MOHAN BABU UNIVERSITY

Sree Sainath Nagar, Tirupati – 517 102

SCHOOL OF LIBERAL ARTS AND SCIENCES

M.Sc. - Computer Science

CURRICULUM AND SYLLABUS
(For 2022-23 Admitted Students)

FULLY FLEXIBLE CHOICE BASED CREDIT SYSTEM (FFCBCS)

MOHAN BABU UNIVERSITY

Vision

To be a globally respected institution with an innovative and entrepreneurial culture that offers transformative education to advance sustainability and societal good.

Mission

- ❖ Develop industry-focused professionals with a global perspective.

- ❖ Offer academic programs that provide transformative learning experience founded on the spirit of curiosity, innovation, and integrity.

- ❖ Create confluence of research, innovation, and ideation to bring about sustainable and socially relevant enterprises.

- ❖ Uphold high standards of professional ethics leading to harmonious relationship with environment and society.

SCHOOL OF LIBERAL ARTS AND SCIENCES

Vision

To be the ideal culmination for the edification of liberal arts and sciences recognised for excellence, innovation, entrepreneurship, environment and social consciousness.

Mission

- ❖ Infuse the essential knowledge of liberal arts and sciences, skills and an inquisitive attitude to conceive creative and appropriate solutions to serve industry and community.

- ❖ Proffer a know-how par excellence with the state-of-the-art research, innovation, and incubation ecosystem to realise the learners' fullest entrepreneurial potential.

- ❖ Endow continued education and research support to working professionals in liberal arts and sciences to augment their domain expertise in the latest technologies

- ❖ Entice the true spirit of environment and societal consciousness in citizens of tomorrow in solving challenges in liberal arts and sciences.

DEPARTMENT OF MATHEMATICAL SCIENCES

Vision

To become a Nation's center of excellence in the field Mathematical Sciences and its allied areas through teaching, training, and research.

Mission

- ❖ Disseminate the knowledge of a diverse group of students by providing solutions through contemporary curriculum.

- ❖ Creating a talent pool of faculty in diverse domains through continuous training.

- ❖ Domain and transferable skill development for holistic personality of students and employability.

- ❖ Inculcating values and Ethics for effective professional practice.

M.Sc. - Computer Science

PROGRAM EDUCATIONAL OBJECTIVES

After few years of graduation, the graduates of M.Sc. Computer Science will:

PEO1. Pursue higher education in their core or allied areas of specialization.

PEO2. Employed as a productive and valued professional in industry/teaching/ research.

PEO3. Engaged in innovation and deployment as a successful entrepreneur.

PEO4. Adapt evolving technologies in the core or allied areas by participating in continuing education programs for lifelong learning.

PROGRAM OUTCOMES

On successful completion of the Program, the graduates of M.Sc. Computer Science will be able to:

PO1 **Knowledge:** To study as well as apply concepts, theories, and practices across the disciplines to gain the foundational knowledge.

PO2 **Problem Analysis:** To identify, analyze and evaluate various experiences and perspectives using foundational disciplinary knowledge for substantiated conclusions.

PO3 **Design/Development of solutions:** To design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 **Modern tool usage:** To create, select, and apply appropriate techniques, resources and modern tools with an understanding of the limitations.

PO5 **Environment and Sustainability:** Understand the issues of environmental contexts and demonstrate the knowledge for sustainable development.

PO6 **Ethics and Society:** Apply the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities under moral dimensions.

PO7 **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, to manage projects and finance in multidisciplinary settings.

PO8 **Effective Communication:** To develop proficiency and efficiency in communicating by connecting people, ideas, books, media, and technology.

PO9 **Life-long learning:** Recognize the need for and acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

PROGRAM SPECIFIC OUTCOMES

On successful completion of the Program, the graduates of M.Sc. Computer Science program students will be able to:

PSO1. Apply the knowledge of Mathematical foundation, Business Management and Information Technology to the solutions of real world problems.

PSO2. Analyze, Design and Develop solutions in real time in the domains of technical, managerial, economical and social constraints by using current technologies in Information Management, Software Engineering, Platform Based Development, and Computer Networks skills.

PSO3. Use innovative ideas to create better environment in order to solve complex problems in the domains of Information Management, Software Engineering, Platform Based Development and Computer Networks for the excellence of an individual and society and apply appropriate techniques, resources, and modern tools to complex real time problems in the domains of Information Management, Software Engineering, Platform Based Development and Computer Networks.

M.Sc. – Computer Science

Basket Wise - Credit Distribution

Sl. No.	Baskets	Credits (Min.- Max.)
1	SCHOOL CORE	24-30
2	PROGRAM CORE	21-26
3	PROGRAM ELECTIVE	33-42
4	UNIVERSITY ELECTIVE	6-9
	TOTAL CREDITS	**Min. 90**

General Information and Guidelines for Students:

1. The students are free to prepare their own Course grid for every semester from the Basket of courses subject to satisfying the prerequisites for the courses selected and adhering to the Minimum and Maximum Credit requirement as per the Program Regulations.

2. The students shall consult the respective Faculty Advisors for selection of courses.

3. The students have an option to decide the pace of his learning [The number of semesters to complete the program]

4. The slot time table to be introduced from the next academic year provides the opportunity to the students to decide their own time table and select the Faculty members.

5. The content to be taught by the faculty member and the course outcomes are primarily decided by the concerned faculty member based on the students batch and the available time in a semester.

Each course shall have a course catalog with the following details:
i) Pre –Requisites of the course, ii) Course Outcomes, iii) Course Description, iv) Reference Resources.

School Core (24 - 30 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22MM201005	Discrete Mathematics	3	-	-	-	3	-
22MM201001	Computer Architecture and Organization	3	-	-	-	3	-
22MM202001	Operating Systems	3	-	2	-	4	-
22MM201017	Mobile Computing and Networking	3	-	-	-	3	-
22EE201001	Research Methodology	3	-	-	-	3	-
22MM211001	Internship	-	-	-	-	2	-
22MM208001	Capstone Project	-	-	-	-	10	-
Mandatory Courses (Min. 4 Credits to be earned, Earned Credits will not be considered for CGPA)							
22AI207601	Statistics with R	2	-	-	-	2	-
22LG207601	Technical Report Writing	2	-	-	-	2	-
22MG201401	Project Management	2	-	-	-	2	-

Program Core (21 – 26 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22MM202002	Object Oriented Programming through JAVA	3	-	2	-	4	-
22MM201003	Design and Analysis of Algorithms	3	-	-	-	3	-
22MM202003	Database Management Systems	3	-	2	-	4	Design and Analysis of Algorithms
22MM201008	Data Warehousing and Data Mining	3	-	-	-	3	-
22MM201002	Computer Networks	3	-	-	-	3	-
22MM202004	Software Engineering	3	-	2	-	4	-
22MM201009	Software Testing and Quality Assurance	3	-	-	-	3	Software Engineering
22MM202007	System software	3	-	2	-	4	Operating Systems

Program Elective (33 – 42 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22MM201010	Information Retrieval Techniques	3	-	-	-	3	Data Warehousing and Data Mining
22MM201004	Cryptography and Network Security	3	-	-	-	3	-
22MM201018	Computer Graphics	3	-	-	-	3	-
22MM202005	Python Programming	3		2		4	
22MM201006	Cyber Security Essentials	3	-		-	3	
22MM201011	Object Oriented Modelling and Design	3	-	-	4	4	Software Engineering
22MM201007	Block chain Technologies	3	-	-	-	3	
22MM202008	Multimedia Application Development	3	-	2	-	4	
22MM201013	Introduction to Machine Learning	3	-	-	-	4	Python Programming
22MM201015	Deep Learning	3		-	-	3	Introduction to Machine Learning
22MM202011	Artificial Intelligence	3	-	2	-	3	Computational Statistics
22MM201016	Formal Language and Automata Theory	3	-	-	-	3	Discrete Mathematics
22MM202006	NoSQL Databases	3	-	2	-	4	Database Management Systems
22MM201014	Internet of Things	3	-	-	-	4	Computer Networks
22CA201001	Computational Statistics	3	-	-	-	3	-

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
22MM201012	Operation Research	3	-	-	-	3	

University Elective (6-9 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22CE201701	Disaster Management	3	-	-	-	3	-
22EC101701	AI in Healthcare	3	-	-	-	3	-
22CB101701	Cyber Laws and Security	3	-	-	-	3	-
22CB101703	Forensic Science	3	-	-	-	3	-
22ME101704	Managing Innovation and Entrepreneurship	3	-	-	-	3	-
22LG201701	Personality Development	3	-	-	-	3	-
22SS101706	Women Empowerment	3	-	-	-	3	-

Note:

1. If any student has chosen a course or equivalent course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s under University Elective.

2. The student can choose courses from other disciplines offered across the schools of MBU satisfying the pre-requisite other than the above list.

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM201005	**DISCRETE MATHEMATICS**	3	-	-	-	3

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: This course addresses the challenges of the relevance of Boolean, Lattice and algebraic systems to computer science and their corresponding systems. To apply number theory, graph theory and their related concepts and algorithm to develop security levels and intelligent systems.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply mathematical logic and predicate calculus to validate precise statements

CO2. Analyze the basic structures of lattice and Boolean algebra.

CO3. Demonstrate the importance of algebraic properties with regard to working within various number systems.

CO4. Formulate recurring Problems and solve their recurrence relations.

CO5. Apply the concepts of graph theory and trees to implement computer algorithms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	-	1	-	-	-	-	-	-	-	3
CO2	3	3	-	2	2	-	-	-	-	2	-	3
CO3	3	2	-	2	2	-	-	-	-	1	-	3
CO4	3	2	-	2	-	-	-	-	-	3	-	2
CO5	3	3	-	2	-	-	-	-	-	2		3
Course Correlation Mapping	**3**	**3**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   MATHEMATICAL REASONING   *(07 Periods)*

Concepts of mathematical logic, Normal Forms, The Predicate Calculus, Rule of Inference, Consistency, Proof of Contradiction, quantifiers.

Module 2:   LATTICES AND BOOLEAN ALGEBRA   *(09 Periods)*

Lattices: Partially Ordered Relations, Hasse Diagram, Lattices as Posets, Properties of Lattices

Boolean Algebra: Basic Definitions, Truth Tables, Boolean Functions, Representation and Minimization of Boolean Functions.

Module 3   ALGEBRAIC STRUCTURES AND NUMBER THEORY   *(11 Periods)*

Algebraic Structures: Binary Operations and Algebraic Structures Groups, Subgroups.

Number Theory: Division Algorithm, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Euler Totient Function, Modular Arithmetic (Fermat's Theorem and Euler's Theorem (without proof))

Module 4   RECURRENCE RELATIONS   *(09 Periods)*

Generating Functions of Sequences, calculating coefficients of generating function, Homogeneous Recurrence relation, solving recurrence relations by substitution and Generating functions, Methods of Characteristic Roots.

Module 5   GRAPHS AND TREES   *(09 Periods)*

Graphs: Representation of Graphs and Graph Isomorphism, Euler Paths and Circuits, Hamiltonian Paths and Circuits, Planar Graphs, Euler's Formula and Graph Coloring.
Trees: Introduction to Trees, Properties of Trees, Spanning Trees, Counting trees, Depth-First Search, Breadth-First Search, Minimum Spanning Trees.

                                                                        Total Periods: 45

EXPERIENTIAL LEARNING

1. Let a > 1 be a positive integer. Pretend you want to divide n people into some number of teams, each of size a or a + 1. Show that this is possible provided n is larger than values in the Fibonacci polynomial $a2 - a - 1 = a(a-1) - 1$.

2. Identify the relations on the set of bits B = {0, 1} that are partial orders and those that are equivalence relations.

3. Pretend you are writing traffic accident software and want to categorize accidents by the day of the week on which they occur. Pretend there are n accident reports to categorize.

   (a) What is the size of the sample space? That is, in how many ways can the accident

reports be distributed over 7 days?

(b) In how many ways can all n accidents occur on one single day?

(c) In how many ways can all n accidents occur on only two days?

(d) Let's looks at the other end: In how many ways can all n accidents occur on seven, and no less, days.

RESOURCES

TEXT BOOKS:

1. Kenneth H. Rosen,Discrete Mathematics and its Applications, Tata McGraw Hill, 8th Edition, 2019.

2. Jon Pierre Fortney, Discrete Mathematics for Computer Science, CRC Press, Taylor & Francis Group, 1st Edition, 2021.

REFERENCE BOOKS:

1. Richard Johsonbaugh, Discrete Mathematics , Prentice Hall,8th Edition, 2019.

2. NarasingDeo, Graph Theory with application to Engineering and Computer Science, Prentice Hall India 2016.

3. J.P. Trembly and R. Manohar, *Discrete Mathematical Structures with Applications to Computer Science,*Tata McGraw Hill, 37th Edition, 2017

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106106183

2. https://nptel.ac.in/courses/106106094

WEB RESOURCES:

1. https://www.coursera.org/learn/discrete-mathematics

2. https://people.cs.pitt.edu/~milos/courses/cs441/

3. https://web.stanford.edu/class/cs103x/cs103x-notes.pdf

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM201001	**COMPUTER ARCHITECTURE AND ORGANIZATION**	3	-	-	-	3

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION:
This course provides a basic understanding of how computers work. Starting from basic number representation to perform computation. This is followed by higher-level systems designs including memory and input/output. It concludes with a brief discussion of advanced topics in computer systems design such as machine language and assembly programming, machine representation of data and instructions, computer arithmetic, the CPU and instruction interpretation.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the impact of instruction set architecture on cost-performance of computer design.

CO2. Design an interconnection networks and multiprocessors.

CO3. Understand memory hierarchy and its impact on computer cost/performance.

CO4. Use tools for modeling various microprocessor design alternatives.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	3	-	3
CO2	3	2	-	3	-	-	-	-	-	3	-	3
CO3	3	2	-	2	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	2	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**2**	**3**	**-**	**2**	**-**	**3**	**-**	**3**	**-**	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   STRUCTURE OF COMPUTERS   *(10 Periods)*

STRUCTURE OF COMPUTERS: Computer types, Functional units, Basic operational concepts, Von-Neumann Architecture, Bus Structures, Software, Performance, Multiprocessors and Multi computer, Data representation, Fixed and Floating point, Error detection and correction codes.
COMPUTER ARITHMETIC: Addition and Subtraction, Multiplication and Division Algorithms, Floating-point Arithmetic Operations, Decimal arithmetic operations.

Module 2:   BASIC COMPUTER ORGANIZATION AND DESIGN   *(09 Periods)*

BASIC COMPUTER ORGANIZATION AND DESIGN: Instruction codes, Computer Registers, Computer Instructions and Instruction cycle. Timing and Control, Memory-Reference Instructions, Input-Output and interrupt.
CENTRAL PROCESSING UNIT: Stack organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Complex Instruction Set Computer (CISC) Reduced Instruction Set Computer (RISC), CISC vs RISC.

Module 3:   REGISTER TRANSFER AND MICRO-OPERATIONS   *(10 Periods)*

REGISTER TRANSFER AND MICRO-OPERATIONS: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro-Operations, Logic Micro -Operations, Shift Micro-Operations, Arithmetic logic shift unit.
MICRO-PROGRAMMED CONTROL: Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit

Module 4:   MEMORY SYSTEM   *(08 Periods)*

MEMORY SYSTEM: Memory Hierarchy, Semiconductor Memories, RAM (Random Access Memory), Read Only Memory (ROM), Types of ROM, Cache Memory, Performance considerations, Virtual memory, Paging, Secondary Storage, RAID.

Module 5:   INPUT OUTPUT   *(08 Periods)*

INPUT OUTPUT: I/O interface, Programmed IO, Memory Mapped IO, Interrupt Driven IO, DMA.
MULTIPROCESSORS: Characteristics of multiprocessors, Interconnection structures, Inter Processor Arbitration, Inter processor Communication and Synchronization, Cache Coherence.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Case study on performing Computer Arithmetic operations

2. Case Study on Addressing Modes - Instruction Formats

3. Explain Instruction Set: Characteristics - Operand Types - Operation Types

4. To find the largest and smallest number in an array of data using 8085 instruction set. Using 8085 Microprocessor Simulator

5. Write an simple Interrupt service routine to understand interrupt using 8085 Microprocessor Simulator

RESOURCES

TEXT BOOKS:

1. M. Moris Mano(2006), Computer System Architecture, 3rd edition, Pearson/PHI, India

REFERENCE BOOKS:

1. Carl Hamacher, Zvonks Vranesic, Safea Zaky (2002), Computer Organization, 5thedition, McGraw Hill, New Delhi, India.
2. Anrew S.Tanenbaum (2006), Structured Computer Organization, 5th edition, Pearson Education Inc,

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=Ol8D69VKX2k&list=PLBlnK6fEyqRgLLlzdgiTUKULKJPYc0 A4q
2. https://www.youtube.com/watch?v=L9X7XXfHYdU&list=PLxCzCOWd7aiHMonh3G6QNKq53C 6oNXGrX
3. http://nptel.ac.in/courses/

WEB RESOURCES:

1. https://www.geeksforgeeks.org/
2. http://www.materialdownload.in/article/Computer-Organization/

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM202001	**OPERATING SYSTEMS**	3	-	2	-	4

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: Operating Systems Operations; Process Scheduling; Process Synchronization, Deadlocks; Paging and Segmentation, Disk Scheduling; File Concepts, I/O Interface; Concepts of Protection and Security.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze performance of CPU scheduling algorithms.

CO2. Design solutions for process synchronization problems by using semaphores and monitors.

CO3. Devise solutions for deadlocks using deadlock handling mechanisms.

CO4. Solve memory management problems using page replacement and disk scheduling algorithms.

CO5. Identify efficient file allocation methods for optimal disk utilization and Analyze services of I/O subsystems and mechanisms of security & protection and Work Independently and Communicate Effectively in Oral and Written forms

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	3	-	3
CO2	3	2	-	3	-	-	-	-	-	3	-	3
CO3	3	2	-	2	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	2	-	-	-	-	-	-
CO5	-	-	-	-	-	-	2	3	-	-	-	-
Course Correlation Mapping	**3**	**2**	**2**	**3**	**-**	**2**	**2**	**3**	**-**	**3**	**-**	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO OPERATING SYSTEM AND PROCESS   *(08 Periods)*
                MANAGEMENT

Introduction: Definition, Operating System Structure and Services, System Calls.
Process Management: Process Scheduling, Process Control Block, Inter Process Communication, Threads, Multithreading Models, CPU Scheduling Criteria, Scheduling Algorithms, Multiprocessor Scheduling.

Module 2:   PROCESS SYNCHRONIZATION AND DEADLOCKS   *(10 Periods)*

Process Synchronization: Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Synchronization Problems, Monitors.
Deadlocks: System Model, Deadlock characterization, Methods for handling deadlocks, Prevention, Detection, Avoidance, Recovery from deadlock.

Module 3:   MEMORY MANAGEMENT AND SECONDARY STORAGE   *(07 Periods)*

Memory Management: Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging.
Virtual Memory: Demand Paging, Page Replacement Algorithms, Copy-on-Write, Thrashing. **Secondary Storage Structure:** Overview of Mass Storage Structure, Disk Structure, Disk   Scheduling, Disk Management.

Module 4:   FILE AND I/O SYSTEMS   *(10 Periods)*

File System: File concept, Access Methods, Directory Structure, File System Structure, i-node, File System Implementation, Directory Implementation, Allocation Methods.
I/O System: I/O Hardware, Application I/O Interface, Kernel I/O subsystem.

Module 5:   PROTECTION AND SECURITY   *(10 Periods)*

Protection: Goals, Principles, Domain of Protection, Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights.
Security: Security Problem, Program Threats, System and Network Threats, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and Networks, Computer-Security Classifications.

Total Periods: 45

EXPERIENTIAL LEARNING

List of Experiments:

1.   Simulate the following CPU scheduling algorithms.

      a) FCFS   b) SJF   c) Round Robin   d) Priority
2.   Write a C program to simulate producer-consumer problem using Semaphores

3.   Write a C program to simulate the concept of Dining-philosophers problem.

4.   Simulate MVT and MFT.

5.   Write a C program to simulate the following contiguous memory allocation Techniques.
      a) Worst fit   b) Best fit   c) First fit.
6.   Write a C program to Simulate all page replacement algorithms
      a)FIFO   b) LRU   c) OPTIMAL

7. Write a C program to simulate the File Organization Techniques
   a) Single level directory   b) Two level directory

8. Write a C program to Simulate the following file allocation strategies
   a) Sequential   b) Indexed   c) Linked.

9. Write a C program to simulate Bankers Algorithm for Dead Lock Avoidance.

10. Write a C program to simulate Bankers Algorithm for Dead Lock Prevention.

11. Write a C program to simulate disk scheduling algorithms.
    a) FCFS   b) SCAN   c) C-SCAN

RESOURCES

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, Wiley India Edition, 9th Edition, 2016.

REFERENCE BOOKS:

1. William Stallings, Operating Systems, Internals and Design Principles, Pearson Education, 7th Edition, 2013.

2. Andrew S. Tanenbaum, Modern Operating Systems, PHI, 3rd Edition, 2009.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc22_cs78/preview

2. https://www.cse.iitb.ac.in/~mythili/os/

3. https://www.youtube.com/watch?v=vBURTt97EkA

WEB RESOURCES:

1. https://www.tutorialspoint.com/operating_system/os_useful_resources.htm

2. https://www.techtarget.com/whatis/definition/operating-system-OS

3. https://www.studytonight.com/operating-system/introduction-operating-systems

4. https://www.geeksforgeeks.org/web-operating-system/

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM201017	**MOBILE COMPUTING AND NETWORKING**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Overview of Mobile computing and Second-Generation Architecture; Wireless Medium Access Control, CDMA, 3G, WIMAX, 4G and 5G Networks; Mobile IP Network Layer; Mobile Transport Layer; Wireless LAN and Personal Area Network Protocols

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on the characteristics of mobile computing, GSM and GPRS.

CO2. Analyze the mobility, scalability, and Medium characteristics of 3G, WIMAX, 4G and 5G networks.

CO3. Analyze the services and protocols of Mobile IP Network Layer and Transport Layer.

CO4. Demonstrate Knowledge on wireless LAN and personal area network protocols

CO5. Understand the Wireless Application Protocol

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	3	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3
CO5	3	2	-	-	-	-	-	-	-	-	-	3
Course Correlation Mapping	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**

Correlation Levels: 3: High; 2: Medium;   1: Low

COURSE CONTENT

Module 1:   OVERVIEW OF MOBILE COMPUTING   *(09 Periods)*

Mobile Computing Architecture: An Overview: Mobile Computing, Mobile Computing Operating System, Mobile Computing Architecture, Design Considerations for Mobile Computing, Mobile Computing and the Apps, Limitations of Mobile Devices, Security Issues

Module 2:   SECOND-GENERATION ARCHITECTURE   *(07 Periods)*

Second-generation Architecture-GSM, GPRS, and Others: GSM Services, GSM System Architecture, Space Division Multiple Access, Time Division Multiple Access, and Frequency Division Multiple Access, Call Routing, Public Land Mobile Network (PLMN) Interface, GSM Subscriber Addresses and Identities, Protocols, Localization, Call Handling, Handover, Security, Introduction to SMS, General Packet Radio Service, High-speed Circuit-switched Data, Digital Enhanced Cordless Telecommunications, WLL Application

Module 3:   WIRELESS MEDIUM ACCESS CONTROL,   *(09 Periods)*
                  CDMA, 3G, WIMAX, 4G AND 5G NETWORKS

Modulation, Medium Access Control, Exposed and Hidden Terminal Problem, Near and Far Terminal Problem, and Power Control for Medium Access, MAC Algorithms, WLAN and CAMA/CA Wireless Protocols, SDMA, TDMA, FDMA and CDMA, Direct Sequence Spread Spectrum, Frequency Hopping Spread Spectrum, Code Division Multiple Access

3G: Applications of 3G Mobile Services, 3G Mobile Services: IMT2000 and UMTs, CDMA 2000: 3G, WCDMA 3G, OFDM, High-speed Packet Access, Mimo in HSPA, Long-term Evolution and WiMax 16E, Ultra-wide Band and Broadband Wireless Access

4G Networks: HS-OFDM, LTE Advanced and WiMax 16M, Upcoming 5G Network Features

Module 4:   MOBILE IP NETWORK LAYER   *(10 Periods)*

Functioning of OSI Layers, and TCP/IP, IP, UDP and ICMP Protocols, Mobile IP, Packet Delivery and Handover Management, Location Management, Registration, IP Header: Encapsulation and Routes Optimization, Mobility Binding, Tunneling, and Reverse Tunneling, Dynamic Host Configuration Protocol, Cellular IP, Mobile IP with IPv6, Voice over IP, IP Security

Module 5:   WIRELESS LAN AND PERSONAL AREA NETWORK   *(10 Periods)*
                  PROTOCOLS

Wireless LANs, Wireless Application Protocol, Wireless Markup Language, Bluetooth, WiMax, ZigBee and Wi-Fi, Bluetooth, and ZigBee Features

Total Periods: 45

EXPERIENTIAL LEARNING

Describe FOUR main principles of mobile computing

1. 1. Develop a music player app which will have control to :

(1) start a service to start playing music (store some music files in appropriate resource directory)

(2) stop playing the music

(3) start another service that checks if the Internet connection is available, if so it talks a music player server and downloads the music files and save in appropriate files that are private to the app

(4) It will have broadcast receivers for the following actions BOOT_COMPLETED, POWER_CONNECTED, AIRPLANE_MODE

(5) Design for the UI of the app had to be done using a fragment

RESOURCES

TEXTBOOKS:

1. Raj kamal, *Mobile Computing,* OXFORD University Press, 3rdEdition, 2019.

REFERENCE BOOKS:

1. Jochen Schiller*, Mobile Communications*, Pearson Education, 2ndEdition, 2009

VIDEO LECTURES:

1. mobile computing introduction| Mobile Computing | Lec - 1| Bhanupriya - YouTube

2. mobile computing introductionFDMA | Mobile Computing | Lec-27 | Bhanu priya - YouTube| Mobile Computing | Lec - 1| Bhanupriya - YouTube

WEB RESOURCES:

1. What is Mobile Computing? - SearchMobileComputing (techtarget.com)

2. What is mobile cloud computing? | IBM Cloud

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22EE201001	**RESEARCH METHODOLOGY**	3	-	-	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION:
The course is developed for the students' to understand the underlying concepts of research methodology and a systematic approach for carrying out research in the domain of interest. The course is emphasized on developing skills to recognize and reflect the strength and limitation of different types of research; formulation of the research hypothesis and its systematic testing methods. The course also emphasizes on interpreting the findings and research articulating skills along with the ethics of research.

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

CO1. Demonstrate the underlying concepts of research methodology, types of research and the systematic research process.

CO2. Demonstrate the philosophy of research design, types of research design and develop skills for a good research design.

CO3. Demonstrate the philosophy of formulation of research problem, methods of data collection, review of literature and formulation of working hypothesis.

CO4. Analyse the data and parametric tests for testing the hypothesis.

CO5. Interpret the findings and research articulating skills along with the ethics of research.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	-	-	-	3	-	-	3	-	-
CO2	-	-	-	3	-	-	3	-	-
CO3	-	-	-	3	-	-	3	-	-
CO4	-	-	-	3	-	-	3	-	-
CO5	-	-	-	-	3	-	-	3	-
Course Correlation Mapping	**-**	**-**	**-**	**3**	**3**	**-**	**3**	**3**	**-**

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1:   Introduction to Research Methodology   (08 Periods)

Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research.

Module 2:   Research Design   (08 Periods)

Research design—Basic Principles, Need of research design, Features of good design, Important concepts relating to research design, Different research designs, Basic principles of experimental designs, Developing a research plan.

Module 3:   Research Formulation   (08 Periods)

Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Data collection – Primary and secondary sources; Critical literature review – Identifying gap areas from literature review; Hypothesis— Types of hypothesis, Development of working hypothesis.

Module 4:   Analysis of Data and Hypothesis Testing   (14 Periods)

Quantitative Tools: Testing and Significance of Measures of Central Tendency, Dispersion; correlation, Principles of least squares—Regression; Errors-Mean Square error, Mean absolute error, Mena absolute percentage errors.
Testing of Hypothesis: Hypothesis Testing Procedure, Types of errors, Parametric testing (t, z and F), Chi-Square Test as a Test of Goodness of Fit; Normal Distribution- Properties of Normal Distribution; Analysis of Variance.

Module 5:   Interpretation and Report Writing   (07 Periods)

Interpretation: Meaning of interpretation; Techniques of interpretation; Precautions in Interpretation.
Report Writing –Significance, Different Steps, Layout, Types of reports, Mechanics of Writing a Research Report, Precautions in Writing Reports; Research ethics—Plagiarism, Citation and acknowledgement.

Total Periods: *45*

 EXPERIENTIAL LEARNING

1.   Should conduct a survey based on a hypothesis, analyze the data collected and draw the inferences from the data.

2.   Should review the literature on the given topic and should identify the scope/gaps in the literature and develop a research hypothesis.

3.   Should study a case, formulate the hypothesis and identify an appropriate testing technique for the hypothesis.

4.   Study an article and submit a report on the inferences and should interpret the findings of the article.

RESOURCES

TEXT BOOKS:
1. C.R. Kothari, Research Methodology: Methods and Techniques, New Age International Publishers, 2nd revised edition, New Delhi, 2004.
2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. *An introduction to Research Methodology*, RBSA Publishers.

REFERENCE BOOKS:
1. R. Panneerselvam, Research Methodology, PHI learning Pvt. Ltd., 2009.
2. Singh, Yogesh Kumar. *Fundamental of research methodology and statistics*. New Age International, 2006.

VIDEO LECTURES:
1. https://nptel.ac.in/courses/121106007
2. https://onlinecourses.nptel.ac.in/noc22_ge08/preview
3. https://www.youtube.com/watch?v=VK-rnA3-41c

Web Resources:
1. https://www.scribbr.com/category/methodology/
2. https://leverageedu.com/blog/research-design/
3. https://prothesiswriter.com/blog/how-to-formulate-research-problem
4. https://www.formpl.us/blog/hypothesis-testing
5. https://www.datapine.com/blog/data-interpretation-methods-benefits-problems/
6. https://leverageedu.com/blog/report-writing/

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SCHOOL CORE

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Course Code	Course Title	L	T	P	S	C
22AI207601	**STATISTICS WITH R**	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course introduces the basic concepts of statistics using R language. The course also deals with various types of sampling methods and its impact in the scope of inference through the computation of confidence intervals. The topics covered in the course also includes descriptive statistics, marginal and conditional distribution, statistical transformations, chi-squared test and ANOVA.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Import, manage, manipulate, structure data files and visualize data using R programming.

CO2. Identify trends and patterns in data using Marginal, Conditional distributions and Statistical transformations.

CO3. Analyse data using sampling and probability distribution methods and compute confidence intervals for statistical inference.

CO4. Apply chi-squared goodness-of-fit test, Pearson's $\chi 2$-statistic and ANOVA to investigate the distribution of data.

CO-PO-PSO Mapping Table:

Learning Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	2	-	-	-	-	-		
CO2	3	2	-	-	-	-	-		
CO3	2	2	-	-	-	-	-		
CO4	3	2	-	-	-	-	-		
Course Correlation Mapping	3	2	-	-	-	-	-		

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Correlation Levels: 3: High;   2: Medium;   1: Low

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COURSE CONTENT

Module 1:   INTRODUCTION   *(05 Periods)*

Data, R's command line, Variables, Functions, The workspace, External packages, Data sets, Data vectors, Functions, Numeric summaries, Categorical data.

Module 2:   BIVARIATE AND MULTIVARIATE DATA   *(07 Periods)*

Lists, Data frames, Paired data, Correlation, Trends, Transformations, Bivariate categorical data, Measures of association, Two-way tables, Marginal distributions, Conditional distributions, Graphical summaries, Multivariate data - Data frames, Applying a function over a collection, Using external data, Lattice graphics, Grouping, Statistical transformations.

Module 3   POPULATIONS   *(06 Periods)*

Populations, Discrete random variables, Random values generation, Sampling, Families of distributions, Central limit theorem, Statistical Inference - Significance tests, Estimation, Confidence intervals, Bayesian analysis.

Module 4   CONFIDENCE INTERVALS   *(06 Periods)*

Confidence intervals for a population proportion, p - population mean, other confidence intervals, Confidence intervals for differences, Confidence intervals for the median, Significance test - Significance test for a population proportion, Significance test for the mean (t-tests), Significance tests and confidence intervals, Significance tests for the median.

Module 5   GOODNESS OF FIT   *(06 Periods)*

The chi-squared goodness-of-fit test, The multinomial distribution, Pearson's χ^2-statistic, chi-squared test of independence and homogeneity, Goodness-of-fit tests for continuous distributions, ANOVA - One-way ANOVA, Using *lm* for ANOVA.

Total Periods: 30

EXPERIENTIAL LEARNING

The following is the sample. Faculty shall frame according to the course domain.

1. The data set babyboom (Using R) contains data on the births of 44 children in a one-day period at a Brisbane, Australia, hospital. Compute the skew of the wt variable, which records birth weight. Is this variable reasonably symmetric or skewed?
    The variable running. time records the time after midnight of each birth.
    The command diff(running.time) records the differences or inter-arrival times. Is this variable skewed?

2. An elevator can safely hold 3, 500 pounds. A sign in the elevator limits the passenger count to 15. If the adult population has a mean weight of 180 pounds with a 25-pound standard deviation, how unusual would it be, if the central limit theorem applied, that an elevator holding 15 people would be carrying more than 3, 500 pounds?

3. The data set MLBAttend (UsingR) contains attendance data for Major League Baseball between the years 1969 and 2000. Use lm to perform a t-test on attendance for the two levels of league. Is the difference in mean attendance significant? Compare your results to those provided by t.test.

RESOURCES

TEXT BOOKS:

1. John Verzani, Using R for Introductory Statistics, CRC Press, 2nd Edition, 2014.
2. Sudha G Purohit, Sharad D Gore, Shailaja R Deshmukh, Statistics Using R, Narosa Publishing house, 2nd Edition, 2021.

REFERENCE BOOKS:

1. Francisco Juretig, R Statistics Cookbook, Packt Publishing, 1st Edition, 2019.
2. Prabhanjan N. Tattar, Suresh Ramaiah, B. G. Manjunath, A Course in Statistics with R, Wiley, 2018.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_ma76/preview
2. https://onlinecourses.nptel.ac.in/noc19_ma33/preview
3. https://youtu.be/WbKiJe5OkUU?list=PLFW6lRTa1g83jjpIOte7RuEYCwOJa-6Gz
4. https://youtu.be/svDAkvh6utM?list=PLFW6lRTa1g83jjpIOte7RuEYCwOJa-6Gz
5. https://nptel.ac.in/courses/111104120

WEB RESOURCES:

1. https://www.geeksforgeeks.org/r-statistics/
2. https://www.geeksforgeeks.org/r-programming-exercises-practice-questions-and-solutions/
3. https://www.w3schools.com/r/r_stat_intro.asp
4. https://www.w3schools.com/r/r_stat_intro.asp
5. https://statsandr.com/blog/descriptive-statistics-in-r/

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG207601	**TECHNICAL REPORT WRITING**	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course deals withpreparing effective technical documents for both written and digital media, with particular emphasis on technical memos, problem-solving and decision-making reports, and organizational, product-support, and technical-information webs.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge of Technical Report Writing and structures with a scientific attitude.

CO2. Analyze the process of writing in preparing effective reports.

CO3. Demonstrate styles of writing for Publication in a Scientific Journal.

CO4. Apply the process of referencing and editing techniques for effective communication in written documents.

CO5. Analyze the strategies in the technical report presentation.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	-	-	-	-	3	-	-	-	-	-	-	3
CO2	-	-	-	-	3	-	-	-	-	2	-	3
CO3	-	-	-	-	3	-	-	-	-	1	-	3
CO4	-	-	-	-	3	-	-	-	-	3	-	2
CO5	-	-	-	-	3	-	-	-	-	2		3
Course Correlation Mapping	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	-	**2**	**-**	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO TECHNICAL REPORT WRITING   *(06 Periods)*

Concepts of Technical Report, Types of Reports, Planning Technical Report Writing, Components of a Technical Report, Report Writing in Science and Technology, Selecting and Preparing a Title, Language Use in Report Writing.

Module 2:   PROCESSOF WRITING   *(06 Periods)*

Writing the 'Introduction', Writing the 'Materials and Methods, Writing the Findings/Results, Writing the 'Discussion', Preparing and using "Tables".

Module 3:   STYLE OF WRITING   *(06 Periods)*

Preparing and using Effective 'Graphs', Citing and Arranging References-I, Citing and Arranging References –II, Writing for Publication in a Scientific Journal.

Module 4:   REFERENCING   *(06 Periods)*

Literature citations, Introductory remarks on literature citations, Reasons for literature citations, Bibliographical data according to ISO standards, Citations in the text, Copyright, and copyright laws, the text of the Technical Report, Using a word processing and desktop publishing (DTP) systems, Document or page layout, hints on editing Typographic details, Cross-references.

Module 5:   PRESENTATION   *(06 Periods)*

Presentation with appropriate pointing, Dealing with intermediate questions, Review and analysis of the presentation, Rhetoric tips from A to Z.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Prepare a report on technologies of modern times that enriched the originality of research works and their impacts on society concerning plagiarism.

2. Make PowerPoint presentations on the various style of writing academic reports.

3. Error-free Reports are so important for successful communication and sharing of information. Prepare a detailed chart on proofreading techniques to make a report effective and error-free.

4. Design a logo for a company and write down the copy-right laws for that.

5. Read research articles from any international journal of science and technology and differentiate research writing from other academic and non-academic writings.

6. Write an organizational memo Include a heading, introduction, and summary at the beginning of your memo, and present the details of your discussion in a logical order. Use headings and topic or main-idea sentences to clarify the organization.

7. Prepare an appraisal report on the staff performance of your company.

8. Prepare a PowerPoint presentation on the annual performance report of a company.

9. Critically review and write a report on any one of the recently released products.

10. Read the newspaper and write a detailed report about the content coverage and analyse the factors for the popularity of the newspaper.

RESOURCES:

TEXTBOOK

1. RC Sharma and Krishna Mohan, "*Business Correspondence and Report Writing",* McGraw-Hill Publishing, 3rd Edition, 2005 (reprint).
2. Patrick Forsyth, "*How to Write Reports and Proposals",* The Sunday Times, Kogan Page, New Delhi, Revised 2nd Edition, 2010.

REFERENCE BOOKS:

1. John Seely, *"The Oxford Writing & Speaking",* Oxford University Press, Indian Edition
2. Anne Eisenberg, "*A Beginner's Guide to Technical Communication"*, McGraw-Hill Education (India) Private Limited, New Delhi, 2013.

VIDEO LECTURES:

1. https://vimeo.com/143714818
2. https://digitalmedia.sheffield.ac.uk/media/002.+The+Anatomy+of+a+Technical+Report /1_u8wntcge

Web Resources:

1. http://www.resumania.com/arcindex.html
2. http://www.aresearchguide.com/writing-a-technical-report.htm
3. http://www.sussex.ac.uk/ei/internal/forstudents/engineeringdesign/studyguides/tec report writing

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MG207601	**PROJECT MANAGEMENT**	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite

COURSE DESCRIPTION: To understand the importance of decision-making while implementing any project and interpret and discuss the results of qualitative and quantitative analysis

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Understand the basic introduction to project management

CO2 Apply the methods of project identification and selection.

CO3 Understand project allocation methods and evaluation.

CO4 Analyse the techniques for project time, review, and cost

CO5 Understand the factors of risk and quality of a project.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**			
CO1	2	1	2	1	-	-	-	-	-			
CO2	1	1	2	2	-		2		1			
CO3	2	2	1	2	1	-	-	1	-			
CO4	3	1	2	2	1	-	-	-	-			
CO5	2	2	1	2	1	1	-	-	-			
Course Correlation Mapping	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**1**	1			

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1:   Introduction   *(05 Periods)*
Concept of project management, project definition and key features of projects, project life cycle phases, typical project management issues, basic project activities

Module 2:   Project Identification and Selection   *(06 Periods)*
Identification and screening (brainstorming, strength and weakness in the system, environmental opportunities and threats), Project evaluation methods- Payback period, Net present value, Internal rate of return and project evaluation under uncertainty.

Module 3:   Project Resource Management   *(07 Periods)*
Scheduling resources, resource allocation methods, project crashing and resource leveling, working of systems, design of systems, project work system design, project execution plan, project procedure manual project control system, planning scheduling and monitoring

Module 4:   Time and Cost Management   *(05 Periods)*
Time Management-Network diagram, forward and backward pass, critical path, PERT and CPM, AOA and AON methods, tools for project network, Cost management-earned value method

Module 5:   Risk and Quality Management   *(07 Periods)*
Risk identification, types of risk, risk checklist, risk management tactics, risk mitigation and contingency planning, risk register, communication management, Quality assurance and quality control, quality audit, methods of enhancing quality

Total Periods: 30

EXPERIENTIAL LEARNING

1.   Refer to any video lecture on project evaluation methods and give a brief seminar using PPT

2.   Select any company wherein you will get the details of activities and time and draw the project network diagram and submit a report.

3.

Activity	Predecessor Activity	Normal Time (Weeks)	Crash Time (Weeks)	Normal Cost (Rs.)	Crash Cost (Rs.)
A	-	4	3	8,000	9,000
B	A	5	3	16,000	20,000
C	A	4	3	12,000	13,000
D	B	6	5	34,000	35,000
E	C	6	4	42,000	44,000
F	D	5	4	16,000	16,500
G	E	7	4	66,000	72,000
H	G	4	3	2,000	5,000

Determine a crashing scheme for the above project so that the total project time is reduced by 3 weeks

4.   Collect any case study that discusses the process of probability calculation of success of the project and submit a report

RESOURCES

TEXT BOOKS:

1. R.Panneerselvam and P.Senthil Kumar (2013), Project Management, PHI Learning Private Limited.
2. Prasanna Chandra (2014), Projects: Planning, Analysis, Selection, Financing, implementation, and Review.

REFERENCE BOOKS:

1. A Guide to the Project Management Body of Knowledge: (PMBOK Guide) by Project Management Institute, 2013.
2. Gopala Krishnan & Rama Murthy, A Text book of Project Management, McMillan India.
3. S. Choudhary (2004), Project Management, Tata McGraw Hill Publication.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc19_mg30/preview

2. https://archive.nptel.ac.in/courses/110/104/110104073/

Web Resources:

1. https://www.pmi.org/about/learn-about-pmi/what-is-project-management

2. https://www.manage.gov.in/studymaterial/PM.pdf

3. https://imada.sdu.dk/u/jbj/DM85/lec7.pdf

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22MM202002	**OBJECT ORIENTATED PROGRAMMING THROUGH JAVA**	3	-	2	-	4

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: Introduction to Object Oriented Programming, Classes and Objects; Inheritance, Packages, Interfaces; Exception handling, Multithreading; Collection Classes; Files, Connecting to a Database, Swings, Event handling.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the basic programming constructs of Java and OOP concepts to developJava programs for a given scenario.

CO2. Design solutions to the problems by using control statements, interfaces, utility classes and Packages.

CO3. Solve real time problems using object oriented programming features – polymorphism, inheritance, exception handling and multithreading.

CO4. Apply multithreading mechanism to enhance the performance of a system.

CO5. Develop user interfaces using GUI programming techniques and Work Independently and Communicate Effectively in Oral and Written forms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	-	3	-	-	3	-	3	3	-
CO2	3	3	3	-	3	-	-	3	-	3	3	-
CO3	3	3	3	-	3	-	-	3	-	3	3	-
CO4	3	3	3	-	3	-	-	3	-	3	3	-
CO5	3	3	3	-	3	-	-	3	-	3	3	-
Course Correlation Mapping	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**3**	**-**	**3**	**3**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO JAVA PROGRAMMING *(07 Periods)*

Basics of Java: History and Basics of Java, Java Environment, JDK Tools, Java Virtual Machine, Java Program Structure, Java Language- Tokens, Keywords, Constants, Variables, and Data Types. Operators and Expressions, Control Statements, Decision Making, Branching and Looping, Labeled Loops Statement, Jump Statements: Break, Continue, and Return, Command Line Argument.

Module 2: CLASSES AND OBJECTS, INHERITANCE,ARRAYS *(10 Periods)*

Classes and Objects: Classes, Objects, Defining a Class, Adding Variables and Methods, Creating Objects, Accessing Class Members, Constructors, Static Members, Nesting of Methods,

Inheritance: Basics Types, Extending a Class, Using Super, Method Overloading, Method Overriding, Final Variables and Methods, Final Classes, Finalize Method, Abstract Methods and Classes, Visibility Control.

Arrays: One and Two Dimensional   Arrays, String Array, String and StringBuffer Classes

Module 3: INTERFACES , PACKAGES AND EXCEPTION HANDLING *(10 Periods)*

Interfaces: Defining Interfaces, Extending Interfaces, Implementing Interfaces, Accessing Interface Variables.

Packages: System Packages, Naming Conventions, Creating Packages, Accessing a Package, Using Package, Adding a Class to a Package.

Exception Handling: Dealing with errors, benefits of exception handling, the classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally.

Module 4: THREADS, APPLETS AND EVENT HANDLING *(08 Periods)*

Java Thread Model: Life Cycle of a Thread, Thread Class, Runnable Interface.

Applets: Creating and Executing Java Applets, Inserting Applets in a Web Page, Applet Tag, Local and Remote Applets, Applets Life Cycle.

Event Handling- Events, Event sources, Event classes, Event Listeners, Examples: handling a button click, handling mouse and keyboard events, Adapter classes.

Module 5: JAVA SWING, I/O STREAM, DATABASE PROGRAMMING USING JDBC *(10 Periods)*

Java Swing: Swing Classes, Japplet, Icons and Labels, Text Fields, Buttons, Radio Buttons, Check Boxes, Combo Boxes, List Boxes, Tabbed and Scroll Panes, Tables.

I/O Stream: Introduction of I/O Stream, Types of Streams, Stream Class Hierarchy, Using File Class, Byte Streams Vs Character Streams, TextfileVs Binary File.

Database Programming Using JDBC: Introduction to JDBC, JDBC Drivers, Types of JDBC Drivers, Connecting with Database.

Total Periods: 45

EXPERIENTIAL LEARNING

List of Experiments:

1. Write a Program in Java to Display Odd Number from 1 to 100.
2. Write a Program in Java to Determine Whether a Number Input from Keyboard is Prime Number Or Not
3. Write a Program in Java to Calculate the Factorial of a Number.
4. Write a program on class and object in java
5. Write a Program in Java to Show Multilevel Inheritance.
6. Write a Program in Java to Check Given String is Palindrome String Or Not in Java
7. Write a program to illustrate Function Overloading & Function Overriding methods in Java
8. Write a program to illustrate the implementation of abstract class
9. Write a program to implement Exception handling
10. Write a program to create packages in Java
11. Write a program on interface in java
12. Write a program to Create Multiple Threads in Java
13. Create a Java GUI Application Using Labels and Text fields.
14. Create a Java GUI Application Using Radio buttons.
15. Create a Java GUI Application Using Checkboxes.

RESOURCES

TEXT BOOKS:

1. Core Java: An Integrated Approach, Authored by Dr. R. Nageswara Rao & Kogent Learning Solutions Inc.
2. E.Balaguruswamy, Programming with JAVA, A primer, 3e, TATA McGraw- Hill Company.
3. John R. Hubbard, Programming with Java, Second Edition, Schaum's outline Series, TMH.
4. Deite and Deitel. Java TM: How to Program, PHI (2007)

REFERENCE BOOKS:

1. Y. Daniel Liang ,2003, An Introduction to JAVA Programming, Prentice-Hall of India Pvt., Ltd.
2. Cay S. Horstmann and Gary Cornell,2005, Core JavaTM2 Volume I-Fundamentals, 7th Edition- Pearson Education.
3. Ken Arnold, James Gosling and David Holmes,2003, The JavaTM Programming Language,3rd Edition, Pearson Education
4. Peter Norton, "Java Programming", Techmedia Publications.
5. Joseph Weber, "Using Java 1.2", PHI, ISBN -81-203-1558-8.

VIDEO LECTURES:

1. https://docs.oracle.com/javase/tutorial/index.html.
2. https://nptel.ac.in/courses/106105191
3. https://onlinecourses.nptel.ac.in/noc22_cs47/preview

WEB RESOURCES:

1. https://www.w3schools.com/java/
2. https://www.javatpoint.com/java-tutorial
3. https://www.tutorialspoint.com/java/index.htm
4. https://docs.oracle.com/javase/tutorial/
5. https://www.iitk.ac.in/esc101/share/downloads/javanotes5.pdf

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22MM201003	**DESIGN AND ANALYSIS OF ALGORITHMS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Algorithms and asymptotic notations; Algorithm performance analysis; Amortized analysis; Recurrences; Disjoint sets; Divide and Conquer; Dynamic programming; Greedy algorithms; Back tracking; Branch and bound; NP-hard and NP complete problems.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze the complexity of algorithms by applying the knowledge of asymptotic notations and recurrence methods.

CO2. Analyze the given problem and identify appropriate algorithm design technique for problem solving.

CO3. Perceive and apply different algorithm design paradigms to find solutions for computing problems.

CO4. Apply the knowledge of NP-hard and NP-Complete complexity classes to classify decision problems.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	-	-	-	-	-	3	2	-
CO3	2	3	3	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	3	2	-
Course Correlation Mapping	3	2	3	-	-	-	-	-	-	3	2	-

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO ALGORITHMS   *(10 Periods)*

Algorithm, Algorithm pseudocode conventions, Performance analysis - Space complexity, Time complexity, Asymptotic notations; Amortized analysis , Aggregate analysis, Accounting method,Potential method; Recurrences - Substitution method, Recursion tree method, Master method.

Module 2: DISJOINT SETS, DIVIDE AND CONQUER   *(08 Periods)*

Disjoint Sets: Operations, Union and Find algorithms.
Divide and Conquer: General method, Defective chess board, Binary search, Finding maximumand minimum, Merge sort, Strassen's matrix multiplication.

Module 3: DYNAMIC PROGRAMMING   *(09 Periods)*

General method, Matrix-chain multiplication, All pairs shortest path, Optimal binary search trees,0/1 Knapsack problem, Traveling salesperson problem, Flow shop scheduling.

Module 4: GREEDY METHOD, BACKTRACKING   *(10 Periods)*

Greedy Method: General method, Knapsack problem, Job sequencing with deadlines, Huffmancodes, Single source shortest paths, Optimal merge patterns.
Backtracking: General method, 8–Queens problem, Sum of subsets, Graph coloring, Hamiltonian cycles.

Module 5: BRANCH AND BOUND, NP-HARD AND NP-COMPLETE   *(08 Periods)*
**   PROBLEMS**

Branch and Bound: LC search, LC branch and bound, FIFO branch and bound, 0/1 knapsackproblem, Traveling salesperson problem.
NP Hard and NP-Complete Problems: Nondeterministic algorithms, NP-hard and NP-complete classes, Cook's theorem, NP-hard scheduling problems – Scheduling identical processors.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Design and develop shortest path algorithm using graphs.

2. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm

3. Compute the transitive closure of a given directed graph using Warshall's algorithm.

4. Implement 0/1 Knapsack problem using Dynamic Programming.

5. Demonstrate Tree Traversal and Graph Traversal .

RESOURCES

TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahni, and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, 2 nd Edition, Universities Press, 2008.

2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction toAlgorithms,3rd Edition, MIT Press, 2009.

REFERENCE BOOKS:

1.   Michael T. Goodrich and Roberto Tamassia, Algorithm Design and Applications, Wiley, 2014.
2.   Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, The Design and Analysis of ComputerAlgorithms, Pearson, 2006.

VIDEO LECTURES:

1.   https://nptel.ac.in/courses/106/106/106106131/
2.   https://archive.nptel.ac.in/courses/106/101/106101060/
3.   https://onlinecourses.nptel.ac.in/noc19_cs47/preview

Web Resources:

1.   https://www.coursera.org/lecture/analysis-of-algorithms/resources-jMWPy
2.   https://www.udemy.com/course/design-and-analysis-of-algorithms/
3.   https://courses.cs.duke.edu/fall08/cps230/Book.pdf

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22MM202003	**DATABASE MANAGEMENT SYSTEMS**	3	-	2	-	4

Pre-Requisite	22MM201003- DESIGN AND ANALYSIS OF ALGORITHMS
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION: Introduction to database systems; Database design; Relational model; Relational algebra; SQL queries; Constraints and triggers; PL/SQL; Schema refinement and normal forms; Transaction management; Concurrency control; Overview of storage and indexing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply the concepts of ER-modeling and normalization to design viable data models for a given problem.

CO2. Formulate relational database schemas, apply suitable integrity constraints, for querying databases.

CO3. Use SQL to store, query, and manipulate data in relational databases.

CO4. Develop PL/SQL blocks to centralize database applications for maintainability and reusability.

CO5. Analyze transaction processing, concurrency control and storage methods for database management.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	3	-	-	-	3
CO2	1	2	-	-	-	-	-	3	-	2	-	3
CO3	3	2	-	-	-	-	-	3	-	1	-	3
CO4	1	2	3	2	-	-	-	3	-	3	-	2
CO5	3	3	-	-	-	-	-	3	-	2		3
Course Correlation Mapping	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**3**	-	**2**	**-**	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO DATABASE SYSTEMS AND *(08 Periods)*
DATABASE DESIGN

Introduction to Database Systems: Database system applications, Purpose of database systems, View of data , Data abstraction, Instances and schemas, Data models; Database languages - Data Definition Language, Data Manipulation Language; Database architecture, Database users and administrators.
Introduction to Database design: Database design and ER diagrams, Entities, attributes and
entity sets, Relationships and relationship sets, Additional features of ER model, Conceptual Design with ER model.

Module 2:   RELATIONAL MODEL AND RELATIONAL ALGEBRA   *(08 Periods)*

Relational Model: Creating and modifying relations, Integrity constraints over relations, Enforcing integrity constraints, Querying relational data, Logical database design, Introduction to views, Destroying/altering tables and views.
Relational Algebra: Preliminaries, Relational Algebra operators

Module 3   SQL AND PL/SQL   *(10 Periods)*

SQL: Form of basic SQL query, Nested queries, Aggregate operators, Null values, Complexintegrity constraints in SQL, Triggers and active databases.
PL/SQL: Generic PL/SQL block, PL/SQL data types, Control structure, Procedures and functions,Cursors, Database triggers.

Module 4   SCHEMA REFINEMENT AND TRANSACTIONS   *(10 Periods)*

Schema Refinement: Problems caused by redundancy, Decompositions, Problems related to decomposition, Functional dependencies, Reasoning about FDs, First normal form, Second normal form, Third normal form, Boyce-Codd normal form, Multivalued dependencies, Fourth normalform, Join dependencies, Fifth normal form.
Transactions: Transaction concept, Transaction atomicity and durability, Concurrent Executions ,
Serializability, Recoverability, Implementation of isolation, Testing for serializability.

Module 5   CONCURRENCY CONTROL, STORAGE AND INDEXING   *(09 Periods)*

Concurrency Control: Lock Based Protocols, Timestamp Based Protocols, Validation BasedProtocols, Multiple Granularity, Deadlock Handling.
Storage and Indexing: Data on external storage, File organizations and indexing, Clusteredindexes, Primary and secondary indexes; Index data structures , Hash based indexing, Tree based
indexing; Comparison of file organizations.

Total Periods: 45

RESOURCES

TEXT BOOKS:

1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw Hill, 3rdEdition, 2014.

2. Abraham Silberschatz, Henry. F. Korth, S. Sudarshan, Database System Concepts, McGrawHill, 7th edition, 2019.

REFERENCE BOOKS:

1.   Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB publications, 4 thEdition, 2017.

2.   Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition,Pearson, 2015.

VIDEO LECTURES:

1.   https://swayam.gov.in/nd1_noc19_cs46/preview

2.   https://www.classcentral.com/course/swayam-introduction-to-database-systems17660

WEB RESOURCES:

1.   https://nptel.ac.in/courses/106105175

2.   https://onlinecourses.nptel.ac.in/noc21_cs04/preview

3.   https://www.coursera.org/learn/database-management

LIST OF EXERCISES:

1.   Design and analyze an ER Model for the following use case. Roadway Travels‖ is in business since 1977 with several buses connecting different places in India. Its main office is located in Hyderabad. The company wants to computerize its operations in the following areas:
  ➢ Reservations.
  ➢ Ticketing.
  ➢ Cancellations
  <u>Reservations:</u>
  Reservations are directly handled by booking office. Reservations can be made 60 days in advance in either cash or credit. In case the ticket is not available, await listed ticket is issued to the customer. This ticket is confirmed against the cancellation.
  <u>Cancellation and Modification:</u>
  Cancellations are also directly handed at the booking office. Cancellation charges will be charged. Waitlisted tickets that do not get confirmed are fully refunded.
2.   a). Implement Data Definition Language commands -Create, Alter, Drop, Truncate, and Rename.
  b). Implement Data Manipulation Language commands - Insert, Select, Update, and Delete.
  C). Implement Single Row functions - Character, Numeric and Date functions.
3.   Implement various types of integrity constraints - NOT NULL constraint, DEFAULT constraint, UNIQUE constraint, PRIMARY key, FOREIGN key, CHECK constraint.
4.   a). Implement group functions with different operators such as aggregate operators, group by, having and order by.
  b). Implement nested and correlated nested queries using set operators and set comparison operators.
5.   a). Creation of views, synonyms, sequence, indexes and save point.
  b). Implement various types of joins - outer join and inner join.
Basic SQL:
6.   Construct PL/SQL block for the following.
  a). To determine whether a number is palindrome
  b). To determine whether a number is an Armstrong number
  c). To find greatest of three numbers
  d). To display Fibonacci series

Control Structures:

7. a). Write a program in PL/SQL to update the salary of a specific employee by 8% if the salary exceeds the mid-range of the salary against this job and update up to mid-range if the salary is less than the mid-range of the salary, and display a suitable message.

b). Write a PL/SQL program to display the description against a student's grade using CASE statement.

Exception Handling:

8. a). Develop a PL/SQL program that displays the name and address of a student whose ID is given. If there is no student with the given student ID in the database, the program should raise a run-time exception NO_DATA_FOUND, which should be captured in the EXCEPTION block.

b). Construct the user-defined exceptions to get the salary of an employee and check it with the job's salary range. If the salary is below the range, raise an exception BELOW_SALARY_RANGE. If the salary is above the range, raise the exception ABOVE_SALARY_RANGE.

Functions:

9. a). Write a function that accepts two numbers A and B and performs the following operations.
- Addition.
- Subtraction.
- Multiplication
- Division.

b). Write a PL/SQL block that updates salary of an employee in Employee table by using incr function which takes employee number as argument and calculates increment and returns increment based on the following criteria. If salary <= 3000, increment = 30% of salary If salary > 3000 and <= 6000, increment = 20% of salary else increment = 10% of salary

Procedures:

10. a). Write a procedure that accepts two numbers and displays their sum.

b). Write procedures to demonstrate IN, IN OUT and OUT parameters.

Cursors:

11. a). Write a block in PL/SQL to create a Cursor that displays the employee name and number of jobs he or she has done in the past.

b). Write a program in PL/SQL to create a cursor to display the name and salary of each employee in the EMPLOYEES table whose salary is less than that specified by a passed-in parameter value.

Triggers:

12. Develop a suitable student database application by considering appropriate attributes. Couple of attributes to be maintained is the attendance of a student in each subject for which he/she has enrolled and internal assessment Using TRIGGERS for the following

a). Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the concerned head of the department.

b). Whenever, the marks in an internal assessment test are entered, check if the marks are less than 40%; if so, and notify the concerned head of the department.

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22MM201008	**DATA WAREHOUSING AND DATA MINING**	3	-	-	-	3

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: Data Mining Fundamentals; Data Preprocessing; Operational Database Systems and Data Warehouses; Mining Frequent Patterns; Classification and Prediction; Clustering; Data warehousing and Mining tools, New Trends and Research Frontiers.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on Data Warehousing architecture, Multidimensional models and OLAP operations.

CO2. Apply data preprocessing techniques to produce refined data.

CO3. Apply Association rules and classification techniques for data categorization.

CO4. Use clustering techniques for grouping similar data items and identify outliers.

CO5. Understand Data Mining trends and applications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3	-	-	-	-	3	-	-	-	3
CO2	1	2	-	-	-	-	-	3	-	2	-	3
CO3	3	2	-	-	-	-	-	3	-	1	-	3
CO4	1	2	3	2	-	-	-	3	-	3	-	2
CO5	3	3	-	-	-	-	-	3	-	2		3
Course Correlation Mapping	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**3**	**-**	**2**	**-**	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT:

Module 1: DATA WAREHOUSING AND ONLINE ANALYTICAL PROCESSING   *(09 Periods)*

Data Warehouse, Operational Database Systems versus Data Warehouses, A Multi tired Architecture, A Multidimensional Data Model, Stars, Snowflakes and Fact Constellations: Schemas, Role of Concept hierarchies, Measures, OLAP Operations, From online Analytical processing to Multidimensional Data Mining, Indexing OLAP Data.

Module 2: DATA MINING AND DATA PREPROCESSING   *(08 Periods)*

Introduction to Data Mining, kinds of data, kinds of patterns, major issues in Data Mining, Data Pre-processing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Discretization.

Module 3 ASSOCIATIONS AND CLASSIFICATION   *(09 Periods)*

Basic Concepts, Frequent itemset Mining Methods, pattern evaluation methods- From Association Mining to Correlation Analysis, Classification, Decision Tree Introduction, Bayesian Classification Methods, Rule Based Classification, Prediction: Linear Regression.

Module 4 SCHEMA REFINEMENT AND TRANSACTIONS   *(10 Periods)*

Cluster Analysis: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods-k-Means and K-Medoids, Hierarchical methods-Agglomerative and divisive method, Density-Based Method-DBSCAN, Grid-Based Method- STING, Outlier Analysis.

Module 5 CONCURRENCY CONTROL, STORAGE AND INDEXING   *(09 Periods)*

Mining Complex Data Types: Mining sequence data, Mining other kinds of data: Spatial, Text, Multimedia and Web data.

Data Mining Trends: Mining Complex Data Types, Methodologies of Data Mining, Data Mining Applications, Data Mining and Society, Data Mining Trends.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Learn how to build a data warehouse and query it (using open source tools like Pentaho Data Integration Tool, Pentaho Business Analytics).
2. Learn to perform data mining tasks using a data mining toolkit (such as open source WEKA).
3. Understand the data sets and data preprocessing.
4. Demonstrate the working of algorithms for data mining tasks such association rule mining, classification, clustering and regression.
5. Exercise the data mining techniques with varied input values for different parameters.
6. To study the file formats for the data mining.

RESOURCES

TEXT BOOKS:

1. Jiawei Han, Micheline Kamber and Jian Pei, *Data Mining: Concepts and Techniques,* Elsevier, Third Edition, 2013.

REFERENCE BOOKS:

1. K.P. Soman, Shyam Diwakar and V. Ajay, *Insight into Data mining Theory and Practice*, Easter Economy Edition, Prentice Hall of India, 2006.

2. G. K. Gupta, *Introduction to Data Mining with Case Studies*, Easter Economy Edition, Prentice Hall of India, 2006.

3. Tan P.N, Steinbach M. and Kumar V., *Introduction to Data Mining*, Addison-Wesley, 2006.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=grFpC2tBKrY
2. https://www.coursera.org/learn/dwdesign
3. https://onlinecourses.nptel.ac.in/noc21_cs06/preview

WEB RESOURCES:

1. http://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann-Series-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data-Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf
2. https://www.edx.org/learn/data-warehouse
3. https://alison.com/tag/data-mining

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22MM201002	**COMPUTER NETWORKS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: The course introduces an overview of the concepts and fundamentals of computer networks, data communication concepts and techniques in a layered network architecture and their protocols, switching and routing, types of communication, varioustypes of networks (LAN, MAN, WAN and Wireless networks); bridges, routers and gateways; ,network congestion, network topologies, network configuration and management, network model components, error detection and recovery; and local and remote procedures.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze the types of network topologies, layers and protocols.

CO2. Evaluate sub netting and routing algorithms for finding optimal paths in networks.

CO3. Solve problems related to flow control, error control and congestion control in data transmission.

CO4. Assess the impact of wired and wireless networks in the context of network protocols Like DNS, SMTP, HTTP, and FTP.

CO5. Apply ethical principles and standards for developing network-based solutions.

CO-PO-PSO Mapping Table:

Learning Outcomes	Program Outcomes									Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3
CO1	3	3	2	-	-	-	-	-	-		-	3
CO2	3	2	-	3	-	-	-	-	-		-	3
CO3	3	2	-	2	-	-	-	-	-		-	3
CO4	-	-	-	-	-	2	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**2**	**3**	**-**	**2**	**-**	**-**	**-**		**-**	**3**

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT

Module 1: INTRODUCTION TO NETWORKS AND MODELS *(08 Periods)*

Introduction, Network models – Internet model, OSI model Physical Layer: Signals – Analog, Digital, Digital Transmission – Coding, Sampling, Analog Transmission – Modulation of digital and analog signal, Multiplexing – FDM, WDM, TDM, Transmission Media – cable, wireless, Circuit switching and Telephone network, DSL Technology, Cable modern, SONET

Module 2: DATA LINK Layer *(10 Periods)*

Data Link Layer: Error detection and correction, Data link control and Protocols – Stop and wait, Go-back-n, Selective repeat, HDLC, point to point access, Channelization, LANS – Traditional Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN"s – IEEE 802.11, Blue tooth, Connecting LANs – Connecting devices, Backbone networks, Virtual LANS, Cellular telephony, Satellite networks, Virtual circuit switching, Frame relay, ATM.

Module 3 NETWORK LAYER *(07 Periods)*

Network Layer:Inter-networks, Addressing, Routing, Network layer Protocols – ARP,IP, JCMP. IPV6, Routing – Introduction, Unicast routing, Protocols – RIP, OSPF, BGP, Multicast Routing, Protocols – DVMRP, MOSPF, CBT, PIM.

Module 4 TRANSPORT LAYER *(10 Periods)*

Transport Layer: Process-to-Process Delivery, UDP, TCP, Data traffic, Congestion and Control, Quality of service (QOS) and techniques to improve QOS, Integrated services, QOS in Switched networks. Security: Introduction. Symmetric-key cryptography, public key cryptography, Message security, Digital signature, User authentication, Key management, Kerberos. Communication Security, Authentications Protocols, E-mail Security, Web security, Social Issues.

Module 5 APPLICATION LAYER *(10 Periods)*

Application Layer: Design issues, file transfer, access and management. Client-Server model, Socket interface Introduction to DNS, Distribution of name space, DNS in the Internet. Electronic mail, SMTP, File Transfer, FTP, HTTP, World Wide web.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Explain the process of Linux Installation
2. Describe the study of LAN environment
3. Describe briefly about Networking commands in Linux

RESOURCES

TEXT BOOKS:

1. Forouzan B A, Data Communications and Networking, 4th edition, Tata McGraw

2. Tanenbaum A S, Computer Networks, 4th edition, Pearson Education, 2003.

3. Andrew S. Tanenbaum and David J. Wetherall, Computer Networks, Pearson, 5th Edition, 2015

REFERENCE BOOKS:

1. Stallings W, Data and Computer Communications, 7th edition, Pearson Education, 2004

2. Gallo M A, and Hancock W M, Computer Communications and Networking Technologies, Thomson Brooks/Cole, 2002.

3. Comer D E, Computer Networks – and Internets with Internet Applications, 4th edition, Pearson Education, 2004.

4. Kutose J F, and Ross K W, Computer Networking – A Top-down Approach Fealuring the Internet, Pearson Education, 2001.

5. Tomasi W, Introduction to Data Communications and Networking, Pearson Education, 2004.

6. Behrouz A. Forouzan, Data Communications and Networking, McGraw Hill, 5th Edition, 2013.

7. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach, Pearson, 7th Edition, 2017.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106106091

2. https://www.digimat.in/nptel/courses/video/106105183/L01.html

3. https://www.youtube.com/watch?v=6_PINy02_g0

4. http://ns2simulator.com/ns2-tcp-congestion-control/

WEB RESOURCES:

1. https://www.cisco.com/c/en/us/solutions/smallbusiness/resourcecenter/networking/networking-basics.html

2. https://memberfiles.freewebs.com/00/88/103568800/documents/Data.And.Computer.Communications.8e.WilliamStallings.pdf

3. http://www.ns2blogger.in

4. https://memberfiles.freewebs.com/00/88/103568800/documents/Data.And.Computer.Communications.8e.WilliamStallings.pdf

5. https://www01.ibm.com/servers/resourcelink/svc0302a.nsf/pages/zVMV7R1sc246333/$file/kijl0_v7r1.pdf

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22MM202004	**SOFTWARE ENGINEERING**	3	-	2	-	4

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: Concepts of Software Engineering; Software Process Models; Conventional and Agile Process Models; Software Requirements Engineering Process; System Analysis; Architectural Design; User Interface Design and Re- engineering; Software Testing; Risk and Quality Management.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on Fundamental concepts of software engineering and analyze process models required to develop a software system.

CO2. Analyze software requirements and model requirements for the given scenario.

CO3. Apply design concepts and metrics for software development.

CO4. Apply testing strategies and techniques for quality software.

CO5. Analyze risks in software development life cycle and apply risk strategies to mitigate risks.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	3	3	-	-	-	-	-	-	3	-	3
CO2	2	3	-	-	-	3	3	2	-	2	-	3
CO3	2	3	3	2	-	2	2	-	-	3	-	3
CO4	2	-	-	-	2	3	-	-	-	2	-	2
CO5	2	-	-	-	2	3	-	-	-	2		3
Course Correlation Mapping	**2**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	-	**2**	-	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   SOFTWARE PROCESS AND AGILE DEVELOPMEN   *(09 Periods)*

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility,Agile process,Extreme programming-XP Process.

Module 2:   REQUIREMENTS ANALYSIS AND SPECIFICATION   *(09 Periods)*

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document , Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management- Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

Module 3   SOFTWARE DESIGN   *(09 Periods)*

Design process , Design Concepts,Design Model, Design Heuristic, Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow, User Interface Design: Interface analysis, Interface Design ,Component level Design: Designing Class based components, traditional Components.

Module 4   TESTING AND MAINTENANCE   *(09 Periods)*

Software testing fundamentals,Internal and external views of Testing-white box testing - basis path testing,control structure testing,black box testing- Regression Testing , Unit Testing , Integration Testing , Validation Testing , System Testing And Debugging ,Software Implementation Techniques: Coding practices,Refactoring,Maintenance and Reengineering-BPR model-Reengineering process model,Reverse and Forward Engineering.

Module 5   PROJECT MANAGEMENT   *(09 Periods)*

Software Project Management: Estimation , LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model , Project Scheduling , Scheduling, Earned Value Analysis Planning , Project Plan, Planning Process, RFP Risk Management – Identification, Projection , Risk Management-Risk Identification-RMMM Plan- CASE TOOLS

Total Periods: 45

LIST OF EXERCISES:

1.   Study and usage of software project management tools such cost estimates and scheduling.

2.   Documentation generators –Study and practice of Documentation generators.

3.   Data Modeling using automated tools.

4.   Structure charts, Data Flow Diagrams, Decision tables and ER diagrams for
     a.   Banking System
     b.   Railway Reservation System
     c.   Hotel management system
     d.   Inventory Control System
     e.   Library management system

5.   Process and Project metric- Implementation of COCOMO model to estimate the project parameters for a given problem.

6.   Software Requirement Specification Developing the SRS for the given project.

7.   UML diagram-Building the Class and Object diagrams for the given project.

8.   UML diagram-Building the Deployment and Timing diagrams for the given project.

9.   UML diagrams-Activity diagram for the given project.

10.   UML diagram- Building the Sequence and Use case diagrams

11.   UML diagram-State chart diagram

12.   Software Testing-Implementation of various testing approaches of white box testing

13.   Case study for risk management.

RESOURCES

TEXT BOOKS:

1.   Roger S. Pressman, Software Engineering - A Practitioner's Approach, McGraw-Hill,Eight Edition, 2015.

2.   Ian Sommerville, Software Engineering, Pearson Education, Ninth Edition, 2011.

REFERENCE BOOKS:

1.   K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age InternationalPublishers, Third Edition, 2007.

2.   Shely Cashman Rosenblatt, Systems Analysis and Design, Thomson Publications, SixthEdition, 2006.

VIDEO LECTURES:

1.   https://nptel.ac.in/courses/106105087/

2.   https://nptel.ac.in/courses/106105182/

WEB RESOURCES:

1.   https://www.coursera.org/courses?query=software%20engineering

2.   https://www.javatpoint.com/software-engineering-tutorial

3.   https://www.geeksforgeeks.org/software-engineering/

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22MM201009	**SOFTWARE TESTING QUALITY ASSURANCE**	3	-	-	-	3

Pre-Requisite   22MM202004- Software Engineering

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: Software Testing basics: Goals, Defects, Terminology, Methodology, Software Testing Life Cycle (STLC) in Software Development Life Cycle (SDLC), Verification and Validation; Software Testing Techniques: White box testing, Black Box Testing, Regression testing; Test Management: Test Planning, Design and Specifications; Test Automation: Tool selection and Guidelines, Software Quality Assurance.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Understand concepts of Software Testing, Terminology and Methodology, Test Management and Metrics to analyze Software testing and Software Quality Assurance concepts for maintain the quality of the software.

CO2 Use testing tools such as Unified Functional Testing (UFT)/ Rational Functional Tester (RFT)/Selenium to control and monitor the functional testing for Airline Reservation System.

CO3 Analyze Testing Techniques, Static testing, Efficient Test Suit Management and Regression Testing and Test Automation strategies to Synthesis the quality of software.

CO4 Analyze and apply the Software Quality Factors, Pre-project software quality components, Ishikawa's Seven Basics to maintain the quality of the software.

CO5 Describe fundamental concepts of software quality assurance. Demonstrate the quality management, assurance, and quality standard to software system.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	3	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3
CO5	3	3	-	3	-	-	-	-	-	-	-	3
Course Correlation Mapping	3	2	-	3	-	-	-	3	-	-	-	3

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO SOFTWARE TESTING   (09 Periods)

Evolution of Software Testing, Software Testing: Myths and Facts; Goals of software testing, Psychology for software testing, Software testing definitions, Model for software testing, Effective software testing vs. exhaustive software testing, Effective testing is hard, Software testing as a process.
Terminology and Methodology: Software testing terminology, Software Testing Life Cycle (STLC), Software testing methodology.

Module 2:   TESTING TECHNIQUES   (09 Periods)

White Box Testing Need of white-box testing, Logic coverage criteria, basis path testing, Graph matrices, Loop testing, Data flow testing, Mutation testing.
Black Box Testing Boundary Value Analysis (BVA), Equivalence class testing, State table-based testing, Decision table-based testing, Cause-effect graphing based testing, Error guessing.

Module 3:   SOFTWARE TEST MANAGEMENT AND METRICS   (09 Periods)

Test Management: Test organization, Structure of testing group, Test planning, detailed test design, Test specifications.
Software Metrics: Definition of software metrics, Classification of software metrics, Size metrics. Efficient Test Suit Management: Minimizing Test Suite and benefits, Test Suit Minimization problem, Test suite Prioritization, Types of Test case prioritization, Prioritization Techniques.

Module 4:   REGRESSION AND AUTOMATION   (09 Periods)

Static Testing: Inspections, Walkthroughs, Technical reviews.
Regression Testing: Progressive vs. regressive testing, Regression testing produces quality software, Regression testability, Objectives of regression testing, Regression testing types, Define regression test problem, Regression testing techniques.
Automation and Testing Tools: Need for automation, Categorization of testing tools, Selection of testing tools, Costs incurred in testing tools, Guidelines for automated testing, Overview of commercial testing tools.

Module 5:   SOFTWARE QUALITY ASSURANCE   (09 Periods)

Software Quality Assurance: The software quality challenge, Meaning of software quality, Software quality factors , Software Quality Lessons Learned, The components of the software quality assurance system, Pre-project software quality components: Contract Review, Development and quality plans, SQA components in the project life cycle: Integrating quality activities in the project life cycle, Assuring the quality of software maintenance components, Assuring the quality of external participants' contributions, CASE tools, Software quality infrastructure components, Pareto Principles, Total Quality Management, Ishikawa's Seven Basics.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Write test cases for any know applications(e.g Banking application)

2. Create a Test plan Document for any know application(e.g library management system)

3. Study of any testing tool(e.g Win Runner)

4. Study of any web testing tool(e.g Selenium)

5. Study of any Bug tracking tool(e.g Bugzilla,bugbit)

6. To Prepare Test Plan for the implemented system under test. The Test Plan shall

   be based on System Requirement Specification. The Test plan consists of

   following issues.

   a. Purpose of the test. /Location and schedule of the test.

   b. Test descriptions. /Pass and Fail Criteria.

7. To perform Black-Box Testing for all the units contained in the architectural

   segments using Equivalence Partitioning, Boundary Value Analysis and

   Orthogonal Array testing methods. To study exploratory Testing for the Module

   under Test and merits/demerits of this technique.

8. To perform Regression Testing / GUI Testing of the System under construction

   with Unit and Integration profiles by using any Functional Testing Tool.

RESOURCES

TEXTBOOKS:

2. Naresh Chauhan, "Software Testing: Principles and Practices," Oxford University Press, 2nd Edition, 2016.

3. Daniel Galin, "Software Quality Assurance: From theory to implementation," Pearson Education Limited, 2004, ISBN 0201 70945 7.

REFERENCE BOOKS:

2. Software Testing and Analysis: Process, Principles and Techniques, by Mauro Pezze and Michal Young, John Wiley & Sons

3. Fenton, Pfleeger, "Software Metrics: A Rigourous and practical Approach", Thomson Brooks/Cole, ISBN 981-240-385-X.

3 Boris Beizer, "Software Testing Techniques," Dream Tech Press, 2nd Edition, 2004.

VIDEO LECTURES:

3. https://www.youtube.com/watch?v=XIcOWh_psSI

4. https://www.simplilearn.com/automation-testing-masters-program-certification-training-course

5. https://www.indeed.com/career-advice/career-development/software-quality-

assurance-certification

6. https://www.skillsoft.com/course/software-quality-assurance-63cc19d0-f9e0-4809-b96a-ca14fab12298

7. https://www.conestogac.on.ca/fulltime/software-quality-assurance-and-test-engineering

WEB RESOURCES:

3. http://agilemodeling.com/essays/examiningBRUF.htm

4. https://www.pluralsight.com/courses/software-testing-quality-assurance-big-picture

5. https://www.udemy.com/course/qa-software-testing-training-course/

6. https://www.coursera.org/courses?query=quality%20assurance

7. https://www.conestogac.on.ca/fulltime/software-quality-assurance-and-test-engineering

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22MM202007	**SYSTEM SOFTWARE**	3	-	2	-	4

Pre-Requisite   22MM202001-Operating Systems

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: System software is a program designed to run a computer's hardware and applications and manage its resources, such as its memory, processors, and devices. It also provides a platform for running application software, and system software is typically bundled with a computer's operating system

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1   Describe the various concepts of assemblers and macroprocessors.

CO2   To understand the various phases of compiler and compare its working with assembler.

CO3   To understand how linker and loader create an executable program from an object module created by assembler and compiler.

CO4   To know various editors and debugging techniques

CO5   Be able to make proper use of system software tools

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	3	-	-	-	3	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3
CO5	3	3	-	3	-	-	-	-	-	-	-	3
Course Correlation Mapping	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**3**	-	**-**	-	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION   *(09 Periods)*

System software and machine architecture – The Simplified Instructional Computer(SIC) - Machine architecture - Data and instruction formats - addressing modes -instruction sets - I/O and programming.

Module 2:   ASSEMBLERS   *(09 Periods)*

Basic assembler functions - A simple SIC assembler – Assembler algorithm and datastructures - Machine dependent assembler features - Instruction formats and addressing47modes – Program relocation - Machine independent assembler features - Literals –Symbol-defining statements – Expressions - One pass assemblers and Multi passassemblers - Implementation example - MASM assemble

Module 3:   LOADERS AND LINKERS   *(09 Periods)*

Basic loader functions - Design of an Absolute Loader – A Simple Bootstrap Loader - Machine dependent loader features - Relocation – Program Linking – Algorithm and Data Structures for Linking Loader - Machine-independent loader features - Automatic Library Search – Loader Options - Loader design options - Linkage Editors – Dynamic Linking – Bootstrap Loaders - Implementation example - MSDOS linker

Module 4:   MACRO PROCESSORS   *(09 Periods)*

Basic macro processor functions - Macro Definition and Expansion – Macro Processor Algorithm and data structures - Machine-independent macro processor features - Concatenation of Macro Parameters – Generation of Unique Labels – Conditional Macro Expansion – Keyword Macro Parameters-Macro within Macro-Implementation example -MASM Macro Processor – ANSI C Macro language

Module 5:   SYSTEM SOFTWARE TOOLS   *(09 Periods)*

Text editors - Overview of the Editing Process - User Interface – Editor Structure. - Interactive debugging systems - Debugging functions and capabilities – Relationship with other parts of the system – User-Interface Criteria.

Total Periods: 45

EXPERIENTIAL LEARNING

List of Exercises

1. Write a program to display lexemes from the given input fil

2. Write a program to identify keywords and identifiers from the given input file

3. Write a program to insert, search and update the identifiers in the symbol table

4. Write a program to implement Recursive decent parser for given grammar

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5. Implement absolute loader..

RESOURCES

TEXTBOOKS:

1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd / 4th Edition, Pearson Education,2011

2. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008

REFERENCE BOOKS:

1. Leland L. Beck, "System Software – An Introduction to Systems Programming", 3rd Edition, Pearson Education Asia, 2000.

2. Santanu Chattopadhyay, "System Software", Prentice-Hall India, 2007

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=xHPtOsnKfRk&list=PLBLsRYJWBempa6P_V5KIK5gqYn_r0HTb7

2. https://www.youtube.com/watch?v=aXHNW4ANEVM&list=PLAC6WcHCOQCGOkgEKnBkHNMV-PkzrCkdb

3. https://www.youtube.com/watch?v=Ts8hvn198mM

WEB RESOURCES:

1. https://www.simplilearn.com/tutorials/programming-tutorial/what-is-system-software

2. https://unacademy.com/goal/computer-science-application/ZRVXW/free-platform/system-software-operating-syst/QTSKL

3. https://www.coursera.org/browse/computer-science/software-development /

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22MM201010	**INFORMATION RETRIEVAL TECHNIQUES**	3	-	-	-	3

Pre-Requisite -- 22MM201008- Data Warehousing and Data Mining

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: Functional overview; Information Retrieval System capabilities; automatic Indexing; stemming algorithms; automatic term clustering; user search techniques; Information visualization technologies; software text search algorithms; Information system evaluation.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate IRS functionality, search and browse capabilities, cataloging and Indexingprocess, data structures, Document and Term Clustering.

CO2. Select and apply stemming algorithms, Automatic Term Clustering and Information visualization technologies, Text search algorithms in the Internet or Web search engine to interpret meaningful and relevant patterns.

CO3. Analyze the information retrieval system capabilities, Automatic indexing, user search techniques, Information system evaluation measures to present the relevant search results to the user.

CO-PO-PSO Mapping Table:

Learning Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	3	2	3	3	-	-	-	-	-	2	-
CO2	2	3	3	2	2	-	-	-	-	-	2	-
CO3	2	2	3	2	3	-	-	-	-	-	2	-
Course Correlation Mapping	**2**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

**Module 1:   INTRODUCTION   AND   INFORMATION   RETRIEVAL   *(11 Periods)*
               SYSTEM CAPABILITIES**

Introduction to IRS: Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses.
Information Retrieval System Capabilities: Search Capabilities, Boolean logic, Proximity, contiguous word phrases, fuzzy searches, Term masking, Browse Capabilities,Ranking, Zoning, Highlighting, Miscellaneous Capabilities- vocabulary Browse, canned query.

Module 2:   CATALOGING AND INDEXING AND DATA STRUCTURE   *(08 Periods)*

Cataloging and Indexing: Objectives, Indexing Process, Automatic Indexing, Information Extraction.
Data Structure: Introduction to data structure, Stemming Algorithms: Introduction to stemming process, Porter stemming algorithm, Successor stemmers, Inverted file Structure, N-Gram Data Structures PAT Data Structure.

Module 3   AUTOMATIC INDEXING   *(08 Periods)*

Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing-probabilistic weighting, Vector weighting, Natural Language, Concept Indexing, Hypertext Linkages.
Document and Term Clustering: Introduction to clustering, Thesaurus Generation, Automatic term clustering- complete term relation method, clustering using existing clusters, one pass assignments.

**Module 4   USER SEARCH TECHNIQUES AND INFORMATION   *(09 Periods)*
             VISUALIZATION**

User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the Internet and Hypertext.
Information Visualization: Introduction, Cognition and Perception, Information Visualization Technologies.

**Module 5   TEXT SEARCH ALGORITHMS AND INFORMATION   *(09 Periods)*
             SYSTEM EVALUATION**

Text Search Algorithms: Introduction to text search techniques, Software Text Search Algorithms, Hardware Text Search Systems
Information System Evaluation: Introduction to information system evaluation, Measures Used in System Evaluations, Measurement Example, TREC Results

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Text Analysis - preprocessing text so that it can be indexed in our search engine.
2. Indexing - programming an index data structure and calculating term statistics.
3. Basic Retrieval - the basic TF/IDF retrieval model.
4. Advanced Retrieval - the Dirichlet Language Model for retrieval
5. Evaluation - evaluating a search engines' performance.
6. Applications - how to scrape web data and index it in a high-
   performance searchframework

RESOURCES

TEXT BOOKS:

1. Gerald J. Kowalski and Mark T. Maybury, "Information Storage and Retrieval Systems," Springer International Edition, 2nd Edition, 2009.

REFERENCE BOOKS:

1. Ricardo Baeza – Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval," Pearson Education, 2004.
2. Robert R. Korfhage, "Information Storage and Retrieval," John Wiley and Sons, 1997.

VIDEO LECTURES:

1. https://www.udemy.com/course/information-retrieval-and-mining-massive-data-sets/
2. https://sites.pitt.edu/~peterb/2140-061/materials.html
3. https://dl.acm.org/doi/book/10.5555/567292
4. https://www.youtube.com/watch?v=fFxpSmyICwI
5. https://www.youtube.com/watch?v=FkRxmlNiC0c
6. https://www.coursera.org/lecture/text-retrieval/lesson-3-1-evaluation-of-tr-systems-YSvkh

WEB RESOURCES:

1. https://www.coursera.org/courses?query=information%20retrieval
2. https://www.coursera.org/learn/text-retrieval
3. https://www.sciencedirect.com/topics/computer-science/information-retrieval-systems
4. https://www.librarianshipstudies.com/2020/02/information-retrieval.html

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22MM201004	**CRYPTOGRAPHY AND NETWORK SECURITY**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Concepts of cryptographic algorithms, Substitution techniques, Symmetric ciphers, Block cipher operations, Cryptographic data integrity algorithms, Key management and distribution, User authentication, Transport level security, Electronic mail security, IP security.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply the knowledge of concepts of network security, symmetric and public key cryptosystems to identify the potential threats in networks.

CO2. Analyze hash functions, message authentication codes, digital signatures for providing data integrity in information security applications.

CO3. Use key management and distribution techniques, user authentication techniques for assuring mutual trust among users.

CO4. Demonstrate knowledge on network and Internet security techniques for addressing the security threats.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	3	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3
Course Correlation Mapping	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION   *(09 Periods)*

Computer security concepts, Security attacks, Security services, Security mechanisms, Model for network security, Symmetric cipher model, Substitution techniques , Monoalphabetic ciphers and Polyalphabetic ciphers.

Module 2:   SYMMETRIC CIPHERS   *(07 Periods)*

Stream ciphers and block ciphers, Data Encryption Standard (DES), Advanced Encryption Standard (AES) , Structure, Transformation Functions; Block Cipher Operation , Multiple encryption and triple DES, Cipher block chaining mode, Cipher feedback mode, Output feedback mode, Counter mode.

Module 3   PUBLIC KEY CRYPTOGRAPHY AND CRYPTOGRAPHIC   *(09 Periods)*
**   DATA INTEGRITY ALGORITHMS**

Public Key Cryptography: RSA, Diffie-Hellman key exchange, Elgamal cryptographic system.

Cryptographic Data Integrity Algorithms: Hash Functions , Simple hash functions, Secure Hash Algorithm SHA-512; Message Authentication Codes , Requirements, Functions, Security of MACs, HMAC; Digital signatures.

Module 4   MUTUAL TRUST   *(10 Periods)*

Key Management and Distribution: Symmetric key distribution using symmetric and asymmetric encryption, Distribution of public keys, X.509 certificates, Public key infrastructure.
User Authentication: Remote user authentication principles, Kerberos, Personal identity verification.

Module 5   NETWORK AND INTERNET SECURITY   *(10 Periods)*

Transport Level Security: Web security considerations, Transport layer security, HTTPS.
Electronic Mail Security: S/MIME, Pretty Good Privacy, DNSSEC.
IP Security: Overview, Policy, Encapsulating security payload.

Total Periods: 45

Experiential learning:

1. Demonstrate how encryption and decryption using the following algorithms:
   a. Ceaser Cipher
   b. Substitution Cipher
   c. Hill Cipher
2. Design and develop program to implement the BlowFish algorithm logic.
3. Design and develop program to implement the Rijndael algorithm logic.
4. Design and develop program program to implement RSA algorithm.

RESOURCES

TEXT BOOKS:

1. William Stallings, Cryptography and Network Security: Principles and Practice, 8th Edition, Pearson, 2020.

2. Wade Trappe, Lawrence C Washington, " Introduction to Cryptography with coding theory", Pearson.

REFERENCE BOOKS:

1. William Stallings, Network Security Essentials: Applications and Standards, 6th Edition, Pearson, 2018.

2. Douglas R. Stinson, Maura B. Paterson, Cryptography: Theory and Practice, 4th Edition, CRC Press, 2018.

3. Atul Kahate, Cryptography and Network Security, 3rd Edition, McGraw Hill, 2017.

VIDEO LECTURES:

1. http://nptel.ac.in/courses/106105031/lecture by Dr. Debdeep MukhopadhyayIIT Kharagpur

2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-033-computer-system-engineering-spring-2009/video-lectures/ lecture by Prof. Robert Morris and Prof. Samuel Madden MIT.

WEB RESOURCES:

1. https://www.udemy.com/introduction-to-cryptography-online-course-rahsoft-cryptocertificate/

2. https://www.coursera.org/learn/asymmetric-cryptography

3. https://www.khanacademy.org/computing/computer-science/cryptography

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22MM201018	**COMPUTER GRAPHICS**	3	-	-	-	3

Pre-Requisite

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: Computer Graphics are created using 2D, 3D designs and Animation designs. In Computer Graphics course, students are usually taught subjects like 2D design, 3D design, web design, animation design, image processing etc. The concept of Physics, Optics, and Geometry are largely used in Computer Graphics

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1	Design and implement algorithms for 2D graphics primitives and attributes.
CO2	Illustrate Geometric transformations on both 2D and 3D objects.
CO3	Apply concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models.
CO4	Decide suitable hardware and software for developing graphics packages using OpenGL.
CO5	Explore projections and visible surface detection techniques for display of 3D scene on 2D screen

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	3	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3
CO5	3	3	-	3	-	-	-	-	-	-	-	3
Course Correlation Mapping	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   **Overview**   *(09 Periods)*

Computer Graphics and OpenGL: Computer Graphics: Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Random Scan and Raster Scan displays, graphics software. OpenGL: Introduction to OpenGL ,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham"s), circle generation algorithms (Bresenham"s).

Module 2:   **Fill area Primitives, 2D Geometric Transformations**   *(09 Periods)*
                  and 2D viewing

Fill area Primitives: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 2D viewing: 2D viewing pipeline, OpenGL 2D viewing functions

Module 3:   **Clipping, 3D Geometric Transformations, Color**   *(09 Periods)*
                  and Illumination Models

Clipping: clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only -polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm only.3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations, OpenGL geometric transformations functions. Color Models: Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong model, Corresponding openGL functions.

Module 4:   **3D Viewing and Visible Surface Detection**   *(09 Periods)*

3DViewing:3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters , Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates. OpenGL 3D viewing functions. Visible Surface Detection Methods: Classification of visible surface Detection algorithms, depth buffer method only and OpenGL visibility detection functions.

Module 5:   **Input & interaction, Curves and Computer**   *(09 Periods)*
                  Animation

Input and Interaction: Input devices, clients and servers, Display Lists, Display Lists and Modeling, Programming Event Driven Input, Menus Picking, Building Interactive Models, Animating Interactive programs, Design of Interactive programs, Logic operations .Curved surfaces, quadric surfaces, OpenGL Quadric-Surface and Cubic-Surface Functions, Bezier Spline Curves, Bezier surfaces, OpenGL curve functions. Corresponding openGL functions.

                                                    Total Periods: 45

EXPERIENTIAL LEARNING

1. Describe how a color CRT works.
2. Describe the tristimulus theory of color perception and its relevance to computer displays.
3. What is the CIE Chromaticity diagram?

RESOURCES

TEXTBOOKS:

1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd / 4th Edition, Pearson Education,2011

2   Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008

REFERENCE BOOKS:

1. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education

2. Kelvin Sung, Peter Shirley, steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning

3   Xiang, Plastock : Computer Graphics , sham"s outline series, 2nd edition, TMG.

VIDEO LECTURES:

1.   https://www.youtube.com/watch?v=qFwOg9M9s2U
2.   https://www.youtube.com/watch?v=zi57OkPwzbk
3.   https://www.youtube.com/watch?v=2tiLGgoAMcU
4.   https://www.geeksforgeeks.org/videos/painters-algorithm-in-computer-graphics/
5.   https://www.youtube.com/watch?v=U9NrXOBXA1I

WEB RESOURCES:

1.   https://www.edx.org/learn/computer-graphics/
2.   https://www.coursera.org/courses?query=computer%20graphics
3.   https://onlinecourses.nptel.ac.in/noc20_cs90/preview

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22MM202005	**PYTHON PROGRAMMING**	3	-	2	-	4

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: Basics of Python programming, Control structures, Lists, Tuples, Strings, Sets, Dictionaries, Regular expressions, Functions, File handling, Objectoriented programming, Exception handling.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on Python constructs, sequences, sets and dictionaries to solve basic computational problems.

CO2. Apply the concepts of regular expressions for searching patterns in strings.

CO3. Develop and use Python modules to provide solutions to problems.

CO4. Apply the knowledge of file operations in Python for file processing.

CO5. Design applications using object-oriented programming features – encapsulation, inheritance, polymorphism and exception handling.

CO6 Work independently and communicate effectively oral and written forms.

CO-PO-PSO Mapping Table:

Learning Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	3	-	-	3	-	3	-	-
CO2	3	2	-	-	3	-	-	3	-	3	-	-
CO3	3	3	3	3	3	-	-	3	-	3	-	-
CO4	3	3	3	2	3	-	-	3	-	-	-	-
CO5	3	3	3	3	3	-	-	3	-	-	-	-
C06	-	-	-	-	-	3	-	3	-	-		
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	-	-	**3**	-	**3**	-	-

Correlation Levels:　　　　3: High;　　　2: Medium;1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO PYTHON PROGRAMMING: *(07 Periods)*

Introduction to Python, Tokens, Variables, Literals, Identifiers, Keywords, Special symbols, Operators, Fundamental datatypes, Expressions, Type conversions, Handling Input and output in Python.

Module 2:   CONTROL STRUCTURES   *(08 Periods)*

Selection Statements: if statement, if-else statement, if-elif-else statement, nested-if statement.
Iterative Statements: while loop, for loop, break statement, continue statement, pass and else statements used with loops.

Module 3   SEQUENCES, SETS, DICTIONARIES AND REGULAR   *(11 Periods)*
**   EXPRESSIONS**

Sequences: Lists and operations , Creating, Inserting elements, Updating elements, Deleting elements, Searching and sorting, List comprehensions, Nested lists;
Tuples , Creating, Searching and sorting, Nested tuples;
Strings: Initializing a string and string operations, String handling methods, String formatting.

Sets: Set creation, Set operations.

Dictionaries: Operations on dictionaries, Dictionary methods, Sorting elements using lambdas.

Regular Expressions: Regular expressions, Sequence characters in regular expressions, Quantifiers in regular expressions, Special characters in regular expressions.

Module 4   FUNCTIONS AND FILE HANDLING   *(09 Periods)*

Functions: Need for functions, Function definition, Function call, Variable scope and lifetime, Return statement, Positional arguments, Keyword arguments, Default arguments and variable length arguments, Recursive functions, Lambda functions, Generators.

File Handling: Types of files, Opening and closing files, Reading and writing data

Module 5   OBJECT ORIENTED PROGRAMMING AND EXCEPTION   *(10 Periods)*
**   HANDLING**

Object Oriented Programming: Introduction to object-oriented programming, Classes and objects, Inheritance and polymorphism, Abstract Classes and interfaces.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1.   Write a program to demonstrate different number datatypes in python
2.   Write a program to perform different arithmetic operations on numbers in python.
3.   Write a python script to convert a given decimal number into octal, hexadecimal and binary.

4. Write a python script to read four integer values separated with commas and display the sum of those four numbers.

5. Write a program to create, concatenate and print a string and accessing substring from a given string.

6. Write a python script to display Fibonacci sequence of numbers using while loop, for loop and do-while loop constructs.

7. Write a python script to perform the following operations on Lists:
   (i) Matrix Addition.
   (ii) Matrix Multiplication.

8. Write a program to demonstrate working with dictionaries in python.

9. Write a python program to find largest of three numbers

10. Write a python program to construct the following pattern using nested for loop

11. Write a python script to read details of N students – name, roll number, branch and age. Sort the student details based on their names and display.

12. Design a function that can perform sum of two or three or four numbers.

13. Write a python script to implement Towers of Hanoi problem.

14. Write a python script to copy the content of one file into another file.

15. Write a python script to read all the strings from the text file and display them

RESOURCES

TEXT BOOKS:

1. R. Nageswara Rao, Core Python Programming, 2nd Edition, Dreamtech Press, 2018.

REFERENCE BOOKS:

1. Reema Thareja, Python Programming using Problem Solving Approach, 1st Edition, Oxford University Press, 2017.

2. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India, 2016.

SOFTWARE/TOOLS:

1. Python 3.10.5

VIDEO LECTURES:

1. http://nptel.ac.in/courses/106102064

2. http://nptel.ac.in/courses/106106127/

3. https://onlinecourses.nptel.ac.in/noc19_cs41/preview

WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc19_cs41/preview

2. https://www.coursera.org/specializations/python

3. https://www.coursera.org/learn/python-for-applied-data-science-ai

4. https://beginnersbook.com/2018/03/python-tutorial-learn-programming/

5. https://www.javatpoint.com/python-tutorial

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22MM201006	**CYBER SECURITY ESSENTIALS**	3	-	-	-	3

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: The Cyberecurity Essentials course develops foundational understanding of cybersecurity and how it relates to information and network security. The 30-hour course introduces students to characteristics of cyber crime, security principles, technologies, and procedures to defend networks. Through interactive, multimedia content, lab activities, and multi-industry case studies, students build technical and professional skills to pursue careers in cybersecurity.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze and evaluate the cyber security needs of an organization.

CO2. Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.

CO3. The students can use basic security tools to enhance system security and can develop basic security enhancements in stand-alone applications.

CO4. Demonstrate knowledge on network and Internet security techniques for addressing the security threats.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	3	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3
Course Correlation Mapping	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   NETWORK & SECURITY CONCEPTS   *(09 Periods)*

Introduction - - Cyber Security Goals - - Security Attacks - - Passive Attacks – Release of Message Contents – Traffic Analysis - - Active Attacks – Masquerade – Replay – Modification of Messages – Denial of Service - - Examples

Module 2: ATTACKER TECHNIQUES   *(07 Periods)*

Introduction - - Antiforensics – Using Proxies – Using Tunneling – Using Botnets – Using Fast Flux - - Fraud Techniques – Phishing – Rogue Antivirus – Click Fraud - - Cyber Security Statistics

Module 3: EXPLOITATION   *(09 Periods)*

Introduction - - Malware - - Types of Malware – VIRUS – Computer Worm – Trojan Horse – Ransomware - - Cyber Attacks - - Denial of Service Attacks - - Man-in-the-Middle Attacks -
-       SQL Injection Attacks

Module 4:   MUTUAL TRUST   *(10 Periods)*

Key Management and Distribution: Symmetric key distribution using symmetric and asymmetric encryption, Distribution of public keys, X.509 certificates, Public key infrastructure.
User Authentication: Remote user authentication principles, Kerberos, Personal identity verification.

Module 5:   DEFENSE & ANALYSIS TECHNIQUES   *(10 Periods)*

Introduction: The Power of Active Defense, Cyber Security Defenses, Firewall, Antivirus Software, Cyber Security Tools, Basic Tools, Monitoring Tools, Expert Tools, Android Security Apps, Tips for Securing Your System

                                                                         Total Periods: 45

EXPERIENTIAL LEARNING:
1.   Describe the Study of Firewalls.
2.   Explain briefly about the Study of IAM.
3.   Describe the Study of patch management.
4.   Explain the Study of insider threat Detection.

RESOURCES

TEXT BOOKS:

1.   Charles J, "Cybersecurity Essentials".

2.   Wade Trappe, Lawrence C Washington, " Introduction to Cryptography with coding theory", Pearson.

REFERENCE BOOKS:

1.   William Stallings, Network Security Essentials: Applications and Standards, 6th Edition, Pearson, 2018.

2. Douglas R. Stinson, Maura B. Paterson, Cryptography: Theory and Practice, 4th Edition, CRC Press, 2018.

3. Atul Kahate, Cryptography and Network Security, 3rd Edition, McGraw Hill, 2017.

VIDEO LECTURES:

1. http://nptel.ac.in/courses/106105031/lecture by Dr. Debdeep MukhopadhyayIIT Kharagpur

WEB RESOURCES:

1. https://www.udemy.com/introduction-to-cryptography-online-course-rahsoft-cryptocertificate/

2. https://www.coursera.org/learn/asymmetric-cryptography

3. https://www.khanacademy.org/computing/computer-science/cryptography

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22MM201011	**OBJECT ORIENTED MODELLING AND DESIGN**	3	-	-	-	3

Pre-Requisite   22MM202004-Software Engineering
Anti-Requisite XXXX-
Co-Requisite   XXXX-

COURSE DESCRIPTION: The course introduces an overview of the concepts and Principles of Object Oriented Programming, Introduction to UML and Behavioral Modeling, Basic Structural Modeling, Collaboration Diagrams and Sequence Diagrams, Advanced Behaviorial and Architectural

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the concepts and principles of object oriented programmingconcepts.

CO2. Analyze major components and key mechanisms of Classand ObjectDiagram.

CO3. Use the modeling techniques of interaction diagrams for the dynamic behavior of objects.

CO4. Use the modeling techniques of State-chart Diagram to represent the state of an objects.

CO5. Applying the techniques for modeling Component and Deployment Diagrams.

CO-PO-PSO Mapping Table:

Learning Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	2	3	2	3	-	-	-	-	-	3	3
CO2	2	3	3	-	-	-	-	-	-	-	-	3
CO3	2	3	2	3	3	-	-	-	-	-	2	2
CO4	2	2	2	2	3	-	-	-	-	-	2	2
CO5	2	3	3	2	2	-	-	-	-	-	3	2
Course Correlation Mapping	**2**	**3**	**3**	**2**	**3**	-	**-**	**-**	-	**-**	**2**	**2**

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT

Module 1:   OBJECT ORIENTED DESIGN AND MODELLING   *(08 Periods)*

Object Oriented Design and Modelling Object Oriented Fundamentals, Objects and object classes, object oriented design process, importance of modelling, principles of modelling, object oriented modelling.

Module 2:   INTRODUCTION TO UML AND BEHAVIORAL MODELING   *(10 Periods)*

Introduction to UML and Behavioral Modeling: Conceptual model of UML, building blocks of UML, Mechanisms in UML, architecture, UML Diagrams , software development life cycle. Behavioral modeling: Interactions use cases, Use Case Diagrams, Interaction Diagrams and activity diagrams, Modeling Concepts - Diagram Organization - Diagram Extension

Module 3   BASIC STRUCTURAL MODELING   *(07 Periods)*

Basic Structural Modeling: Classes, relationships, common mechanisms, class and object diagrams. Advanced structural Modeling: Advanced classes, advanced relationships, Interfaces types and roles, packages, instances and object diagrams.

Module 4   COLLABORATION DIAGRAMS AND SEQUENCE   *(10 Periods)*
**   DIAGRAMS**

Collaboration Diagrams and Sequence Diagrams Terms, concepts and depicting a message in collaboration diagrams. Terms and concepts in sequence diagrams. Difference between collaboration and sequence. Diagram. Depicting synchronous messages with/without priority call back mechanism.

Module 5   ADVANCED BEHAVIORIAL AND ARCHITECTURAL   *(10 Periods)*

Advanced Behavioral and Architectural Modelling Advanced Behavioral: Events and signals, state machines, process and threads, time and space, state chart diagrams. Architectural Modelling: Terms, Concepts, examples, Modelling techniques for component diagrams and deployment diagrams.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Design an automated system to perform the Passport Process.

2. Create a system to perform the Exam Registration system.

3. create a system to perform the credit card processing

RESOURCES

TEXT BOOKS:

1. Grady Booch, James Rumbaugh, Ivar Jacobson : The Unified Modeling Language User Guide, Pearson Education,2008
2. Object-Oriented Analysis and Design with the Unified Process By John W. Satzinger, Robert B Jackson and Stephen D Burd, Cengage Learning.

REFERENCE BOOKS:

1. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit,WILEY-Dreamtech India Pvt. Ltd,2012
2. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education,2000
3. Pascal Roques: Modeling Software Systems Using UML2, WILEY-DreamtechIndia Pvt. Ltd.,2011
4. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies,2007
5. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit,WILEY-Dreamtech India Pvt. Ltd,2012

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc16_cs19
2. http://engineeringvideolectures.com/video/1237
3. https://www.udemy.com/course/djeyamala-ooad-uml/

WEB RESOURCES:

1. www.uml-diagrams.org/uml-object-oriented-concepts.html
2. https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_quick_guide.htm

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22MM201007	**BLOCKCHAIN TECHNOLOGIES**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Introduction to Blockchain Technologies and its decentralization concepts, Digital Currencies, Smart Contracts, Ethereum, Hyperledger, Alternative Blockchains, Current Challenges and Scope of Research.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze the concepts of distributed systems, decentralization and blockchains in the Blockchain ecosystem.

CO2. Devise suitable Blockchain platforms for scalable applications.

CO3. Assess the challenges, trending technologies for understanding the research scope in Blockchain technologies.

CO4. Pertain to ethical and legal usage of Blockchain applications.

CO5. Formulate secured and sustainable Blockchains for healthy and safe society.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	3	-	-	-	3	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3
CO5	3	2	-	3	-	-	-	-	-	-	-	3
Course Correlation Mapping	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**3**	-	**-**	-	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT:

Module 1:	**Overview of Block Chain**	*(09 Periods)*

The Internet of Information, In Search of the Trust Protocol, What is Block chain?, Practitioner Perspective: Andreas Wallendahl, Head of Strategic Initiatives at ConsenSys, Practitioner Perspective: Rob Carter, Executive VP and CIO, FedEx40s,Achieving Trust in the Digital Age, How Blockchain Works, The Internet of Information, In Search of the Trust Protocol / What is Blockchain,

Achieving Trust in the Digital Age, How Blockchain Works, The Second Era of the Internet, Steps of a Blockchain Transaction

Module 2: Blockchain Design Principles   *(07 Periods)*

Intro to Blockchain Design Principles, Principle 1: Networked Integrity, Principle 2: Distributed Power, Practitioner Perspective: Rob Carter, Executive VP and CIO, FedEx1m, Principle 3: Value as Incentive, Principle 4: Security. Principle 5: Privacy, Principle 6: Rights Preserved, Principle 7: Inclusion, Practitioner Perspective: Julie Maupin, Director of Social Impact & Regulatory Affairs at IOTA Foundation, Privacy Rights and Inclusion, Blockchain Design Principles

Module 3: Public and Private Ledgers   *(09 Periods)*

The Benefits of Shared Knowledge, How Much is Too Much Transparency, Centralized vs. Distributed Ledgers ,Public vs Private Ledgers, Practitioner Perspective: Rolf Hoefer, Keyless Technologies.

Practitioner Perspective: Andreas Wallendahl, Head of Strategic Initiatives at ConsenSys, Transparency as a Strategic Risk, Transparency as a Strategic Asset , Usage of Multiple IDs, Zero Knowledge Proofs, Implementation in Public vs. Private Block chains.

Module 4: The Blockchain Ecosystem   *(10 Periods)*

Intro to the Blockchain Ecosystem ,Blockchain Stakeholders Part, Practitioner Perspective: Rob Carter, Executive VP and CIO, FedEx, Blockchain Stakeholders Part ,Blockchain Stakeholders Part ,Practitioner Perspective: Oleg Fomenko, Co-founder of Sweatcoin, Stewarding the Blockchain Revolution

Module 5: Blockchain Implementation Challenges   *(10 Periods)*

Overcoming Showstoppers, Challenge 1: The Technology is Not Ready for Prime Time, Challenge 2: The Energy Consumed is Unsustainable, Challenge 3: Governments Will Stifle or Twist It, Practitioner Perspective: Oleg Fomenko, Co-Founder at Sweatcoin, Practitioner Perspective: Will Harborne, Director of Operations at Ethfinex, Challenge 4: Powerful Incumbents of the Old Paradigm Will Usurp It, Challenge 5: The Incentives are Inadequate. Challenge 6: Blockchain is a Job Killer, Challenge 7: Governing the Protocols, Practitioner Perspective: Rob Carter, Executive VP and CIO, FedEx, Challenge 8: Distributed Autonomous Agents, Challenge 9: Privacy, Challenge 10: Criminals Will Use It, Reasons Blockchain Will Fail or Implementation Challenges? Course Wrap-up

EXPERIENTIAL LEARNING:

Part 1 Understanding Block using (https://tools.superdatascience.com/Blockchain/block)

1.1 Understanding Block chain using (https://tools.superdatascience.com/Blockchain/Blockchain)

1.2 Understanding Distributed Blockchain using https://tools.superdatascience.com/Blockchain/distributed

1.3 Understanding Tokens using https://tools.superdatascience.com/Blockchain/tokens

1.4 Understanding coin based transaction using (https://tools.superdatascience.com/Blockchain/tokens)

Part 2 Using JavaScript Perform following (Source: YouTube Channel: Simply Explain Savjee)

2.1 Creating a Blockchain

2.2 Implementing Proof-of-Work

2.3 Miner rewards & transactions

2.4 Signing transactions

2.5 Angular frontend

Part 3 Introduction to Geth:

3.1 Introduction to geth

3.2 Creation of private Blockchain

3.2 Creation of Account

3.4 Mining using geth

Part 4 Introduction to Remix Ethereum:

4.1 Introduction to Metamask

4.2 Creation of account using Metamask

4.3 Introduction to Remix Ethereum

4.4 Introduction to solidity program structure, compilation and deployment environment.

4.5 Write a smart contract in solidity to store and get "Hello World".

4.6 Write a smart contract in solidity to create a function setter and getter to set and get a value.

4.7 Write a smart contract in solidity to print the array of integers and its length.

4.8 Write a solidity code to print array elements and its position.

Part 5 Introduction to Ethereum-Ganache:

5.1 Creation of account using Ganache.

5.2 Introduction to solidity smart contract compilation and deployment environment.

5.3 Write a smart contract in solidity to store and get "Hello World".

RESOURCES:

TEXT BOOKS:

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Second Edition, Packt Publishing, 2018

REFERENCE BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands On Approach", VPT, 2017.

2. Roger Wattenhofer, "The Science of the Blockchain" CreateSpace Independent Publishing, 2016.

3. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.

VIDEO LECTURES:

1. https://in.coursera.org/learn/introduction-blockchain-technologies

WEB RESOURCES:

1. https://www.udemy.com/topic/blockchain/

2. https://in.coursera.org/courses?query=blockchain

3. https://www.simplilearn.com/blockchain-certification-training-course

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22MM202008	**MULTIMEDIA APPLICATION DEVELOPMENT**	3	-	2	-	4

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: Multimedia Concepts; Data Representation; Action script Programming Concepts; Dynamic Action Script and Event Handling Mechanism; Video and audio compression Techniques and Multimedia communication and data transmission..

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1   Understand the concepts of Multimedia, hypermedia, validation of forms and action script programming and Event Handling.

CO2   Design and Develop online media applications using searching of motor vectors and Moving Picture Expert Group (MPEG) techniques for visual design

CO3   Demonstrate Bitmap Programming, multimedia software tools, graphic software, scanning and digital photography to create original images

CO4   Analyze image data representation graphics, image data types, file formats, color models in images and color models in videos to design graphics and videos.

CO5   Investigate and solve the compression of audio and video problems using audio and video compression techniques

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	2	2	-	-	3
CO2	3	2	-	-	-	-	-	2	2	-	-	3
CO3	2	3	-	-	-	-	-	2	2	-	-	3
CO4	2	3	-	2	-	-	-	2	2	-	-	3
CO5	2	2	-	3	-	-	-	2	2	-	-	3
Course Correlation Mapping	**2**	**3**	**-**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**3**

Correlation Levels: 3: High; 2: Medium;   1: Low

COURSE CONTENT

**Module 1:   MULTIMEDIA   AUTHORING   AND   DATA   *(09 Periods)*
REPRESENTATIONS**

Multimedia Authoring and Data Representations: Multimedia and hypermedia, World Wide Web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video.

Module 2:   ACTION SCRIPT   *(09 Periods)*

Action Script: Core Concepts, Conditionals and Loops, Instance Methods Revisited, Static Variables and Static Methods, Functions, Inheritance, Compiling and Running a program, Data types and Type Checking, Interfaces.

Module 3:   DISPLAY AND INTERACTIVITY   *(09 Periods)*

Display and Interactivity: Events and Event Handling, Exceptions and Error Handling, Dynamic Action Script, Scope, Events and Display Hierarchies, Interactivity. Screen Updates, Programmatic Animation, Drawing with Vectors, Bitmap Programming, Text Display and Input..

Module 4:   BASIC VIDEO COMPRESSION TECHNIQUES   *(09 Periods)*

Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG video coding I- MPEG-1 and 2, Basic Audio Compression Techniques: ADPCM in Speech Coding, G.726 ADPCM, Vocoders, LPC.

Module 5:   MULTIMEDIA COMMUNICATION AND RETRIEVAL   *(09 Periods)*

Multimedia Communication and Retrieval: Computer and Multimedia Networks: Basics of Computer and Multimedia Networks, Multiplexing Technologies, LAN and WAN, Access Networks. Multimedia Network Communications and Applications: Quality of Multimedia Data Transmission, Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG-4, Media-On- Demand (MOD).

Total Periods: 45

EXPERIENTIAL LEARNING

List of Exercises

1. Student should known about the multimedia software and hardware tools and also they can interact with multimedia practically.

2. Multimedia is supportive for informal learning of science and technology

3. Multimedia provide new platform document.

4. Multimedia provide real world experiences to students

5. Use Effective Cropping Techniques to design a collage.

RESOURCES

TEXTBOOKS:

1. Ze-Nian Li, and Mark S. Drew," Fundamentals of Multimedia", Pearson Education,2008

2   Colin Moock, SPD O, REILLY, "Essentials ActionScript 3.0", 1st Edition, 2007.

REFERENCE BOOKS:

1.   Nigel chapman, and jenny chapman, "Digital Multimedia", Wiley-Dreamtech, 2005. y

2.   Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Pearson Education, 2001.

VIDEO LECTURES:

1.   https://www.youtube.com/watch?v=w5Q4DYr4utQ
2.   https://www.youtube.com/watch?v=ZXUTIpytCdo
3.   https://www.youtube.com/watch?v=q9X-ogQSJFg

WEB RESOURCES:

1.   https://www.nielit.gov.in/aurangabad/content/certified-multimedia-developer
2.   https://iisdt.in/product/advance-diploma-in-multimedia-application/
3.   https://www.coursera.org/courses?query=mobile%20app%20development
4.   https://www.udemy.com/courses/development/mobile-apps/
5.   https://onlinecourses.swayam2.ac.in/nou20_cs05/preview

Course Code	Course Title	L	T	P	S	C
22MM201013	**INTRODUCTION TO MACHINE LEARNING**	3	-	-	-	3

Pre-Requisite   22MM202005-Python Programming

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Introduction to machine learning, Bayesian concept learning, Supervised learning, Unsupervised learning, Artificial neural networks, Ensemble learning.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze the process of machine learning modeling and evaluation to automatically infer a general description for a given learning problem.

CO2. Analyze the underlying mathematical models within machine learning algorithms and learning tasks.

CO3. Design and implement machine learning solutions for classification, regression, and clustering problems.

CO4. Design and implement efficient neural architectures to model patterns for a given learning problem.

CO5. Develop intelligent solutions to solve societal problems related to computer vision, information security, healthcare and other areas.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	-	-	-	-	-	-	-	3
CO2	2	3	-	-	-	-	-	-	-	-	-	3
CO3	2	3	3	3	-	-	-	-	-	-	-	3
CO4	3	3	3	-	-	-	-	-	-	-	-	3
CO5	1	3	3	3	-	3	-	-	-	-	-	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO MACHINE LEARNING   *(07 Periods)*

Machine Learning: Human learning, Types of human learning, Machine learning, Types of machine learning, Applications of machine learning, Issues in machine learning.

**Module 2:   MODELING AND EVALUATION, BAYESIAN CONCEPT   *(10 Periods)*
                LEARNING**

Modeling and Evaluation: Selecting a model, Training a model, Model representation and interpretability, Evaluating performance of a model, Improving performance of a model.

Feature Engineering: Feature transformation, Feature subset Selection.

Bayesian Concept Learning: Introduction, Importance, Bayes' theorem, Bayes' theorem and concept learning, Bayesian belief network.

Module 3:   SUPERVISED LEARNING   *(09 Periods)*

Classification: Classification model, Classification learning steps, K-Nearest Neighbor, Support vector machines, Decision Tree - Decision tree representation,

Regression: Introduction, Simple linear regression, Multiple linear regression, Polynomial regression model, Logistic regression.

Module 4:   UNSUPERVISED LEARNING   *(09 Periods)*

Introduction, Unsupervised vs supervised learning, Applications of unsupervised learning, Clustering as a machine learning task, Types of clustering techniques, Partitioning methods, K-Medoids, Hierarchical clustering, DBSCAN.

**Module 5:   ARTIFICIAL NEURAL NETWORKS, ENSEMBLE   *(10 Periods)*
                LEARNING**

Artificial Neural Networks: Neural network representations, Appropriate problems for neural network learning, Perceptrons, Multilayer networks and Backpropagation algorithm, Convergence and local minima, Representational power of feedforward networks, Hypothesis space search and inductive bias, Hidden layer representations, Generalization, Overfitting, Stopping criterion.

Ensemble Learning: Bagging, Boosting, Gradient boosting.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Perform Exploratory Data Analysis on the given dataset. Implement CART algorithm for decision tree learning. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
2. Train an SVM Classifier with Linear Kernel. Use an appropriate data set for building the SVM Classifier and apply this knowledge to classify a new sample.
3. Build linear regression and multiple regression models to predict the price of the house (Boston House Prices Dataset).
4. Build a neural network that will read the image of a digit and correctly identify the number.
5. Solve classification problem by constructing a feedforward neural network using Backpropagation algorithm. (Wheat Seed Data)

RESOURCES

TEXT BOOKS:

1. Tom M. Mitchell, Machine Learning, McGraw Hill, 1997.

2. Saikat Dutt, Subramanian Chandramouli, Amit kumar das, Machine Learning, Pearson, 2019.

REFERENCE BOOKS:

1. Manaranjan Pradhan, U Dinesh Kumar, Machine Learning Using Python, Packt Publishing, 2019.

2. Aurelien Geron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 2nd Edition, O'Reilly, 2019.

3. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, 4th Edition, 2020.

4. Shai Shalev Shwartz, Shai Ben David, Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press, 2014.

SOFTWARE/TOOLS:

1. Python
2. Scikit-learn/Keras/TensorFlow

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106106202/

2. https://www.coursera.org/learn/machine-learning

3. https://onlinecourses.nptel.ac.in/noc23_cs18/preview

4. https://onlinecourses.nptel.ac.in/noc23_cs87/preview

5. https://onlinecourses.nptel.ac.in/noc23_ee87/preview

6. https://www.coursera.org/learn/ntumlone-algorithmicfoundations

7. https://www.coursera.org/specializations/machine-learning-introduction

8. http://ndl.iitkgp.ac.in/document/YkxlRXFvZXJrTDBkVzVVZi9ESjl6eXpRZkxRc2lhOWhlVXBh UVVWaXZlNDNyZUVldU9LdlYvd20wbkQ4MC92UQ

9. https://www.coursera.org/learn/unsupervised-learning-recommenders-reinforcement-learning

WEB RESOURCES:

1. https://www.ibm.com/topics/machine-learning

2. https://www.simplilearn.com/tutorials/machine-learning-tutorial/what-is-machine-learning

3. https://www.w3schools.com/python/python_ml_getting_started.asp

4. https://developers.google.com/machine-learning/crash-course

5. https://www.greenteapress.com/thinkstats/

6. https://info.deeplearning.ai/machine-learning-yearning-book

7. https://www.kaggle.com/code/kanncaa1/machine-learning-tutorial-for-beginners

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22MM201015	**DEEP LEARNING**	3	-	-	-	3

Pre-Requisite	22MM201013-Introduction to Machine Learning
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION: Overview of machine learning; Fundamentals of deep learning; Modern approaches in deep learning; Feedforward neural network architectures; Deep learning Models and Applications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Analyze a neural network by applying the basics of mathematics and machine learning.

CO2 Analyze the data using multilayer perceptron and backpropagation algorithms. CO3.

CO3 Apply regularization and optimization techniques to improve the performance of Deep neural networks.

CO4 Identify appropriate deep learning model for text, multimedia, and biological data analysis.

CO5 Compare deep neural networks and deep learning models to infer the suitable learning algorithm on large scale data.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	2	2	-	-	3
CO2	3	2	-	-	-	-	-	2	2	-	-	3
CO3	2	3	-	-	-	-	-	2	2	-	-	3
CO4	2	3	-	2	-	-	-	2	2	-	-	3
CO5	2	2	-	3	-	-	-	2	2	-	-	3
Course Correlation Mapping	**2**	**3**	**-**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	-	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION   *(09 Periods)*

Historical Trends in Deep Learning – Machine Learning basics - Learning algorithms: Supervised and Unsupervised Training - Linear Algebra for Machine Learning - Testing - Cross Validation - Dimensionality Reduction - Over fitting /Under Fitting - Hyper parameters and validation sets - Estimators – Bias – Variance - Loss Function- Regularization

Module 2:   NEURAL NETWORKS   *(09 Periods)*

Biological Neuron – Idea of Computational units - Linear Perceptron - Perceptron Learning Algorithm - Convergence theorem for Perceptron Learning Algorithm - Linear Separability-Multilayer perceptron – Backpropagation.

Module 3:   MODERN PRACTICES IN DEEP NETWORKS   *(09 Periods)*

Introductions to Simple DNN - Platform for Deep Learning - Deep Learning Software Libraries - Deep Feed forward networks – Gradient-Based Learning - Architecture Design– Various Activation Functions, ReLU, Sigmoid – Error Functions - Regularization methods for Deep Learning - Early Stopping - Drop Out - Optimization methods for Neural Networks-Adagrad, Adam

Module 4:   DEEP LEARNING MODELS   *(09 Periods)*

Convolutional Neural Networks (CNNs): CNN Fundamentals – Architectures – Pooling – Visualization – Sequence Modeling: Recurrent Neural Networks (RNN) - Long-Short Term Memory (LSTM) – Bidirectional LSTMs-Bidirectional RNNs -Deep Unsupervised Learning: Autoencoders – Auto Encoder Applications -Deep Boltzmann Machine (DBM).

Module 5:   CASE STUDY AND APPLICATIONS   *(09 Periods)*

Application Case Study - Handwritten digits recognition using deep learning - LSTM with Keras – Sentiment Analysis – Image Dimensionality Reduction using Encoders LSTM with Keras – Alexnet – VGGnet.

Total Periods: 45

EXPERIENTIAL LEARNING

1.   Implementation of different activation functions to train Neural Network.
2.   Implementation of different Learning Rules
3.   Implementation of Adeline network for system identification.
4.   Pattern matching using different rules.
5.   Implementation of Madeline network

RESOURCES

TEXTBOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, *Deep Learning*, 4th Edition, MIT Press, 2016.

REFERENCE BOOKS:

1. Kevin P. Murphy, "*Machine Learning: A Probabilistic Perspective*", MIT Press, 2012

2. Michael A. Nielsen, *Neural Networks and Deep Learning, Determination* Press, 2015.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=lhufOy2W3Ps
2. https://www.youtube.com/watch?v=DooxDIRAkPA&list=PL9ooVrP1hQOEX8BKDplfG86ky 8s7Oxbzg
3. https://www.youtube.com/watch?v=YFNKnUhm_- s&list=PLZoTAELRMXVPGU70ZGsckrMdr0FteeRUi

WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs22/preview
2. https://www.simplilearn.com/introduction-to-deep-learning-free-course-skillup
3. https://www.udemy.com/tutorial/deeplearning/what-is-deep-learning/

<u>**PROGRAM ELECTIVE**</u>

Course Code	Course Title	L	T	P	S	C

22MM202011   **ARTIFICIAL INTELLIGENCE**   3 - 2 - 4

Pre-Requisite   22CA201001-Computational Statistics

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: Introduction to artificial intelligence, Designing intelligent agents, Solving general purpose problems, Search in complex environments, Probabilistic reasoning, Represent knowledge and reason under uncertainty, Robotics, Ethics and safety in AI.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1.   Architect intelligent agents using artificial intelligence techniques and principles.

CO2.   Analyze and interpret the problem, identify suitable solutions using heuristic functions, optimization algorithms and search algorithms.

CO3.   Select and apply appropriate knowledge representation to build Bayesian network models to reason under uncertainty.

CO4.   Investigate robot hardware and frameworks for intelligent robotic perception.

CO5.   Demonstrate knowledge on ethical implications of intelligent machines for providing privacy, trust, security and safety.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	3	-	-	-	3	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3
CO5	3	2	-	-	-	-	-	-	-	-	-	3
Course Correlation Mapping	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**3**	-	**-**	-	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   **INTRODUCTION TO ARTIFICIAL INTELLIGENCE**   *(09 Periods)*

Foundations of artificial intelligence, History of artificial intelligence, State of the art, Risks and benefits of AI, Intelligent agents – Agents and environments, The concept of rationality, Structure of agents.

Module 2: PROBLEM SOLVING BY SEARCHING *(07 Periods)*

Problem solving agents, Search algorithms, Uninformed search strategies, Informed search strategies – Greedy best-first search, A* search; Heuristic functions.

Module 3: SEARCH IN COMPLEX ENVIRONMENTS *(09 Periods)*

Local search algorithms and optimization problems – Hill-climbing search, Simulated annealing, Local beam search, Evolutionary algorithms; Optimal decisions in games – The minimax search algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Move ordering; Monte Carlo tree search.

Module 4: ROBOTICS, ETHICS AND SAFETY IN AI *(10 Periods)*

Robotics: Robots, Robot hardware, Robotic perception, Alternative robotic frameworks, Application domains.

Ethics and Safety in AI: Limits of AI, Ethics of AI – Surveillance, security and privacy, Fairness and bias, Trust and transparency, AI safety.

Module 5: ROBOTICS, ETHICS AND SAFETY IN AI *(10 Periods)*

Robotics: Robots, Robot hardware, Robotic perception, Alternative robotic frameworks, Application domains.

Ethics and Safety in AI: Limits of AI, Ethics of AI – Surveillance, security and privacy, Fairness and bias, Trust and transparency, AI safety.

Total Periods: 45

LIST OF EXPERIMENTS

List of Exercises

1. **Speech Recognition:** Read an audio file with Python and use the Google speech recognition API to perform conversion of Speech to Text.
2. Detect the language of the text using Language detection library (langdetect) ported from Google's language-detection.
3. **Language Translation:** Perform translation of given input text phrases or document using Google Translate API.
4. **Object Detection:** Detect multiple objects present in an image using Detectron-Facebook's free API.
5. **Human Body Estimation:** Extract a 3D mesh model of a human body from 2D RGB images using Facebook's DensePose tool.
6. Real time Smile Detection in Human Face using OpenCV.
7. Face Recognition using Microsoft Face API.

8. Test and evaluate the performance of the Google Tesseract OCR tool in recognizing printed Text characters.

9. **Chatbot:** Build a Chatbot capable of communicating and interacting with the users based on the given text input.

10. **Video Recognition –** Test and evaluate the videos using Google's tools

RESOURCES

TEXTBOOKS:

1. Stuart Russell, Peter Norvig, *Artificial Intelligence: A Modern Approach*, Prentice Hall, 4thEdition, 2020.

REFERENCE BOOKS:

1. Denis Rothman, *Artificial Intelligence by Example*, Packt Publishers, 2018.

2. Dr. Joshua Eckroth, *Python Artificial Intelligence projects for Beginners*, Packt Publishers, 2018.

VIDEO LECTURES:

1. Artificial Intelligence | Introduction | Lec-1| Bhanu Priya - YouTube
2. What Is Artificial Intelligence? | Artificial Intelligence (AI) In 10 Minutes | Edureka - YouTube

WEB RESOURCES:

1. https://searchenterpriseai.techtarget.com/definition/AI-Artificial-Intelligence
2. http://aima.cs.berkeley.edu/
3. https://ai.google/education/
4. https://www.coursera.org/courses?query=artificial%20intelligence
5. https://www.edureka.co/blog/artificial-intelligence-with-python/

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22MM201016	**FORMAL LANGUAGE AND AUTOMATA THEORY**	3	-	-	-	3

Pre-Requisite   22MM201005-Discrete Mathematics

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: This course focuses on the basic theory of Computer Science and formal methods of computation like automata theory, formal languages, grammars and Turing Machines. The objective of this course is to explore the theoretical foundations of computer science from the perspective of formal languages and classify machines by their power to recognize languages.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1   understand the basic properties of formal languages and grammars.

CO2   differentiate regular, context-free and recursively enumerable languages.

CO3   make grammars to produce strings from a specific language.

CO4   acquire concepts relating to the theory of computation and computational

        Models ncluding decidability and intractability

CO5   understand the basic properties of formal languages and grammars.

        differentiateregular, context-free and recursively enumerable languages.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3
CO1	3	3	-	3	-	-	-	3	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3
CO5	3	3	-	3	-	-	-	-	-	-	-	3
Course Correlation Mapping	3	2	-	3	-	-	-	3	-	-	-	3

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   Introduction to Finite Automata: (09 Periods)

Introduction to Finite Automata, Central Concepts of Automata Theory, Deterministic Finite Automata(DFA), Nondeterministic Finite Automata (NFA), Finite Automata with Epsilon Transition

Module 2: Regular Expressions and Languages: *(09 Periods)*

Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Proving Languages Not to Be Regular, Closure Properties of Regular Languages, Equivalence and Minimization of Automata –Pumping Lemma.

Module 3: *(09 Periods)*
Context Free Grammars and Languages Parse Trees:

Applications of Context Free Grammars, Ambiguity in Grammars and Languages, Eliminating Useless Symbols, Computing the Generating and ReachableSymbols, Eliminating Epsilon Productions, Eliminating Unit Productions, BacosNaur Form (BNF), Chomsky Normal Form (CNF)

Module 4: Pushdown Automata, CFL and NCFL: *(09 Periods)*

Definition of the Pushdown Automaton (PDA), The Languages of a PDA, Equivalence of PDA's and CFG's,Deterministic Pushdown Automata , The Pumping Lemma for Context Free Languages , Closure Properties of Context Free Languages, Pumping lemma for CFL, Intersections and Complements of CFL, Non- CFL

Module 5: Turing Machine (TM): *(09 Periods)*

Problems That Computers Cannot Solve, TheTuring Machine, Programming Techniques for Turing Machines,Extensions to the Basic Turing Machine, Restricted Turing Machines , Turing Machines and Computers , Definition of Post's Correspondence Problem, A Language That Is Not Recursively Enumerable, AnUndecidable Problem That Is RE, Context sensitive languages and Chomsky hierarchy, Other Undecidable Problems

Total Periods: 45

EXPERIENTIAL LEARNING

1. Develop a lexical analyzer to recognize a few patterns (using C)
2. Implementation of lexical analyzer for IF statements.(Using C)
3. implement Operator precedence parser (Using C)

RESOURCES

TEXTBOOKS:

1. John Hopcroft, Rajeev Motowani, and Jeffrey Ullman, Automata Theory, Languages, and Computation , Pearson Education, Third editon, 2006.

REFERENCE BOOKS:

1. Adesh K. Pandey, An introduction to automata theory and formal languages, S. K.Kataria& Sons, First Edition, 2013.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=WQ8bJooiEeQ

2. https://www.youtube.com/watch?v=9syvZr-9xwk

3. https://archive.nptel.ac.in/courses/111/103/111103016/

4. https://www.youtube.com/watch?v=drIbsV-pTAw

5. https://www.youtube.com/watch?v=afLFTsNenjE

WEB RESOURCES:

1. http://en.wikipedia.org/wiki/Theory_of_computation

2. http://meru.cecs.missouri.edu/courses/cecs341/tc.html

3. https://www.coursera.org/courses?query= theory%20of%20computation

4. nptel.ac.in/courses/106104028/theory of computation.

5. https://lagunita.stanford.edu/courses/course-v1:ComputerScience+Automata+SelfPaced/about

Program Elective

Course Code	Course Title	L	T	P	S	C
22MM202006	**NOSQL DATABASE**	3	-	2	-	4

Pre-Requisite	22MM202003-Database Management Systems
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION: This course will explore the origins of NoSQL databases and the characteristics that distinguish them from traditional relational database management

systems. Core concepts of NoSQL databases will be presented, followed by an exploration of how different database technologies implement these core concepts. We will take a closer look at 1-2 databases from each of the four main NoSQL data models (key-value, column family, document, and graph), highlighting the business needs that drive the development and use of each database. Finally, we will present criteria that decision makers should consider when choosing between relational and non-relational databases and techniques for selecting the NoSQL database that best addresses specific use cases.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1   Explain and compare different types of NoSQL Databases

CO2   Compare and contrast RDBMS with different NoSQL databases.

CO3   Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.

CO4   Explain performance tune of Key-Value Pair NoSQL databases.

CO5   Apply Nosql development tools on different types of NoSQL Databases.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	3	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3
CO5	3	3	-	3	-	-	-	-	-	-	-	3
Course Correlation Mapping	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**

Correlation Levels: 3: High;   2: Medium; 1: Low

COURSE CONTENT

Module 1:   Introduction to NoSQL   *(12 Periods)*
Why NoSQL? The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases.

Module 2:   Interacting with NoSQL   *(08 Periods)*
Distribution Models; Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes

Module 3:   NoSQL Storage Architecture: *(08 Periods)*
Map-Reduce, Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations, A Two Stage Map-Reduce Example, Incremental Map-Reduce Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets

Module 4:   NoSQL Stores   *(09 Periods)*
Document Databases, What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, ECommerce Applications, When Not to Use, Complex Transactions Spanning Dif erent Operations, Queries against Varying Aggregate Structure

Module 5:   Indexing and Ordering Data Sets   *(08 Periods)*
Essential Concepts Behind A Database Index, Indexing And Ordering In Mongodb, Creating and Using Indexes In Mongodb, Indexing And Ordering In Couchdb, Indexing In Apache Cassandra.
                                                              Total Periods: 45

EXPERIENTIAL LEARNING

List of Exercises

1. Installation and Setup - Install MongoDB, Start MongoDB shell, Access MongoDBShell.

2. Creating and Inserting the Data - Creating a Database , Creating a Collection, Inserting Documents.

3. Querying Data - Basic Queries, Filtered Queries, Projection.

4. Find ,Updating and Deleting Data - Find Documents, Updating Documents, Deleting Documents

5. Indexing and Query optimization - Creating Indexes, Querying with Index

   Aggregation - Aggregation Pipeline
6. a) Create a more complex dataset with multiple documents.

   b) Use the aggregation framework to perform data transformations and analysis.

7. Operators in Mongodb - Arithmetic and Logical Operations.

   Full Text Search –
8. a) Enable and configure the text search index.

   b) Insert documents with text content and perform full-text search queries.

   CURD Operations in MONGODB. - Student Databse Agenda : Create
9. Database,Create Collection, Insert Data, Find, Find One, Sort, Limit,skip,distinct,projection.

10. Update Modifiers ($set,$unset,$inc,$push,$pushAll,$pull,$pullAll,$addToSet) Using Employee Database

11. Deleting Documents

12. Creating a Book Database Agenda : Create Database, Create Collection, Insert data,find,sort,limit,$all,$in.

RESOURCES

TEXTBOOKS:

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition ,2019.

REFERENCE BOOKS:

1. Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338)

2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=xh4gy1lbL2k
2. https://www.youtube.com/watch?v=0buKQHokLK8
3. https://www.youtube.com/watch?v=xQnIN9bW0og
4. https://www.youtube.com/watch?v=5LESkiqobbc

WEB RESOURCES:

1. https://www.ibm.com/cloud/learn/nosql-databases
2. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
3. https://www.geeksforgeeks.org/introduction-to-nosql/
4. https://www.javatpoint.com/nosql-databa

PROGRAM ELECTIVE

Subject Code	Subject Title	L	T	P	S	C
22MM201014	**INTERNET OF THINGS**	**3**	**-**	**-**	**-**	**3**

Pre-Requisite	22MM201002-Computer Networks
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION

Basic concepts of IoT, evolution, characteristics, advantages and disadvantages of IoT, principles of connected devices and internet connectivity, software for IoT applications, IoT security and vulnerabilities, IoT related used cases

COURSE OUTCOMES

After successful completion of the course, students will be able to:

CO1. Demonstrate the basic concepts of IoT to work with IoT environment.

CO2. Familiarize the principles of connected devices and internet connectivity

CO3. Develop the program for IoT applications

CO4. Demonstrate the IoT security and vulnerabilities

CO5. Develop various IoT related used cases and applications to solve real world problems.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO1	PSO2	PSO3
CO1	3									-	-	3
CO2	3									-	-	3
CO3	3		3							-	-	3
CO4	3									-	-	3
CO5	3		3		3					-	-	3
Course Correlation Mapping	3		3		3					-	-	3

Correlation Levels: 3: High;   2: Medium; 1: Low

COURSE CONTENT

Module 1:   BASICS OF IOT   (09 Periods)

Definition of "Internet of Things", Technological trends which have led to IoT, impact of IoT on society, History of IOT, How IOT works, IOT Applications, Characteristics of IoT, Challenges of IoT, Advantages of IoT, Disadvantages IOT, evolution of IOT.

Module 2:   PRINCIPLES OF CONNECTED DEVICES AND INTERNET   (09 Periods) CONNECTIVITY

IoT/M2M System Layers, Communication technologies, Data enrichment, Data consolidation and Data Management at Gateway, Ease of Designing and Affordability, Internet-based communication, IP addressing in IoT, Media Access control, Application Layer protocols.

Module 3:   PROTOTYPING AND DESIGNING THE SOFTWARE FOR IOT   (09 Periods) APPLICATIONS

Prototyping embedded device software, Devices, Gateways, Internet and Web/cloud services software development, Prototyping online component API and Web API.

Module 4:   IOT PRIVACY, SECURITY AND VULNERABILITIES   (09 Periods)

Vulnerabilities, security requirements and threat analysis, use cases and misuse cases, IoT security tomography and layer attacker model, identity management, access control, secure message communication, security models, profiles and protocols for IoT

Module 5:   IOT USE CASES AND APPLICATIONS   (09 Periods)

Smart lighting, Home intrusion detection, smart parking, weather monitor system, air pollution monitor, smart irrigation, smart grid, smart supply chain,

Total Periods: 45

EXPERIENTIAL LEARNING

1.   To write a program to sense the available networks using Arduino.

2.   To write a program to measure the distance using ultrasonic sensor and make LED blink using Arduino.

3.   To write a program to connect with the available Wi-Fi using Arduino

4.   To write a program to sense a finger when it is placed on the board Arduino.

RESOURCES

TEXT BOOKS:

1.   Rajkamal, *Internet of Things: Architecture and Design Principles,* McGraw Hill Education, 1st edition.

2.   Arshdeep Bahga and Vijay Madisetti, *Internet of Things: A Handson Approach*, Universities Press, 2nd Edition.

REFERENCE BOOKS:

1.   David Hanes, Gonzalo salgueiro, *IoT Fundamentals Networking Technologies, Protocols and Use Cases for Internet of Things,* Cisco Press Kindle Edition 2017.

2.   Adrian McEwen, Hakim, *Designing the Internet of Things,* Cassimally Paperback, 1st edition

3.   Andrew Minteer, *Analytics for the Internet of Things(IoT),* Kindle Edition 1st edition

VIDEO RESOURCES:

1. https://archive.nptel.ac.in/courses/106/105/106105166/
2. https://www.urduitacademy.com/courses/videos/54/990
3. https://www.tutorialspoint.com/iot-internet-of-things-for-beginner/index.asp

WEB RESOURCES:

1. https://www.studocu.com/in/document/jawaharlal-nehru-technological-university-hyderabad/computer-science-and-engineering/internet-of-things-complete-notes/17640878
2. https://www.tutorialspoint.com/internet_of_things/internet_of_things_tutorial.pdf
3. https://core.ac.uk/download/pdf/132530214.pdf
4. https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CA201001	**COMPUTATIONAL STATISTICS**	3	-	-	-	3

Pre-Requisite	-
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION: This course covers measures of Central Tendency, measures of Dispersion and basics of 'R' language. Fitting the Probability distributions of Discrete Probability Distributions, Continuous Probability Distributions and implementing the probability distributions in R. Correlation and Regression Analysis is done and able to calculate Correlation and Regression Coefficients along with fitting lines of Regression in R tool. Testing of hypothesis can be done for Large sample Tests and Small sample tests.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the concepts of descriptive statistics, basics in R, Probability Distributions, Testing of Hypothesis, Correlation and Regression.

CO2. Apply testing of hypothesis on small and large sample testing using Z-test, t-test, F-test and chi-square test and to draw the valid inferences and solve the problems on probability distributions.

CO3. Use R programming tools to Simulate Binomial, Poisson and Normal distributions, and calculate Correlation and Regression Coefficients, Fitting lines of Regression.

CO4. Analyze the relationship between variables using Correlation and Regression.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	2	3	-	-	-	-	-			
CO2	3	3	2	3	3	-	-	-	-			
CO3	3	3	3	3	3	-	-	-	-			
CO4	3	3	3	3	-	-	-	-	-			
Course Correlation Mapping	3	3	2.5	3	3	-	-	-	-			

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO DESCRIPTIVE STATISTICS   (10 Periods)

Measures of Central Tendency: The Arithmetic Mean, The Arithmetic Mean Computed from Grouped data, Median, Mode,   Empirical   Relation Between the   Mean, Median, and Mode, Geometric Mean, Harmonic Mean.

Measures of Dispersion: The Range, The Mean Deviation, The Semi- Interquartile Range, The Standard Deviation, The Variance, coefficient of variation and Moments, measures of Skewness and Kurtosis.

Module 2:   BASICS IN R   (09 Periods)

Basic concepts of R, R Studio, run R, Variables, Data Types, Vectors, Data Frames, Lists, Matrices, Arrays, Classes, Functions, and diagrammatical presentations in R.

Module 3:   PROBABILITY DISTRIBUTIONS   (09 Periods)

Discrete Probability Distributions: Binomial Distribution- Mean and variance and fitting of Binomial distribution; Poisson distribution -Mean and variance and fitting of Poisson distribution.

Continuous Probability Distributions: Normal Distribution- Mean, variance and area properties of Normal distribution.

Implementing in R: Simulate Binomial, Poisson and Normal distributions

Module 4:   CORRELATION AND REGRESSION ANALYSIS   (08 Periods)

Correlation Analysis: Linear Correlation, scatter diagram, Karl Pearson's coefficient of Correlation and Spearman's Rank correlation coefficient (with and without tied ranks).

Regression Analysis: Regression Lines, Fitting of two lines of Regression, Regression coefficients and multiple regression.

Implementing in R: Calculate Correlation and Regression Coefficients and Fitting lines of Regression.

Module 5:   TESTING OF HYPOTHESIS   (09 Periods)

Large sample Tests: Null hypothesis and Alternative hypothesis, Type-I and Type-II errors, Level of significance, Critical Region, one tailed and two tailed tests; Test of Significance of single proportion, Difference of two Proportions, Single mean, Difference of two Means.

Small sample tests: t-test: Single mean, Difference of two Means; F-test; chi-square test**:** chi-square test for independence of attributes, chi-square test for goodness of fit.

Total Periods: 45

EXPERIENTIAL LEARNING

I.   For **Covid 19 scenario,** do the following using R Programming tool:

Globally, the number of new weekly cases has continued to decline since the peak in January 2022. During the week of 30 May to 5 June 2022, over three million cases were reported, a 12% decrease as compared to the previous week. The number of new weekly deaths also continues to decline, with over 7,600 fatalities reported, representing a 22% decrease as compared to the previous week. As of 5 June 2022, over 529 million confirmed cases and over six million deaths have been reported globally.

a. Requirement gathering
   i.   Identify the variables and methods
   ii. Draw Histogram for statistical analysis
   iii. Write use cases for Patient information & Recovery percentage

b. Analysis
   i. Fit the Linear Regression model for the system
   ii. Draw Mathematical relationship to find the Patient information
   iii. Identify the Patient current condition and to provide right Medication

C. Design
   i.   Design Data Visualization for "patient entry "and conditions
   ii. Draw R-Chart based on the Statistical analysis.

d. Evaluate quality of design
Given R-Chart, diagrammatic Representation of Histogram, evaluation of mathematical relationships will provide the patient recovery percentage in Visualization

II.   **Do a MOOC on** Computational Statistics: https://www.my-

mooc.com/en/categorie/statistics-and-probability

RESOURCES

TEXT BOOKS:

1. T. K. V. Iyengar, B. Krishna Gandhi etal., "*Probability and Statistics*," S. Chand and Company ltd: New Delhi, 3rd Edition, 2011.
2. Allerhand M. "*Tiny Handbook of R,*" Springer Briefs in Statistics, 2011.

REFERENCE BOOKS:

1. Shanaz Bhatul, "*Probability and Statistics*", RIDGE Publications, 2nd Edition, 2006.
2. S.C. Gupta and V.K. Kapoor, "*Fundamentals of Applied Statistics,*" S.Chand and Sons, New Delhi, 2010.
3. Baayen R. "*Analyzing Linguistic Data - A Practical Introduction to Statistics using R,*" 2008.
4. Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, "*Beginner's Guide to R,*" Springer, 2009.

SOFTWARE/TOOLS:

1. R Programming
2. R studio

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=GuTd8Yb2jUk
2. https://www.youtube.com/watch?v=_V8eKsto3Ug

WEB RESOURCES:

1. http://www.nptelvideos.in/2012/11/probability-and-statistics.html.
2. https://www.classcentral.com/course/swayam-probability-and-statistics-5228.
3. https://www.coursera.org/browse/data-science/probability-and-statistics.

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22MM201012	**OPERATION RESEARCH**	3	-	-	-	3

Pre-Requisite - -

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: Requirements of Linear Programming Problem, Formulation, Graphical solution, Simplex method, Big-M method, Two Phase Method; Vogel"s approximation method; Modified distribution (MODI) method to find optimal solution; Two person zero sum games; Saddle point; Inventory costs and deterministic inventory control models; Project management
through network analysis.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply linear programming techniques to solve complex problems and obtain
Optimal solutions.

CO2. Analyze games through appropriate strategies to influence the game outcome.

CO3. Apply suitable inventory control models for cost reduction and simulate them.

CO4. Develop network models and solve project management issues involving diverse
Resources.

CO5. Apply queuing models to compute the relevant characteristics and simulate them.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	-	-	-	-	-			-
CO2	3	3	-	-	-	-	-	-	-			-
CO3	2	3	3	-	-	-	-	-	-			-
CO4	3	3	-	-	-	-	-	-	-			-
CO5	3	3	-	-	-	-	-	-	-			-
Course Correlation Mapping	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	-			**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   LINEAR PROGRAMMING PROBLEM   *(10 Periods)*

Requirements of Linear Programming Problem, Formulation, Graphical solution, Simplex method, Big-M method, Two Phase Method, Dual formulation, Dual Simplex Method, Linear Programming special cases- Infeasible solution, Unboundedness, Redundancy, Alternate Optimal solutions.

Module 2:   TRANSPORTATION AND ASSIGNMENT MODELS   *(08 Periods)*

Transportation model: Methods to find Basic Feasible Solution- North-West corner rule, Least cost method, Vogel's approximation method; Modified distribution (MODI) method to Find optimal solution, Special cases of transportation problems, Transshipment problem.
Assignment model: Hungarian method, Travelling Salesman Problem

Module 3:   GAME THEORY AND INVENTORY MODELS   *(09 Periods)*

Game Theory – Two person zero sum games, Saddle point, Pure strategy, Mixed strategy – Dominance, Algebraic method and Graphical method.
Inventory Models – Functions, Types, Associated costs, Factors involved in inventory problem analysis, Inventory costs and deterministic inventory control models - single item Inventory control models without shortages and with shortages, with quantity discounts.

Module 4:   NETWORK MODELS   *(10 Periods)*

Network Flow models – Minimal Spanning Tree, Shortest Path Problem and Maximal Flow Problem, Project management through network analysis- Critical Path Method, Program Evaluation Review Technique, Cost analysis and Crashing.

Module 5:   QUEUING AND SIMULATION   *(08 Periods)*

Queuing: Infinite queue length model, Poisson arrivals and Exponential service times - Single server and multi-server.
Simulation: Monte Carlo simulation, Simulation of a waiting line problem, Simulation of Inventory model.

                                                            Total Periods: 45

EXPERIENTIAL LEARNING

1. IBFS of Transportation problem by using North- West corner rule
2. IBFS of Transportation problem by using Matrixminimum method
3. IBFS of Transportation problem by using VAM
4. Solution of Assignment problem using Hungarian method
5. Traveling salesman problem
6. Solution of sequencing problem—processing of n jobs through two machines
7. Solution of sequencing problem - processing of n jobs through three machines
8. To perform Project scheduling of a given project (Deterministic case-CPM).
9. To perform Project scheduling of a given project (Probabilistic case-PERT).

RESOURCES

TEXT BOOKS:

1. Hamdy A Taha, *Introduction to Operations Research*, Pearson India, 10th Edition, 2017

2. J.K. Sharma, *Operations Research: Theory and Applications*, Macmillan, New Delhi, 5th Edition, 2013.

REFERENCE BOOKS:

1. Hillier, Libermann, *Introduction to Operations Research*, McGraw Hill Education(India)

Private

   Limited, 10th Edition, 2017.

3. KantiSwarup, P.K. Gupta, Manmohan, *Operations Research*, Sultan Chand & Sons, 2019.

VIDEO LECTURES:
1. https://www.digimat.in/nptel/courses/video/112106134/L01.html
2. https://www.youtube.com/watch?v=OwNPKGQ3UDY

Web Resources:
1. https://libguides.mines.edu/orwe/orgsandwebsources
2. https://www.bbau.ac.in/dept/UIET/EMER-601%20Operation%20Research%20Queuing%20theory.pdf

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22EC101701	**AI IN HEALTHCARE**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Concepts of Artificial Intelligence (AI) in Healthcare; The Present State and Future of AI in Healthcare Specialties; The Role of Major Corporations in AI in Healthcare; Applications of AI in Healthcare.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Understand the fundamental concepts of AI in Healthcare sector.

CO2 Analyse the present state and future of AI in Healthcare specialties for different scenarios.

CO3 Apply design concepts and metrics for AI in Healthcare.

CO4 Demonstrate basic concepts and terminologies of future applications of Healthcare in AI.

CO5 Develop AI applications through AI techniques for healthcare

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	2	-	-	-	-	-	-	-	-
CO2	2	3	-	2	-	2	2	-	-	-	-	-
CO3	2	-	2	2	-	-	-	-	-	-	-	-
CO4	2	-	-	-	2	2	-	-	-	-	-	-
CO5			3									
Course Correlation Mapping	2	-	3	2	2	2	2	-	-	-	-	-

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE IN HEALTHCARE *(08 Periods)*

Introduction to AI in Healthcare, Benefits & Risks, AI in the health sector, AI versus human intelligence, The future of AI in health sector, AI & Neural networks.

Module 2: THE PRESENT STATE & FUTURE OF AI IN HEALTHCARE SPECIALTIES *(10 Periods)*

Artificial Intelligence in: preventive healthcare, Radiology, Pathology, Surgery, Anesthesiology, Psychiatry, Cardiology, Pharmacy, Dermatology, Dentistry, Orthopedics, Ophthalmology.

Module 3: THE ROLE OF MAJOR CORPORATIONS IN AI IN HEALTHCARE *(08 Periods)*

IBM Watson, The role of Google & Deep mind in AI in Healthcare, Baidu, Facebook & AI in Healthcare, Microsoft & AI in Healthcare.

Module 4: FUTURE OF HEALTHCARE IN AI *(10 Periods)*

Evidence-based medicine, personalized medicine, Connected medicine, Virtual Assistants, Remote Monitoring, Medication Adherence, Accessible Diagnostic Tests, Smart Implantables, Digital Health and Therapeutics, Incentivized Wellness, Block chain, Robots, Robot-Assisted Surgery, Exoskeletons, Inpatient Care, Companions, Drones, Smart Places, Smart Homes, Smart Hospitals.

Module 5: APPLICATIONS OF AI IN HEALTHCARE *(09 Periods)*

Case Study 1: AI for Imaging of Diabetic Foot Concerns and Prioritization of Referral for Improvements in Morbidity and Mortality.

Case Study 2: Outcomes of a Digitally Delivered, Low-Carbohydrate, Type 2 Diabetes Self-Management.

Case Study 3: Delivering A Scalable and Engaging Digital Therapy.

Case Study 4: Improving Learning Outcomes for Junior Doctors through the Novel Use of Augmented and Virtual Reality for Epilepsy.

Case Study 5: Big Data, Big Impact, Big Ethics: Diagnosing Disease Risk from Patient Data.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Analyze how the artificial intelligence is used to predict the disease result and Prognosis Assessment of a patient.
2. How does drug discovery happen and how does AI is helping in drug discovery and Labs.
3. Justify that artificial intelligence provide engineering solutions for early detection and Diagnosis of diseases.
4. Demonstrate the prediction of bladder volume of a patient.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Dr. Parag Mahajan, *Artificial Intelligence in Healthcare*, MedManthra Publications, First Edition 2019.
2. Arjun Panesar, *Machine Learning and AI for Healthcare Big Data for Improved Health*, Apress Publications, 2019.

REFERENCE BOOKS:

1. Michael Matheny, Sonoo Thadaney Israni, Mahnoor Ahmed, and Danielle Whicher, *Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril*, National Academy of Medicine Publication, First Edition 2019.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=-aHBwTQQyNU
2. https://intellipaat.com/blog/artificial-intelligence-in-healthcare/

Web Resources:

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6616181/
2. https://www.ibm.com/topics/artificial-intelligence-healthcare
3. https://builtin.com/artificial-intelligence/artificial-intelligence-healthcare

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101701	**CYBER LAWS AND SECURITY**	3	-	-	-	3

Pre-Requisite –
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Cyber Crimes and Indian IT Act; Cyber Offenses; Tools and Methods used in Cyber Crime; Phishing ad Identity Theft; Indian and Global Perspective on Cyber Crimes and Cyber Security; Organizational Implications on Cyber Security; IPR Issues; Cyber
Crime and Terrorism; Cyber Crime Illustrations

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Demonstrate knowledge in Cyber security, Cybercrimes and its related laws in Indian and Global Act.
CO2. Analyze the legal perspectives and laws related to cybercrimes in Indian context.
CO3. Apply security and privacy methods in development of modern applications and in organizations to protect people and to prevent cybercrimes.
CO4. Solve Cyber security issues using privacy policies and Use antivirus tools to minimize the impact of cyber threats.
CO5. Apply security standards for the implementation of Cyber Security and laws.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2										
CO2	3	2										
CO3	3	2	3									
CO4	3	2	3									
CO5	3	2	2									
Course Correlation Mapping	**3**	**2**	**3**									

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO CYBER CRIMES AND OFFENSES   *(09 Periods)*
Cyber Crimes: Introduction, Definition, Origin, Cybercrime and information security, Cyber criminals, Classifications of cybercrimes, The legal perspectives and Indian perspective, Cybercrime and Indian ITA 2000, Global perspective on cybercrimes.
Cyber Offenses: Introduction, Criminals planning on attacks, Social engineering, Cyber stalking, Cyber cafe and crimes, Botnets.

Module 2:   TOOLS AND METHODS USED IN CYBER CRIME AND   *(09 Periods)*
**   PHISHING AND IDENTITY THEFT**
Introduction, Proxy servers and Anonymizers, Phishing, Password cracking, Key loggers and Spywares, Virus, Worms and Ransomware, Trojan horses and Backdoors, Steganography, DoS and DDoS attacks.
Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).
Module 3   CYBER   CRIMES   AND   CYBER   SECURITY-LEGAL   *(08 Periods)*
**   PERSPECTIVES**

Introduction, Cyber laws in Indian context, The Indian IT act, Challenges to Indian law and Cybercrime scenario in India, Consequences of not addressing the weakness in IT act, Digital signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber law, Technology and Students in India scenario.

Module 4   CYBER SECURITY-ORGANIZATIONAL IMPLICATIONS   *(10 Periods)*
Introduction, Web threats for organizations – evils and perils, Security and privacy implications from cloud computing, Social Media Marketing-Security risks and Perils for organizations, Social computing and associated challenges for organizations, Protecting people's privacy in organization, Organizational guidelines for internet usage, Safe computing and Usage policy, Incident handling and Best practices.

Module 5   CYBER CRIME AND TERRORISMAND ILLUSTRATIONS   *(09 Periods)*
Cyber Crime & Terrorism: Introduction, Intellectual property in the cyber space, The ethical dimension of cybercrimes, The psychology, Mindset and skills of hackers and cyber criminals, Sociology of cyber criminals, Information warfare.
Cyber Crime Illustrations: Indian banks lose millions of rupees, Justice vs. Justice, Parliament attack, The Indian case of online gambling, Bank and credit card related frauds, Purchasing goods and services scam, Nigerian 419 scam.

Total Periods: 45

EXPERIENTIAL LEARNING

1. The Cyber Security Risks on Social Media – Learn from Case Studies: https://www.rswebsols.com/tutorials/internet/cyber-security-risks-social-media
2. SIX automates key cybersecurity tasks to actively protect itself against social media threats: https://www.hootsuite.com/resources/six-group-case-study
3. Important Cyber Law Case Studies : https://www.cyberralegalservices.com/detail-casestudies.php
(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES
TEXT BOOKS:
1. Nina Gobole, SunitBelapure, *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Wiley India, 2011.
REFERENCE BOOKS:
1. Prashant Mali, *Cyber Law and Cyber Crimes*, Snow White Publications Pvt. Ltd., 2013.
2. Alfred Basta and et al, *Cyber Security and Cyber Laws*, Cengage Learning India 2018

VIDEO LECTURES:
1. Learn Cyber Security | Cyber Security Training:
    https://www.youtube.com/watch?v=PlHnamdwGmw
2. Cyber Security For Beginners: https://www.youtube.com/watch?v=4RE4d23tDFw
WEB RESOURCES:
1. https://study.com/academy/course/computer-science-110-introduction-to-cybersecurity.html
2. https://www.pandasecurity.com/en/mediacenter/panda-security/types-of-cybercrime/
3. https://mediasmarts.ca/digital-media-literacy/digital-issues/cyber-security/cyber-security-spam-scams-frauds-identity-theft

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101703	**FORENSIC SCIENCE**	3	-		-	3

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion on Concepts of Forensic Science, Tools and Techniques in Forensic Science, Forensic Photography, Crime Scene Management, Crime Scene Management Laws and Forensic Science.

COURSE OUTCOMES: *After successful completion of the course, students will be able to*:

CO1   Understand the basic concepts of Forensic science.

CO2   Apply various tools and techniques in forensic science for crime investigation.

CO3   Understand Forensic Photography fundamentals.

CO4   Perform Crime scene investigation, scene reconstruction and prepare reports.

CO5   Understand Legal aspects of Forensic Science.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3											
CO2	3	3	2	2	2							
CO3	3	3										
CO4	3	3	2	2	2							
CO5	3	3	2	2	2							
Course Correlation Mapping	**3**	**3**	**2**	**2**	**2**							

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION   *(09 Periods)*

Introduction, Need, Scope, Concepts and Significance of Forensic Science, History and Development of Forensic Science, Laws and Basic principles of Forensic Science, Branches of forensic science, Organizational set-up of a Forensic Science Laboratory. Investigative strategies. Expert testimony and eye-witness report.

Module 2:   TOOLS AND TECHNIQUES IN FORENSIC SCIENCE   *(09 Periods)*

Basic principles of microscopy, spectroscopy, chromatography, Electrophoresis, Enzyme_Linked Immunosorbent Assay (ELISA), Radio Immuno Assay (RIA). Measuring and optical instruments. Research methodologies; Formation of research design on a specific problem. Central tendency and Dispersion. Test of significance.

Analysis of variance, Correlation and Regression.

Module 3: FORENSIC PHOTOGRAPHY   *(8 Periods)*

Basic principles of Photography, Techniques of black & white and color photography, cameras, lenses, shutters, depth of field, film; exposing, development and printing techniques; Different kinds of developers and fixers; UV, IR, fluorescence illumination guided photography; Modern development in photography- digital photography, working and basic principles of digital photography; Surveillance photography. Videography and Crime Scene & laboratory photography.

Module 4: CRIME SCENE MANAGEMENT   *(11 Periods)*

Crime scene investigations, protecting and isolating the crime scene; Documentation, sketching, field notes and photography. Searching, handling and collection, preservation and transportation of physical evidences, Chain of custody and Reconstruction of scene of crime. Report writing.

Module 5: LAW AND FORENSIC SCIENCE   *(8 Periods)*

Legal aspects of Forensic Science: Forensic Science in the Criminal Justice System, The Criminal Investigation Process, Production of Evidence: The Subpoena, The Rules of Evidence, Authentication of Evidence: The Chain of Custody, The Admissibility of Evidence, Laboratory Reports, Examples of Analysis and Reports, Expert Testimony, Getting into Court, Testifying, Being a Witness and an Expert, Considerations for Testimony.

Total Periods: 45

EXPERIENCIAL LEARNING
1.   Study of Computer Forensics and different tools used for forensic investigation
2.   **Identify and list the steps for hiding and extract any text file behind an image file/ Audio file using Command Prompt**

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Houck M.M and Siegel J.A, *Fundamentals of Forensic Science*, Elsevier, 2nd edition, 2010.
2. Sharma B.R, *Forensic Science in Criminal Investigation and Trials*, Universal Publishing Co., New Delhi, 2003.

REFERENCE BOOKS:

1. Nanda B.B and Tewari, R.K, *Forensic Science in India- A vision for the Twenty First Century*, Select Publisher, New Delhi, 2001.
2. James, S.H and Nordby, J.J, *Forensic Science- An Introduction to Scientific and Investigative Techniques*, CRC Press, USA, 2003.
3. Saferstein, Criminalistics, *An Introduction of Forensic Science*, Prentice Hall Inc, USA,2007.
4. Barry, A.J. Fisher, *Techniques of Crime Scene Investigation*, CRC Press, NewYork, 7th edition, 2003.

VIDEO LECTURES:

1.   https://nptel.ac.in/courses/106106178
2.   https://www.youtube.com/watch?v=X5fo1H7bc0g

WEB RESOURCES:

1.   https://www.nist.gov/forensic-science
2.   https://www.coursera.org/learn/forensic-science

University Elective

Course Code	Course Title	L	T	P	S	C
22ME101704	**MANAGING INNOVATION AND ENTERPRENEURSHIP**	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION:

Evolution of entrepreneurship from economic theory Managerial and entrepreneurial competencies; Concepts of Shifting Composition of the Economy Purposeful Innovation & Sources of Innovative Opportunity; The Innovation Process; Innovative Strategies; Entrepreneurial Motivation; Entrepreneurs versus inventors; Ethics and International Entrepreneurship; Strategic Issues in International Entrepreneurship; Problem solving Innovation and Diversification

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO1. Demonstrate the principles of innovation process for establishing Industrial ventures.

CO2. Identify and analyze the gaps in an organization for innovation in the context of developed economies

CO3. Develop a comprehensive and well-planned business structure for a new venture.

CO4. Demonstrate knowledge on intellectual property rights, patents, trademarks, copyrights, trade secrets and commercialization of intellectual property.

CO5. Apply ethics in constructive innovation framework and problem solving.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1		1	1	1	1			1	
CO2	3	2	1		1						1	
CO3	3	3	1	1	1						1	
CO4	3	2	1	1	1	1					1	
CO5	3	3	3	1	1	1					2	
Course Correlation Mapping	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**			**1**	

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   CREATIVITY AND INNOVATION   *(09 Periods)*

Introduction, Levels of innovation, Purposeful innovation and the sources of innovative opportunity, The innovation process, Innovative strategies, Strategies that aim at introducing and innovation, Dynamics of ideation and creativity – Inbound, Outbound; Context and process of new product development, Theories of outsourcing.

Module 2:   PARADIGMS OF INNOVATION   *(09 Periods)*

Systems approach to innovation, Innovation in the context of developed economies and

Emerging economies, Examining reverse innovation and itsapplication,Performancegap,Infrastructuregap,Sustainabilitygap,Regulatory gap, Preference gap, organizational factors effecting innovation at firm level.

Module 3:   SOUCES OF FINANCE AND VENTURE CAPITAL   *(09 Periods)*

Importance of finance, Comparison of venture capital with conventional development capital, Strategies of venture funding, Investment phases, Investment process, Advantages and disadvantages of venture capital, Venture capital developments in India.

Module 4:   INTELLECTUAL PROPERTY INNOVATION AND   *(09 Periods)*
**   ENTREPRENEURSHIP**

Introduction to Entrepreneurship, Evolution of entrepreneurship from economic theory, Managerial and entrepreneurial competencies, Entrepreneurial growth and development, Concepts, Ethics and Nature of International Entrepreneurship, Intellectual property – forms of IP, Patents, Trademarks, Design registration, Copy rights, Geographical indications, Patent process in India.

Module 5:   OPEN INNOVATION FRAME WORK & PROBLEM   *(09 Periods)*
**   SOLVING**

Concept of open innovation approach, Difference between open innovations and Cloud innovation approaches, Limitations and Opportunities of open innovation frame work, Global context of strategic alliance, Role of strategic alliance, Problem Identification and Problem Solving, Innovation and Diversification

                                                                    Total Periods:45

EXPERIENTIAL LEARNING

1. Identify the Innovative Marketing Strategies for Startups

2. Identify the Coca-cola Company Intellectual Property Rights

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

CASE STUDIES/ARTICELS:

Contemporary relevant case studies/ Articles will be provided by the course instructor at the beginning.

1. Tesla Inc.: Disrupting the Automobile Industry
    This case study examines how Tesla Inc. disrupted the traditional automobile industry through its innovative electric vehicles and sustainable energy solutions. It discusses the sources of innovative opportunity that Tesla leverages, the ideation and creativity dynamics involved in new product development, and the strategies that the company uses to introduce and market its innovations.
2. Google Inc.: Innovation in Developed Economies
    This case study explores how Google Inc. became a global leader in the technology industry through its innovative search engine, advertising, and cloud computing solutions. It highlights the performance gap that Google addressed, the regulatory and sustainability gaps that it leveraged, and the impact of its innovation strategies on the company's growth and profitability.

3. Flipkart: From Startup to Unicorn
    This case study examines how Flipkart, an Indian e-commerce company, secured venture capital funding to become one of the largest online marketplaces in India. It discusses the importance of finance in entrepreneurship, the advantages and disadvantages of venture capital, and the strategies that Flipkart used to attract venture funding.

4. Patanjali Ayurved: Building a Brand through Intellectual Property
    This case study explores how Patanjali Ayurved, an Indian consumer goods company, built a strong brand through its intellectual property strategies. It discusses the forms of IP that Patanjali leverages, the patent process in India, and the impact of IP on the company's growth and profitability.

5. Procter & Gamble: Innovation through Open Innovation
    This case study analyzes how Procter & Gamble, a global consumer goods company, leveraged open innovation to achieve unprecedented success in product development and marketing. It discusses the difference between open and cloud innovation approaches, the limitations and opportunities of open innovation, and the role of strategic alliances in global innovation.

RESOURCES
TEXT BOOKS:

1. Vinnie Jauhari, Sudhanshu Bhushan, *Innovation Management*, Oxford University Press, 1st Edition, 2014.
2. Drucker, P.F., *Innovation and Entrepreneurship*, Taylor & Francis, 2nd Edition, 2007.

REFERENCE BOOKS:

1. Robert D Hisrich*,* Claudine Kearney*, Managing Innovation and Entrepreneurship,* Sage Publications, 1st Edition*,* 2014.
2. V.K. Narayanan, *Managing Technology and Innovation for Competitive Advantage,* Pearson India, 1st Edition, 2002.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=wWsl48VLfVY
2. https://www.youtube.com/watch?v=dDpQ9ALKX0U
3. https://www.youtube.com/watch?v=Eu_hkxkJGTg

UNIVERSITY ELECTIVE

Course Code	Course Title	L T P S C
22LG201701	**PERSONALITY DEVELOPMENT**	3 - - - 3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course gives awareness to students about the various dynamics of personality development.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge in Self-Management and Planning Career

CO2. Analyze the functional knowledge in attitudes and thinking strategies

CO3. Learn and apply soft skills for professional success.

CO4. Function effectively as an individual and as a member in diverse teams

CO5. Communicate effectively in public speaking in formal and informal situations.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	3	-	-	-	-	2	-	-
CO4	1	1	-	-	-	-	-	-	3	3	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	2	2	3	-	3	-	-	-	3	3	-	-

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   SELF-ESTEEM & SELF-IMPROVEMENT   *(09 Periods)*

Know Yourself – Accept Yourself; Self-Improvement: Plan to Improve - Actively Working to Improve Yourself- Exercises- case studies

Module 2:   DEVELOPING POSITIVE ATTITUDES   *(09 Periods)*

How Attitudes Develop – Attitudes are Catching – Improve Your Attitudes – Exercises- case studies

Module 3   SELF-MOTIVATION & SELF-MANAGEMENT   *(09 Periods)*

Show Initiative – Be Responsible Self-Management; Efficient Work Habits – Stress Management – Employers Want People Who can Think – Thinking Strategies- Exercises- case studies

Module 4   GETTING ALONG WITH THE SUPERVISOR   *(09 Periods)*

Know your Supervisor – Communicating with your Supervisor – Special Communication with your Supervisor – What Should you Expect of Your Supervisor? – What your Supervisor expe of you - Moving Ahead Getting Along with your Supervisor- Exercises- case studies

Module 5   WORKPLACE SUCCESS   *(09 Periods)*

First Day on the Job – Keeping Your Job – Planning Your Career – Moving Ahead- Exercises- case studies

                                                            Total Periods: 45

EXPERIENTIAL LEARNING

1. List out the self-improvements in you on the charts and explain in detail.

2. Discuss different famous personalities and their attitudes.

3. Describe different personalities with respect to self-motivation and self-management.

4. Imagine you are a supervisor and illustrate different special communications.

5. Assume and Interpret different experiences on the first day of your job.

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

RESOURCES

TEXTBOOK:

1. Harold R. Wallace and L. Ann Masters, *Personal Development for Life and Work*, Cengage Learning, Delhi, 10th edition Indian Reprint, 2011. (6th Indian Reprint 2015)
2. Barun K. Mitra, *Personality Development and Soft Skills,* Oxford University Press, 2011.

REFERENCE BOOKS:

1. K. Alex, *Soft Skills*, S. Chand & Company Ltd, New Delhi, 2nd Revised Edition, 2011.
2. Stephen P. Robbins and Timothy A. Judge*, Organizational Behaviour*, Prentice Hall, Delhi, 16th edition, 2014

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=6Y5VWBLi1es
2. https://www.youtube.com/watch?v=H9qA3inVMrA

Web Resources:

1. https://www.universalclass.com/.../the-process-of-perso...
2. https://www.ncbi.nlm.nih.gov/pubmed/25545842
3. https://www.youtube.com/watch?v=Tuw8hxrFBH8

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22SS101706	**WOMEN EMPOWERMENT**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Concept & Framework, Status of Women, Women's Right to Work, International Women's Decade, and Women Entrepreneurship.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Demonstrate the knowledge of the characteristics and achievements of empowered women and women's empowerment techniques by analyzing women's legal and political status.

CO2 Apply the knowledge of women's rights by analyzing various societal issues and obstacles in different fields, including science and technology.

CO3 Demonstrate the knowledge of the significance of women's participation in policy debates, National conferences, and common forums for equality and development by identifying and analyzing issues.

CO4 Analyze the concept of women's entrepreneurship, government schemes, and entrepreneurial challenges and opportunities.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1	-	-	1	3	-	1	–	–	-	-
CO2	3	1	-	-	-	2	-	-	-	–	-	-
CO3	3	1	-	-	-	2	-	-	-	3	-	-
CO4	3	1	-	-	-	-	-	-	-	-	2	-
Course Correlation Mapping	3	1	-	-	1	3	-	1	–	3	2	-

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   CONCEPT & FRAMEWORK   *(09 Periods)*

Introduction– Empowered Women's Characteristics – Achievements of Women's Empowerment **Concept of Empowerment:** Meaning & Concept – Generalizations about Empowerment – Empowerment Propositions – Choices women can make for empowerment – Women's participation in decision making, development process & in Governance. **Framework for Empowerment** – Five levels of equality – Tenets of Empowerment– Elements – Phases and aspects – Techniques – Categories and Models – Approaches.

Module 2:   STATUS OF WOMEN   *(09 Periods)*

Legal Status: Present Scenario – Call for Social Change – Significant Trends – Legal & Schemes – Personal Law – Joint Family – Criminal Law – Shift towards Dowry – Deterrent Punishment – Criminal Law (II Amendment) – Discrimination in Employment.

Political Status: Present Scenario – Political Participation & its NatureSocio–economic Characteristics – Political Mobilization: Mass Media – Campaign Exposure – Group Orientation – Awareness of issues and participation – Progress & Future Thrust.

Module 3:   WOMEN'S RIGHT TO WORK   *(09 Periods)*

Introduction – Present Scenario – Changes in Policy & Programme – National Plan of Action– Women's Cells and Bureau – Increase in the work participation rate – Discrimination in the labour market – Women in unorganized sector – Issues and Obstacles– Women in Education – Women in Science & Technology – Case Study: Linking Education to Women's Access to resources.

Module 4:   WOMEN'S PARTICIPATORY DEVELOPMENT   *(09 Periods)*

Dynamics of social change – conscious participation – Information Explosion – Organized Articulation – National Conference – Common Forums – Participatory Development – New Issues Identified – Role of other Institutions.

Module 5:   WOMEN ENTREPRENEURSHIP   *(09 Periods)*

Introduction – Definition – Concept – Traits of women Entrepreneurs – Role of Women Entrepreneurs in India – Reasons for Women Entrepreneurship – Government schemes & Financial Institutions to develop Women Entrepreneurs – Key policy recommendations – Project Planning – Suggestions and measures to strengthen women entrepreneurship – Growth & Future challenges – Training and Opportunities – Case Study: Training Women as Hand–pump Mechanics– Case Study: Literacy for Empowering Craftswomen

Total Periods: 45

EXPERIENTIAL LEARNING

1. Prepare poster presentation on "impact of women's self-help groups on their empowerment and socio-economic development."
2. Prepare a comparative analysis chart on the status of women in various countries.
3. Prepare a presentation on women and cultural responsibilities in different societies.
4. Prepare a presentation on the women of the past, present and future in terms of responsibilities and duties.
5. Prepare a presentation on the great women entrepreneurs of India.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. SahaySushama, *Women and Empowerment,* Discovery Publishing House, New Delhi, 2013.
2. NayakSarojini, Jeevan Nair, *Women's Empowerment in India*, Pointer Publishers, Jaipur, 2017.

REFERENCE BOOKS:

1. Baluchamy. S, *Women's Empowerment of Women*, Pointer Publishers, Jaipur, 2010.
2. Khobragade Grishma, *Women's Empowerment: Challenges and Strategies Empowering Indian Women*, Booksclinic Publishing, Chhattisgarh, 2020.

Web Resources:

1. https://www.economicsdiscussion.net/entrepreneurship/women–entrepreneurs–in–india
2. https://www.businessmanagementideas.com/entrepreneurship–2/women entrepreneurs

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CE201701	**DISASTER MANAGEMENT**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on disaster prone areas in India, repercussions of disasters and hazards, disaster preparedness and management, risk assessment and disaster management.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze the vulnerability of an area to natural and man-made disasters/hazards as per the guidelines to solve complex problems using appropriate techniques ensuring safety, environment and sustainability.

CO2. Analyze the causes and impacts of disasters using appropriate tools and techniques and suggest mitigation measures ensuring safety, environment and sustainability besides communicating effectively in graphical form.

CO3. Suggest the preparedness measures using appropriate tools and techniques and suggest mitigation measures ensuring safety, environment and sustainability.

CO4. Analyze the Risk Assessment using appropriate tools and techniques and suggest mitigation measures ensuring safety, environment and sustainability.

CO5. Design disaster management strategies to solve pre, during and post disaster problems using appropriate tools and techniques following the relevant guidelines and latest developments ensuring safety, environment and sustainability besides communicating effectively in graphical form.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	-	2	2	2	2	2	-	-	-	-
CO2	3	3	-	2	2	2	2	-	-	2	-	-
CO3	3	3	-	2	2	2	2	-	-	-	-	-
CO4	3	3	-	3	2	2	2	-	-	-	-	-
CO5	3	2	3	2	2	2	1	2	-	1	3	2
Course Correlation Mapping	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**2**	**3**	**2**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1: DISASTER PRONE AREAS IN INDIA   *(09 Periods)*
Introduction: Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types And Magnitude. **Disaster Prone Areas:** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.

Module 2: REPERCUSSIONS OF DISASTERS AND HAZARDS   *(09 Periods)*
Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Module 3: DISASTER PREPAREDNESS AND MANAGEMENT   *(11 Periods)*
Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Module 4: RISK ASSESSMENT   *(08 Periods)*
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Module 5: DISASTER MANAGEMENT   *(08 Periods)*
Disaster management organization and methodology, Disaster management cycle, Disaster management in India – Typical cases and Cost–benefit analysis, Disaster management programs implemented by NGOs and Government of India, Usage of GIS and Remote sensing techniques in disaster management, Leadership and Coordination in Disaster management, Emerging trends in disaster management.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Perform hazard assessment and vulnerability analysis for any nearby town/city and prepare a detailed report of possible impacts of various disasters on environment, infrastructure and development.

2. Prepare a detailed report on the causes and effects of Tsunami that was occurred in the year 2004. Also discuss various advancements in Tsunami warning systems.

3. Identify the major causes of urban floods in cities like Chennai, Hyderabad & Mumbai. Also list various mitigation strategies to reduce the impact of floods.

4. Prepare a detailed report on how various man-made activities are directly/indirectly related to the occurrence of landslides that occurred in recent days in India.

5. Visit AP State Disaster Response and Fire Services Department and record about various methods used by them in mitigating disasters and their management.

RESOURCES

TEXT BOOKS:

1. Sharma V. K., Disaster Management, Medtech Publishing, 2nd Edition, 2013.

2. Anand S. Arya, Anup Karanth, and Ankush Agarwal, Hazards, Disasters and Your Community: A Primer for Parliamentarians, GOI–UNDP Disaster Risk Management Programme, Government of India, National Disaster Management Division, Ministry of Home Affairs, New Delhi, Version 1.0, 2005

REFERENCE BOOKS:

1. Donald Hyndman and David Hyndman, Natural Hazards and Disasters, Cengage Learning, USA, 5th Edition, 2015.
2. Disaster Management in India, A Status Report, Ministry of Home Affairs, Govt. of India, May 2011.
3. Rajendra Kumar Bhandari, Disaster Education and Management: A Joyride for Students, Teachers, and Disaster Managers, Springer India, 2014.
4. Singh R. B., Natural Hazards and Disaster Management, Rawat Publications, 2009.
5. R. Nishith, Singh AK, Disaster Management in India: Perspectives, issues and strategies, New Royal book Company.
6. Sahni, PardeepEt.Al. (Eds.), Disaster Mitigation Experiences And Reflections, Prentice Hall of India, New Delhi.
7. Goel S. L. , Disaster Administration And Management Text And Case Studies, Deep &Deep Publication Pvt. Ltd., New Delhi

VIDEO LECTURES:

1. https://nptel.ac.in/courses/105104183

2. https://www.digimat.in/nptel/courses/video/124107010/L01.html

Web Resources:

1. https://egyankosh.ac.in/handle/123456789/25093

2. https://www.egyankosh.ac.in/handle/123456789/25912

3. https://www.nios.ac.in/media/documents/333courseE/12.pdf

4. https://ndmindia.mha.gov.in/images/public-awareness/Primer%20for%20Parliamentarians.pdf