Estd. 1962
"A++" Accredited by NAAC (2021)
With CGPA 3.52

SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA
PHONE:EPABX-2609000, www.unishivaji.ac.in, bos@unishivaji.ac.in
शिवाजी विद्यापीठ, कोल्हापूर -४१६००४,महाराष्ट्र
दूरध्वनी-ईपीएबीएक्स -२६०९०००, अभ्याससमंडळे विभाग दुरध्वनी ०२३१—२६०९०९४
०२३१—२६०९४८७

Ref.No.SU/BOS/Science/ 275 **Date: 03/05/2025.**

To,

The Principal,
All Concerned Affiliated Colleges/Institutions
Shivaji University, Kolhapur

The Head/Co-ordinator/Director
All Concerned Department (Science)
Shivaji University, Kolhapur.

Subject: Regarding revised syllabi of degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0).

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0).

1.	M.C.A. Part I
2.	M.C.A. Part I (YCSRD)
3.	M.A. Part II Travel and Tourism

This syllabus, nature of question and equivalence shall be implemented from the academic year 2025-2026 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in NEP-2020 (Online Syllabus)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2025 & March/April 2026. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dy Registrar
Dr. S. M. Kubal

Encl: As above

for Information and necessary action

Copy to:

1	Dean, Faculty of Science & Technology	6	Appointment Section A & B
2	Director, Board of Examinations and Evaluation	7	I.T.Cell /Computer Centre
3	Chairman, Respective Board of Studies	8	Eligibility Section
4	OE-II & B.Sc.-M.Sc. Exam Section	9	Affiliation Section (T.1) (T.2)
5	Internal Quality Assurance Cell (IQAC Cell)	10	P.G. Seminar Section

SHIVAJI UNIVERSITY, KOLHAPUR

NAAC A++ Grade with CGPA 3.52

Multiple Entry and Multiple Exit Option (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 2025-26)

M.C.A. (Science) Part – I (Level-6.0)

Programme Structure

Structure in Accordance with National Education Policy - 2020
With Multiple Entry and Multiple Exit Options
M.C.A. (Science) Part – I (Level-6.0)

		Course Code	Teaching Scheme			Examination Scheme					
			Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
			Lectures + Tutorial/ (Hours / week)	Practical (Hours / week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
Semester-I											
Major Mandatory		MMT-101	4	--	4	60	24	2	40	16	
		MMT-102	4	--	4	60	24	2	40	16	
		MMPR-103	--	8	4	60	24	2	40	16	
		MMT-104	2	--	2	30	12	2	20	8	
		MMT-105	4		4	60	24	2	40	16	
Major Elective		MET-106	4	--	4	60	24	2	40	16	
		MET-107									
Total					22	330			220		
Semester-II											
Major Mandatory		MMT-201	4	--	4	60	24	2	40	16	
		MMT-202	4	--	4	60	24	2	40	16	
		MMPR - 203	--	8	4	60	24	2	40	16	
		MMT-204	2	--	2	30	12	2	20	8	
Project		MMPR-205	--	8	4	60	24	2	40	16	
Major Elective		MET-206	4	--	4	60	24	2	40	16	
		MET-207									
Total					22	330			220		
Total (Sem I + Sem II)					44						

<table>
<tr><td rowspan="3">• MMT–Major Mandatory Theory
• MMPR–Major Mandatory Practical
• MET–Major Elective Theory
• MEPR–Major Elective Practical
• RM - Research Methodology
• OJT/FP- On Job Training/ Field Project</td><td>• Total Marks for M.C.A.-I : 1100</td></tr>
<tr><td>• Total Credits for M.C.A. -I (Semester I & II) : 44</td></tr>
<tr><td>• Separate passing is mandatory for University and Internal Examinations</td></tr>
<tr><td colspan="2">*Evaluation scheme for OJT/FP shall be decided by concerned BOS</td></tr>
<tr><td colspan="2">• Requirement for Entry at Level 6.0: Completion of Level 5.5</td></tr>
<tr><td colspan="2">• Requirement for Exit after Level 6.0:
Students can exit after completion of Level 6.0 with Post Graduate Diploma in Computer Application</td></tr>
<tr><td colspan="2">• Requirement for Entry at Level 6.5: He/ She have completed MCA Part-I (Level 6.0)</td></tr>
</table>

M.C.A. (Science) Part–II (Level-6.5)

Programme Structure

Structure in Accordance with National Education Policy – 2020

With Multiple Entry and Multiple Exit Options

M.C.A. (Science) Part–II (Level-6.5)

	Course Code	Teaching Scheme			Examination Scheme					
		Theory and Practical			University Assessment(UA)			Internal Assessment(IA)		
		Lectures + Tutorial/ (Hours/ week)	Practical (Hours / week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
Semester-III										
Major Mandatory	MMT-301	4	--	4	60	24	2	40	16	
	MMT-302	4	--	4	60	24	2	40	16	
	MMPR-303	--	8	4	60	24	2	40	16	
	MMT-304	2	--	2	30	12	2	20	8	
	MMT305	4	--	4	60	24	2	40	16	
Major Elective	MET-305	4	--	4	60	24	2	40	16	
	MET-306									
Total				22	330			220		
Semester-IV										
Major Mandatory	MMT-401-Industrial / Research project	--	8	18	300	120		150	60	
Major Elective (Swayam)	MET-402	4	--	4	60	24	2	40	16	
	MET-403									
Total				22	360			190		
Total (Sem III+ SemVI)				44						

- MMT–Major Mandatory Theory
- MMPR–Major Mandatory Practical
- MET–Major Elective Theory
- MEPR–Major Elective Practical
- RP-Research Project

- Total Marks for M.C.A..-II :**1100**
- Total Credits for M.C.A.-II (Semester III&IV):44
- **Separate passing is mandatory for University and Internal Examinations**

#Evaluation scheme for Research Project shall be decided by concerned BOS

- **Requirement for Exit after Level 6.5: Students can exit after completion of Level 6.5 with Master of Computer Application**

Course Codes

M.C.A. Semester-I		
Course Code	**Major Mandatory**	
MMT-101	Advanced Java Programming (4 credits)	**MSU0325MML929G1**
MMT-102	Relational Database Management System(4 credits)	**MSU0325MML929G2**
MMPR-103	Practical-I(4 credits)	**MSU0325MMP929G1**
MMT-104	Cyber Security (2 credits)	**MSU0325MML929G3**
MMT-105	Advanced Data Structures (4 credits)	**MSU0325RML929G**
	Major Elective	
MET-106	Computer Networks (4 credits)	**MSU0325MEL929G1**
MET-107	Computer Architecture (4 credits)	**MSU0325MEL929G2**
M.C.A. Semester-II		
	Major Mandatory	
MMT-201	Front End Development (4 credits)	**MSU0325MML929H1**
MMT-202	Artificial Intelligence (4 credits)	**MSU0325MML929H2**
MMPR-203	Practical-II (4 credits)	**MSU0325MMP929H1**
MMT-204	Data Engineering (2)	**MSU0325MML929H3**
MMPR-205	Project(4credits)	**MSU0325OJ929H**
	Major Elective	
MET-206	Network Security (4 credits)	**MSU0325MEL929H1**
MET-207	Software Engineering (4 credits)	**MSU0325MEL929H2**
M.C.A. Semester-III		
	Major Mandatory	
MMT-301	Mobile Application Development (4 credits)	**MSU0325MML929I1**
MMT-302	Back End Development (4 credits)	**MSU0325MML929I2**
MMPR-303	Practical-III (4 credits)	**MSU0325MMP929I1**
MMT-304	Advanced Python Programming (2 credits)	**MSU0325MML929I3**
MMT-305	Machine learning (4 credits)	**MSU0325RP929I**
	Major Elective	
MET-305	Cloud Computing(4credits)	**MSU0325MEL929I1**
MET-306	Data Science(4credits)	**MSU0325MEL929I2**
M.C.A. Semester-IV		
MMT-401	Industrial Project/Research Project(18 credits)	**MSU0325MML929J1**
	Major Elective	
MET-402	NPTEL, SWAYAM Course (4 credits)	**MSU0325MEL929J1**
MET-403	NPTEL, SWAYAM Course (4 credits)	**MSU0325MEL929J2**

Master of Computer Application (MCA) Part I Semester I
Course Code: MMT-101
Title of Course: Advanced Java Programming

Internal Marks: 40 **External Marks: 60** **Theory: 04 hours/week**

Course Outcomes: Upon successful completion of this course, the student will be able to:

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 Enterprise Java Beans.
6. Understand Spring and Spring Boot Framework.

UNIT I **(15 Hours)**

Features of Java: Enhancing code expressiveness, Flexible constructor bodies, Structured concurrency, Updated class file API, Generational Z Garbage Collector (ZGC). Java Magic: Byte Code, OOP in Java , Objects and classes ,Java Database Connectivity: JDBC overview , Architecture , Steps to create JDBC Application, Types of JDBC Drivers-Type1, Type2, Type3, Type4,Database connection statements, Resultsets, transaction, Metadata and Aggregate functions , callable statements. Connection pooling.

UNIT II **(15 Hours)**

Java Servlets: Servlet vs CGI, Servlet life cycle , servlet basics , Generic servlet, HTTPServlet, The Servlets API, request server side –Cookies , session tracking , databases and non-HTML content , request dispatching , shared attributes, resource abstraction. RMI: Introduction & Architecture of RMI, Stubs & skeleton, Java RMI classes and interfaces ,Writing simple RMI application , Parameter passing in remote methods (marshalling and unmarshalling) Java Beans: Java Beans Introduction, design pattern, Beans persistence & introspection, writing simple bean.

UNIT -III **(15 Hours)**

Enterprise Java Beans (EJB): Types of Enterprise Java Beans- Session Bean, Message Driven Bean, Entity Bean, Advantages and Disadvantages of Enterprise Java Beans.JSP(Java Server Pages: Introduction to JSP, Use of JSP, JSP Architecture, JSP tags, Implicit and Explicit objects, Request forward, Request –time include ,use of Beans in JSP and their scopes. JSF(Java Server Faces):Introduction of JSF, components of JSF, Benefits of JSF

UNIT IV **(15 Hours)**

Hibernate framework application, Introduction Working on Hibernate framework, Features of Hibernate ORM, its advantage and disadvantage, Struts framework Architecture and details, Struts frameworks Components. Overview of the Spring Framework, Spring MVC Architecture, Bean Life Cycle in Java Spring: Bean Life Cycle Phases, Benefits of using Spring with Hibernate.

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)

Master of Computer Application (MCA) Part I Semester I
Course Code: MMT-102
Title of Course: Relational Database Management System
Internal Marks: 40 **External Marks: 60** **Theory: 04 hours/week**

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Learn and practice data modelling using the entity-relationship and developing database designs.
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.
5. Provide overview of transaction management, database recovery and security.
6. Understanding the concepts of NO-SQL database

UNIT I **(15 Hours)**

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 Hours)**

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 Hours)**

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 Hours)**

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 Wiley Dreamtech 2012

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, Dasgupta Wiley Dreamtech2011
8. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence Martin Fowler

Master of Computer Application (MCA) Part I Semester I
Course Code: MMPR-103
Title of Course: Practical-I

Course Outcomes: Upon successful completion of this course, the student will be able to:

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.

Practical's will be based on MMT-101 and MMT-102

Master of Computer Application (MCA) Part I Semester I
Course Code: MMT-104
Title of Course: Cyber Security

Internal Marks: 20 **External Marks: 30** **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 mobile forensics
4) Understand cryptography and cyber security safegurards.
5) Understand cyber law and cyber crime.
6) Understand social media forensics.

UNIT I **(15 Hours)**

Introduction to Cyber Security: Overview of Cyber Security, Cyber Security Dark Web, Cyber Threats:- Cyber Warfare-Cyber terrorism-Cyber Espionage, Cyber Hygiene & Security, Cyber Security Vulnerabilities and Cyber Security Safeguards: Cyber Security Vulnerabilities -Overview, vulnerabilities in software, System administration, Weak Authentication, Poor Cyber Security Awareness.AI-powered attacks, Role of AI in Cyber Security ,Zero Trust Security, Wi-Fi Attacks, Passive attacks: eavesdropping; Traffic control Active attacks: Phishing, Sniffing, spoofing, Denial of service attack. Hackers, Crackers Authentication, Biometrics, Footprinting

UNIT II **(15 Hours)**

Ethical Hacking, Introduction to Cryptography: Cryptanalysis, Message Authentication, Digital Signatures, Digital certificate, Introduction to cyber crime: catching cyber criminals, Introduction to Cyber law: objective of cyber law, different sections in cyber law, Introduction to Mobile Forensics – Mobile Phone Basics, cellular connected mobile device, Inside Mobile devices, data acquisition procedures for cell phones and mobile devices. Cell Phone Crime, 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

Master of Computer Application (MCA) Part I Semester I
Course Code: MMT-105
Title of Course: Advanced Data Structures
Internal Marks: 40 External Marks: 60 Theory: 04 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

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. Understanding concepts of linear and non linear data structure
5. To implement different ways of data structures such as stacks, linked lists and trees
6. Understand different algorithm design approaches.

UNIT I (15 Hours)

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 Hours)

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 Hours)

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 Hours)

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, memorization, Optimal SubstructureProperty in Dynamic Programming

References:

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

Fundamentals of Computer Algorithms, Second edition. By Ellis Horowitz, Sartaj Sahani,

Sanguthevar Rajasekaran, University Press.
Data structures and algorithm analysis in C, Second edition. By Mark Allen weiss
Fundamental algorithms by Donald E. Knuth, Pearson Education.
Data and file structure by A. Tanenbaum by PHI

Master of Computer Application (MCA) Part I Semester I

Course Code: MET-106
Title of Course: Computer Networks
Internal Marks: 40 External Marks: 60 Theory: 04 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

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 Hours)

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 Hours)

Data Link Layer: The Medium Access Sub Layer: Channel allocations problem, multiple access protocols, 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 Hours)

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). VPNs, Tunneling and Overlay Networks: Virtual Private Networks (VPNs), Multiprotocol Label Switching (MPLS), Overlay Networks – VoIP and Multimedia Networking: Overview of IP Telephony.

UNIT IV (15 Hours)

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 Easwara kumar, R Bala subramanian, 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

Course Code: MET-107
Title of Course: Computer Architecture
Internal Marks: 40 External Marks: 60 Theory: 04 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Understand the basic structure, function, and characteristics of computer systems, including instruction sets, CPU architecture, and system buses.
2. Explain the operations of arithmetic and logic UNITs, and evaluate performance using techniques like pipelining and parallelism.
3. Analyze the concepts of memory hierarchy, including cache, main memory, and virtual memory, and their impact on system performance.
4. Compare various types of I/O architectures and data transfer methods such as programmed I/O, interrupt-driven I/O, and DMA.
5. Illustrate control UNIT design principles using hardwired and microprogrammed control methods.
6. Apply the concepts of RISC and CISC architectures and analyze how modern architectures improve computational efficiency.

UNIT I **(15 Hours)**

Basic Computer Organization and Design: Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory-reference instructions, input-output and interrupt, complete computer descriptions, design of basic computer, design of accumulator logic.

UNIT II **(15 Hours)**

Central Processing UNIT: Introduction, General register organization, stack organization, instruction format, address modes, data transfer and manipulation, program control, reduced instruction set computer(RISC), Pipeline and vector processing: parallel processing, pipelining, arithmetic pipeline, instruction pipeline, RISC pipeline, vector processing, array processors.

UNIT III **(15 Hours)**

Input-Output organization: Peripheral devices, input-output interface, asynchronous data transfer, modes of data transfer, priority interrupt, DMA, input-output processor, serial communications.

UNIT IV **(15 Hours)**

Memory organization: memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, memory management hardware, Multiprocessors: Characteristics of multiprocessors, interconnections structures.

References:

1) Computer System Architecture------ M Morris Mano (Pearson Education)
2) Computer Architecture ------ William Stallings

3) Computer Architecture ------Hwang Briggs
4) Computer Architecture and Organization------- J P Hayes (MGH)
5) Computer System Architecture------- Baer J L (Computer Science press)

Master of Computer Application (MCA) Part I Semester II
Course Code: MMT-201
Title of Course: Front End Development
Internal Marks: 40 External Marks: 60 Theory: 04 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. understand the basics of web design
2. gain proficiency in HTML and CSS
3. understand the importance CSS
4. utilize the JavaScript with websites

UNIT I (15 Hours)

Introduction to web design principles, overview of web development technologies and tools, understanding the role of HTML, CSS, and JavaScript, HTML basics, HTML elements, Attributes, heading, paragraphs, Styles, Formatting, Quotations, colors, links, images, table, list tags, Iframe, File paths, HTML layouts, Introduction to CSS syntax and selectors, applying styles to HTML elements, managing layouts using CSS

UNIT II (15 Hours)

Overview of JavaScript and its role in web development, setting up the development environment, Writing and executing JavaScript code, Declaring and assigning variables, working with numbers, strings, booleans, and arrays, Type coercion and type conversion, Conditional statements, Switch statements, Loops, Break and continue statements, Element Access in Javascripts, Event and event handling, dialog boxes, Defining and invoking functions, working with arrays, Introduction to objects and properties, Object-oriented programming concepts

UNIT III (15 Hours)

Introduction to Nodejs, Architecture of Nodejs Application, Advantages of Node JS, Synchronous and Asynchronous Programming, Call back Function in nodejs, Promises in Nodejs, Mongodb with Nodejs, Design the Schema in Nodejs, Design the Rest API's, GET, POST, PUT, DELETE, JSON web Token Authentication in nodejs, Create the Auth APP in nodejs

UNIT IV (15 Hours)

NodeJS Modules, Functions, Buffer, Module, Module Types, Core Modules, Local Modules, Module.Exports, NPM, Installing Packages Locally, Adding dependency in package.json, installing packages globally, updating packages, Fs.read File, Writing a File, Writing a file asynchronously, Opening a file, Deleting a file, Other IO Operations, When to use Event Emitters, Binding Functions to Events, Event Requests, Event Listening

References

1. Head First HTML and CSS by Elizabeth Robson and Eric Freeman
2. HTML, CSS, and JavaScript All in One by Meloni and Kyrin's
3. HTML5andCSS3 All-in-One For Dummies –by Andy Harris
4. Node.js web development by David Herron
5. Beginning Node.js, Express & MongoDB Development by Greg Lim
6. Node.js Design Patterns by Mario Casciaro and Luciano Mammino

Master of Computer Application (MCA) Part I Semester II
Course Code: MMT-202
Title of Course: Artificial Intelligence

Internal Marks: 40 External Marks: 60 Theory: 04 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Understand working of Artificial Neural Networks.
2. Derive solutions for problems with uncertainty using Fuzzy theory.
3. To develop a good understanding of Natural Language Processing
4. Apply Genetic Operations on Binary Strings, and Perform various operations of genetic algorithms
5. Discuss the concepts of an Expert system.

UNIT I (15 Hours)

Artificial Neural Networks: Introduction, Basic Concepts of Artificial Neural Networks, Model of an Artificial Neuron, Deterministic Model of Neuron, Stochastic Model of Neuron , Activation Functions, Network Architectures: Single-Layer Feedforward Networks, Multi-Layer Feedforward Networks, Recurrent Networks , Introduction to deep learning and deep neural network.

UNIT-II (15 Hours)

Introduction to **Fuzzy Set**, Properties of Fuzzy sets, Operations on Fuzzy sets, fuzzy membership function, Features of Membership Functions, Defuzzification,
Fuzzy Inference System (FIS): Functional Blocks of FIS, Working of FIS, Methods of FIS.

UNIT III (15 Hours)

Genetic Algorithm: Genetic Algorithm (GA), Genetic Representations, (Encoding) Initialization and Selection, Different Operators of GA, Analysis of Selection Operations, the Hypothesis of Building Blocks, Schema Theorem and Convergence of Genetic Algorithm, Introduction to Expert System.

UNIT IV (15 Hours)

Natural Language Processing: Introduction, Phases of NLP, advantages, disadvantages, applications. Introduction to **Expert Systems**, Architecture of expert systems, Representation and organization of knowledge, Basics characteristics, and types of problems handled by expert systems.

References

1. Elaine Rich and Kelvin Knight, Artificial Intelligence, Tata McGraw Hill
2. Nils J Nilson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers , Inc., San Francisco, California, 2000.
3. Saroj Kaushik , Artificial Intelligence, Cengage Learning
4. B. Yegnanarayana, Artificial Neural Networks, Prentice-Hall of India
5. Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications, S. Rajasekaran, G. A. Vijayalakshmi Pai, Prentice-Hall of India, 2003
6. Artificial Intelligence: A Modern Approach, 2nd edition, by Russell and Norvig, Prentice Hall

Master of Computer Application (MCA) Part I Semester II
Course Code: MMPR-203
Title of Course: Practical-II
Internal Marks: 40 External Marks: 60 Practical: 08 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

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

Practical's will be based on MMT-201 and MMT-204

Master of Computer Application (MCA) Part I Semester II
Course Code: MMT-204
Title of Course: Data Engineering
Internal Marks: 20 **External Marks: 30** **Theory: 02 hours/week**

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. To introduce students to data storage systems and technologies commonly used in data engineering.
2. To enable students to design and implement databases for efficient data storage and retrieval.
3. To teach students how to optimize data storage and access patterns for performance.
4. To explore data security and privacy considerations in data engineering.
5. To provide experience in using cloud-based storage and database services.

UNIT I **(15 Hours)**

Data Pipeline, Data Flow: the flow of data through different stages of processing, transformation, and storage within a data engineering ecosystem.

Data Storage and Retrieval: Knowledge of various data storage technologies, such as relational databases (SQL) and NoSQL databases.

Data Processing and Transformation: data processing frameworks and tools, like Apache Spark, for handling large-scale data processing and transformation tasks.

UNIT II **(15 Hours)**

Data Integration and ETL (Extract, Transform, Load), Data Warehousing, Big Data Technologies: such as Hadoop ecosystem components (e.g., HDFS, MapReduce) and Apache Kafka for handling real-time data streams.

Cloud Computing for Data Engineering: Understanding the benefits of cloud-based data engineering and working with cloud data storage and processing platforms like AWS, Azure, and Google Cloud Platform.

References:

1. "Data Engineering" by Pramod J. Sadalage and Martin Fowler
2. "Data Engineering Cookbook" by Andreas Kretz

Master of Computer Application (MCA) Part I Semester II

Course Code: MMPR-205

Title of Course: Project

Internal Marks: 40 **External Marks: 60** **Practical: 08 hours/week**

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Gain industrial experience
2. Learn office ethics
3. Learn to work in team
4. Identify the industry problems
5. Implement recent technologies

Student is supposed to do the project with discussion with guide as per industry norms and requirements.

Master of Computer Application (MCA) Part I Semester II
Course Code: MET-206
Title of Course: Network Security
Internal Marks: 40 External Marks: 60 Theory: 04 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

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.
5. Identify some of the factors driving the need for network security.
6. Identify and classify particular examples of attacks.
7. Able to compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems.

UNIT I (15 Hours)

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 Hours)

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 Hours)

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 Hours)**

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
Course Code: MET-207
Title of Course: Software Engineering
Internal Marks: 40 External Marks: 60 Theory: 04 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Describe the definition, characteristics, application domains of software, the nature of web applications, and explain various software process models such as Waterfall, Spiral, and Agile methodologies.
2. Evaluate and select appropriate software development models such as XP, Scrum, or Formal Methods for given project requirements.
3. Carry out requirements engineering tasks, use the SRS template, and apply function-oriented, object-oriented, top-down, and bottom-up design approaches.
4. Calculate size-oriented measures, function points, and cyclomatic complexity using control flow graphs.
5. Distinguish between different types of testing (UNIT, integration, system), apply black-box and white-box techniques, and use testing tools to ensure software quality.
6. Classify types of maintenance, apply software estimation techniques, manage software configuration, and perform risk analysis.

UNIT I **(15 Hours)**

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 Hours)**

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. Design strategies: function oriented design, object oriented design, top down and bottom up design. Software measurement and metrics: various size oriented measures: function point (FP) based measures, cyclomatic complexity measures: control flow graphs.

UNIT -III **(15 Hours)**

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.

UNIT IV **(15 Hours)**

Need for maintenance, categories of maintenance: preventive, corrective and perfective maintenance, cost of maintenance, software reengineering, reverse engineering. Software configuration management activities, change control process, software version control, an overview of CASE tools. Estimation of various parameters such as cost, efforts, schedule/ duration, resource allocation models, software risk analysis and management.

References:

1. Software Engineering by Roger Pressman. 7th edition.
2. Software Engineering for students: A Programming Approach by Douglas Bell, Pearson publication.

3. Software Engineering Sommer ville 8th edition.
4. The unified modeling language user guide Grady Booch, James Rumbaugh, Ivar Jacobson Addison Wesley 2005.

Scheme of Teaching

1. Each contact session for teaching or practical should be of 60 minutes each.
2. 60 lectures should be conducted for each course of 4 credits and 30 lectures for 2 credits.
3. One Practical Batch should be of 30 students.
4. Practical evaluation should be conducted before the commencement of University examination

10. Examination Pattern

Theory:

- **For 4 credit course-** University examinations: 60 marks, Internal evaluation: 40 marks
    - Two tests should be conducted of MCQ type questions. Each test will be of 10 marks
    - Assignments/Seminar/Activities carries 20 marks
- **For 2 credit course-** University examinations: 30 marks, Internal evaluation: 20 marks
    - One test should be conducted of MCQ type questions of 10 marks.
    - Assignments/ Seminar carries 10 marks

- 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.

Practical:

Practical evaluation will be through university appointed panels of one external and one internal examiner.

Project:

- **For 4 credit course-** University examinations: 60 marks, Internal evaluation: 40 marks
    - Project viva by university appointed external and internal examiners.
    - Internal evaluation will be carried out by internal guide.

Project Work (18 credits):

1. Project work can be carried out as industrial training of four months in the Industry or in the Institute as Research project with prior permission of the Institute.
2. Project viva-voce by the University panel will be conducted at the end of semester.

3. The project report should be prepared in a format prescribed by the University, which also specifies the contents and methods of presentation.
4. Project work may be done individually or in groups in case of bigger projects.
5. The project work carry 150 marks for internal assessment and 300 marks for External viva. The external viva shall be conducted by a panel of external and internal examiners.

OR

The student shall be allowed to formulate a proposal for startup and the same shall be rated equivalent to project. A detailed problem statement showing innovation along with marketability, business plan and cash flow shall be part of the evaluation criteria

11. Nature of Question Paper and Scheme of Marking

Theory:

1) There will be Seven (7) questions of 12 Marks and out of which Four (4) to be attempted from question no 2 to 7.
2) Question No.1 is compulsory and is of multiple choice questions. There will be 6 multiple choice question each carries 2 marks
3) Question No.2 to Question No. 6 should consist 2 sub question each carries 6 marks
4) Question No. 7 should be short note types consisting of 4 sub questions out of which 2 needs to be attempted each carries 6 marks.

Practical:

1) Duration of Practical Examination: 2.30 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.
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.

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.

Backlog

Student should not have more than 6 backlogs for 2nd year admission

12. Equivalence of courses

M. C. A. Part I (Semester I and II)

*** Two more chances be given to the repeater student.**