks, passive attacks, intrusion detection system, firewall, concept of cryptography, OSI security architecture Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory product cryptosystem – cryptanalysis.

Unit- II   **(15   hrs)**
Symmetric Key Cryptography: Mathematics Of Symmetric Key Cryptography: Algebraic structures – Modular arithmetic-Euclid's algorithm- Congruence and matrices -Groups, Rings, Fields- Finite fields- Symmetric Key Ciphers: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation Evaluation criteria for AES – Advanced Encryption Standard – RC4 – Key distribution.

Unit- III   **(15 hrs)**

Public Key Cryptography: Mathematics Of Symmetric Key Cryptography: Primes – Primality Testing –Factorization Euler's totient function, ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

Unit- IV   **(15 hrs)**

Message Authentication and Integrity

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications – Kerberos, X.509

Reference Books:

1. Charlie Kaufman and Radia Perlman, Mike Speciner, "Network Security, Second Edition, Private Communication in Public World", PHI 2002.

2. Tony Bradley, "Essential Computer Security: Everyone's Guide to Email, Internet and Wireless security", Syngress Publication 2006

3. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata McGraw Hill, 2007. 4. Information & Network Security for GTU, I. A. Dhotre V. S. Bagad, Technical Publication, Edition 2018

4. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall PTR

5. Cryptography and Network Security Principles and Practice Fourth Edition, William Stallings, Pearson Education

Master of Computer Application (MCA) Part I Semester II
(NEP-2020)
To be implemented from the academic year 2023-2024

Course Code: CC-205:2,   **Title of Course:** Software Engineering

Internal Marks: 20   **External Marks: 80**   **Theory: 04 hours/week**

Course Outcomes:

1. Students will get foundation of software engineering, various process models and canapply the new models in development process.

2. Students will have effective communication and interaction skills for requirementengineering tasks.

3. Students can apply design principles for various types of software and designing objectoriented software using UML tools.

4. Students can implement testing strategies thoroughly using testing tools.

5. Students will understand the need of lifelong learning and adapt to new softwareengineering concepts.

UNIT-I   **(15 Hrs)**

Introduction to Software Engineering: Software definition, characteristics, software application domains, unique nature of web apps, seven principles of software engineering, software development process, Waterfall Model, prototyping, spiral model, Concurrent Models, The Formal Methods Model, 12 Principles of Agility, Extreme Programming (XP), Scrum process flow, Selection of Software Process models.

UNIT -II   **(15 Hrs)**

Requirements Engineering and Design Concepts: Seven tasks of requirement engineering, Eliciting Requirements, Types of requirement, fundamental problem in defining requirements, SRS template.Translating the requirement model into the design model, software design concepts- abstraction, architecture, pattern, separation of concerns, modularity, information hiding, functional independence-cohesion, coupling, refinement, aspects, refactoring.

UNIT -III   **(15 Hrs)**

Introduction to UML: The design model: Developing use cases, Relationships, class diagrams, associations, generalizations, object diagram, Dynamic modeling – State diagrams, Sequence diagrams, Collaboration diagrams, Activity diagrams etc. Logical and physical architecture – Component diagram, Deployment diagrams etc. Case Studies: Courseware management system, ATM, Airline reservation System

UNIT-IV (15 Hrs)

Introduction to Testing: A Strategic Approach to Software Testing, Strategic Issues, Unit testing, Integration testing, Validation Testing, System Testing, Black box testing and white box testing, The Art of Debugging. Testing web applications- testing strategy, testing process, content testing, user interface testing, navigation testing, configuration testing, security testing, performance testing. Study of software testing tool.

References:

1. Software Engineering by Roger Pressman. 7th edition.
2. Software Engineering for students: A Programming Approach by Douglas Bell, Pearsonpublication.
3. Software Engineering Sommerville 8th edition.
4. The unified modeling language user guide Grady Booch, James Rumbaugh, Ivar JacobsonAddisonWesley 2005.
5. UML A Beginners Guide Jason T. Roff McGraw Hill Professional.
6. Learning UML 2. 0 Kim Hamilton, Russ Miles O'Reilly Media 2006.
7. Software Quality Engineering by Jeff Tian.
8. Software Testing And Quality Assurance Theory And Practice By Kshirasagar Naik, Priyadarshi Tripathy
9. The art of software testing by GJ Myers, Wiley
10. Software Testing: Principles and Practices by Srinivasan D and Gopalswamy R, PearsonEd, 2006
11. Software Testing Foundations, Andreas Spillner, Tilo Linz, Hans Schaefer, Shoff Publishers and Distributors

Master of Computer Application (MCA) Part I Semester II
(NEP-2020)
To be implemented from the academic year 2023-2024

Course Code: OJT -206 **Title of Course::** On Job Training

Internal Marks: 00   **External Marks: 100**   **Theory: not applicable**

Student is suppose to carry out on job training during his/her semester vacation.