SNDT Women's University, Mumbai

Master of Computer Applications in Management

(MCA-M)

as per NEP-2020

Syllabus

(2023-24)

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* Passed in BOS under the faculty of Management studies.

Programme Degree e.g. M.A./M.Com./M.Sc./ M.M.S., etc.		Master of Computer Applications (MCA)
Parenthesis if any (Specialization) e.g. History, Human Development, English, etc.		
Preamble (Brief Introduction to the programme)		The name of the programme shall be Masters of Computer Applications (M.C.A) The revised MCA Curriculum 2020 builds on the implementation of the Choice Based Credit System (CBCS) and Grading System in alignment with NEP 2020. The curriculum takes the MCA programme to the next level in terms of implementing Outcome Based Education along with the Choice Based Credit System (CBCS) and Grading System. The Institutes should organize placement programme for M.C.A. students by interacting with Industries and software consultancy. At the end of each semester, appearing for various certifications is possible for each student enabling them to make their resume rich. With the rapidly changing scenario industry and academia should identify possible areas of collaboration and work together. Institute's placement cell should focus on identifying industrial expectations and institutional preparation for meeting industrial needs.

Programme Outcomes (POs) *Action Verbs demonstrating (Major) discipline-related knowledge acquisition, mastery over cognitive and professional, vocational skills are to be used* *e.g. demonstrate sound understanding of.., analyse, compare, create, design, etc...* *(minimum 5)*		After completing this programme, Learner will
		Ability to apply computing fundamentals, specialization, mathematics, and domain knowledge to abstract and conceptualize models, solve complex problems, and use research-based methods.
		Develop and adapt methodologies, resources, and modern tools for complex computing activities, considering public health, safety, cultural, sociological, and environmental factors in designing solutions.
		Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.
		Develop independent study skills for career advancement in computing; effectively communicate complex tasks to the community and the public through reports, documentation, persuasive presentations and clear instructions.
		Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.
		Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.
		Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.

Eligibility Criteria for Programme		Applicant/Candidate must be a female. Appeared for MH-CET/SNDTWU'S JDBIMSR ENTRANCE EXAM. Scored at-least 60% in all her academic journey. Total Seats: 120
Intake (For SNDT WU Departments and Conducted Colleges)		120

MCA – in Management

As per NEP (AY-2023-24)

SEMESTER				1Credit = 25Marks TotalCredits = 88 TotalMarks = 88*25 = 2200
I	II	III	IV	
22	22	22	22	

SEMESTER-I

Code	Subject	Typeof Course	L	Pr.	Cr.	Int.Exam.	Ext.Exam.	Total Marks
116411	**OperatingSystems**	Major (Core)	4	-	4	50	50	100
116412	**DataCommunicationsandNetworking**	Major(Core)	4	-	4	50	50	100
116413	**DataStructuresandAnalysisofAlgorithm**	Major(Core)	2	-	2	0	50	50
116424	**DataStructuresandAnalysisofAlgorithm-Lab**	Major (Core)	-	2	2	25	25	50
116425	**OperatingSystems-Lab**	Major (Core)	-	2	2	25	25	50
	Elective-I- Management Subjects	Major (Elective)	4	-	4	50	50	100
136411	**ResearchMethodology**	Minor Stream (RM)	4	-	4	50	50	100
	Total				**22**	**250**	**300**	**550**

SEMESTER-II

Code	Subject	Type of Course	L	Pr.	Cr.	Int.Exam.	Ext.Exam.	Total Marks
216411	Advanced JAVA	Major (Core)	4	-	4	50	50	100
216412	DatabaseManagementSystems	Major (Core)	4	-	4	50	50	100
216413	WebTechnology	Major (Core)	2	-	2	50	0	50
216424	Advanced JAVA-Lab	Major (Core)	-	2	2	25	25	50
216425	Database Management Systems-Lab	Major (Core)	-	2	2	25	25	50
	Elective-II- Management Subjects	Major (Elective)	4	-	4	50	50	100
256431/ 246441	RP/OJT	RP/OJT		4	4	50	50	100
	Total				22	300	250	550

SEMESTER-III

Code	Subject	Typeof Course	L	Pr.	Cr.	Int.Exam.	Ext.Exam.	TotalMarks
316411	**Applied Statistical Methods**	Major (Core)	4	-	4	50	50	100
316412	**Big Data Analytics**	Major (Core)	4	-	4	50	50	100
316413	**Business Intelligence**	Major (Core)	2	-	2	0	50	50
316424	**Applied Statistical Methods-Lab- Using R**	Major (Core)	-	2	2	25	25	50
316425	**Data science and Analytics lab - Using Python)**	Major (Core)	2	-	2	25	25	50
	Elective-III- Management Subjects	Major (Elective)	4	-	4	50	50	100
356431	**RP**	RP	4	-	4	50	50	100
	Total				**22**	**250**	**300**	**550**

SEMESTER-IV

Code	Subject	Type of Course	L	Pr.	Cr.	Int.	Ext.	Total
416411	Block Chain Technology	Major (Core)	4	-	4	50	50	100
416412	Managerial Economics	Major (Core)	4	-	4	50	50	100
416413	Software Engineering	Major (Core)	2	-	2	0	50	50
416424	**Software Testing and Quality Assurance Lab**	Major (Core)	-	2	2	50	0	50
	Elective-IV- Management / CS & IT Subjects	Major (Elective)	4		4	50	50	100
446441	**OJT**	OJT/R	6		6	100	50	150
	Total				**22**	300	250	**550**

	Elective-I-Management Subjects		**Elective-II- Management Subjects**
126411	Principles & Practices of Management	226411	Digital Business
126412	Fundamentals of Organization Behavior	226412	Entrepreneurship Development

	Elective-III- Management Subjects		**Elective-IV**
326411	Enterprise Performance Management	426411	Artificial Intelligence
326412	Strategic Management	426412	Project Management

SN	Courses, Modules and Outcomes	Course Contents	Cr
	Semester I		
116411	**Operating Systems** **Major (Core)**		**4**
	Course Outcomes: **Learners will be able to:** • Demonstrate a comprehensive understanding of the fundamental concepts of operating systems, including computer-system organization, architecture, and key components. • Apply knowledge of process concepts, scheduling algorithms, and inter-process communication to effectively manage processes, including multithreading models and associated issues. • Exhibit competence in memory management, encompassing swapping, contiguous memory allocation, paging, segmentation, and virtual memory management techniques. • Acquire skills in file management, covering file concepts, access methods, directory structures, and file protection, as well as I/O management techniques and disk management. • Understand the types and structures of distributed operating systems, network topologies, communication protocols, and key design issues in distributed systems. • Master the concepts of distributed file systems, including naming transparency, remote file access, and considerations for stateful versus stateless services. • Develop problem-solving and critical-thinking skills to analyze and address challenges related to deadlocks, file-system implementation, distributed coordination, and security issues in computing environments.		
Module 1	**Introduction to Operating Systems(OS)**		1
	LOs: Learners will be able to • Understand the fundamental concepts of operating systems, including computer-system organization and architecture. • Apply knowledge of process management, including process scheduling and inter-process communication, in practical scenarios. • Demonstrate proficiency in navigating the user operating system interface, system calls, and system programs. • Analyze and discuss the design and implementation aspects of operating systems, with a focus	**Module Contents:** Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security, Distributed Systems, Special-Purpose Systems, Computing Environments. Operating-System Services, User Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating-System Structure, Virtual Machines, Operating-System Generation.	

	on virtual machines. • Gain a foundational understanding of computing environments, encompassing memory management, storage, protection, and security		
Module 2	**Process Management, Process Coordination, Memory Management and Virtual Memory Management**		1
	LOs: Learners will be able to • Apply a solid understanding of the process concept, demonstrating proficiency in process scheduling and related operations. • Evaluate and implement various process scheduling algorithms in diverse computing scenarios. • Understand and apply concepts of process coordination, including synchronization, semaphores, and deadlock prevention strategies. • Gain practical skills in managing multiple processors through efficient thread scheduling and coordination mechanisms.	**Module Contents:** • Processor Management: Process concept, Process scheduling, Operations on Processes, Inter-process Communication, Multithreading models, threading issues, Process scheduling algorithms, Thread scheduling, Multiple processor Scheduling. Process Coordination: Synchronization, Semaphores, Monitors, Deadlocks characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock Avoidance, Deadlock detection, recovery from deadlock. • Memory Management:Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation • Virtual memory Management: Demand Paging, Copy-on-Write, Page replacement, Allocation of Frames, Thrashing.	
Module 3	**File Management, I/O Management, Disk management, Distributed systems, Distributed File Systems, Distributed Coordination**		1
	LOs: • Apply knowledge of memory management techniques, including swapping, contiguous memory allocation, and paging. • Evaluate virtual memory management strategies, such	**Module Contents:** • File Management: File Concept, File Access Methods, and Directory Structure, File Sharing, File Protection, File-System Structure, File-System Implementation, Directory Implementation, Allocation	

	as demand paging, copy-on-write, and page replacement algorithms. • Gain proficiency in analyzing and addressing challenges related to thrashing and efficient allocation of frames in virtual memory. • Gain insights into log-structured file systems, NFS, and performance considerations in I/O management.	Methods, Free-Space Management, Efficiency and Performance, Recovery, Log-Structured File Systems, NFS. • I/O Management: I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to Hardware Operations, STREAMS, Performance. • Disk Management: Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure, Stable - Storage Implementation, Tertiary - Storage Structure • Distributed systems: Types of Distributed Operating, Network Structure, Network Topology, Communication Structure, Communication Protocols, Robustness, Design Issues. • Distributed File Systems: Naming and Transparency, Remote File Access, Stateful Versus Stateless Service, File Replication • Distributed Coordination: Event Ordering, Mutual Exclusion, Atomicity, Concurrency Control, Deadlock Handling, Election Algorithms, Reaching Agreement	
Module 4	**Protection and Security**		1
	LOs: Learners will be able to • Evaluate and apply principles of protection, including access control mechanisms and capability-based systems. • Demonstrate understanding and proficiency in implementing access matrices for effective security. • Analyze and address security challenges, including program threats, system and network threats, and cryptography as a security tool. • Evaluate and implement user	**Module Contents:** Protection and Security: Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights, Capability-Based Systems, Language-Based Protection. The Security Problem, Program Threats, System and Network Threats, Cryptography as a Security Tool, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and	

	authentication mechanisms for enhanced security.	Networks, Computer-Security Classifications	
Assignments/ Activities towards CCE			
	• Evaluate and analyze the structure and functionalities of a real-world operating system. • Implement and evaluate different process scheduling algorithms. • Design and implement a basic file system, incorporating key file management concepts. • Propose and design a security implementation plan for a given computing environment.		

Bibliography:

Abraham Silberscatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 7th Ed.JohnWileyandSons,Inc2005.

MilanMilenkovic,OperatingSystemsConceptsAndDesign",SecondEdition,McGraw-HillInternationalEditions,"

WilliamStallings,"OperatingSystems:InternalsanddesignPrinciples",5thEdPrentice Hall,2005.

AndrewTanenbaum,"Modernoperatingsystems"3rdEd,PearsonEducation.

SN	Courses, Modules and Outcomes	Course Contents	Cr
	Semester I		
116412	**Data Communications and Networking** **Major (Core)**		**4**
	Course Outcomes: **Learners will be able to:** • Acquire a solid understanding of computer networks, categorizations, and hardware components. • Differentiate between broadcast and point-to-point networks, including LANs, MANs, and WANs. • Analyze network software, protocols, and architecture, comparing the OSI and TCP/IP Reference models. • Understand data communication models, digital and analog data, and explore various transmission media. • Differentiate between circuit and packet switching, and explore multiplexing techniques. • Analyze design issues in the data link layer, including framing, error control, and medium access control. • Investigate network layer design principles, routing algorithms, and advanced topics such as congestion control and mobile host routing.		
Module 1	**Introduction and Data Communication Model**		1
	LOs: Learners will be able to • Explain the concept of computer networks and their diverse applications in modern computing environments. • Categorize and differentiate various types of computer networks, including LANs, MANs, WANs, and inter-networks. • Identify and describe the hardware components involved in computer networks, emphasizing the distinctions between broadcast and point-to-point networks. • Explain the principles of wireless networks, including radio waves, microwaves, and infrared waves, along with an introduction to satellite communication. • Differentiate between the OSI	**Module Contents:** Introduction: Computer Networks and its uses, Network categorization and Hardware : Broadcast and point-to-point networks, Local Area Network (LAN), Metropolitan Area Network(MAN), Wide Area Networks (WAN), Inter networks, Topologies, Wireless Networks, Network Software: Protocols, Services, network architecture, design issues, OSI Reference model, TCP/IP Reference model, Comparison of OSI and TCP/IP Models. Introduction to Example Networks: Internet, Connection-Oriented Networks– X.25,FrameRelay,ATM Data Communication Model, Digital and Analog data and signals, bit rate, baud, bandwidth, Nyquist bit rate, Guided Transmission Media – Twisted Pair, Coaxial cable, Optical fiber; wireless transmission–Radio waves, microwaves, infrared waves; Satellite	

	Reference model and the TCP/IP Reference model, recognizing their structures and functionalities.	Communication.	
Module 2	**Switching and Error Detection and Correction**		1
	LOs: Learners will be able to • Understand the fundamental concepts of data communication models, including digital and analog data, bit rate, baud, and bandwidth. • Analyze various guided transmission media such as twisted pair, coaxial cable, and optical fiber, and understand their applications. • Explore wireless transmission methods, including radio waves, microwaves, and infrared waves, with an emphasis on satellite communication. • Differentiate between circuit switching and packet switching, and comprehend the essentials of both methods. • Understand the principles of multiplexing, including frequency division multiplexing (FDM), time division multiplexing (TDM), and synchronous/asynchronous TDM. • Analyze transmission impairments and understand the role of modems in mitigating these impairments. • Understand encoding techniques, with a focus on Manchester and differential Manchester encoding.	**Module Contents:** Switching: Circuit Switching, Packet switching; Multiplexing: Frequency Division Multiplexing, Time Division Multiplexing, Synchronous and Asynchronous TDM, Modems, Transmission impairments, Manchester and differential Manchester encoding. Error Detection and Correction: Types of errors Redundancy, Detection Versus Correction, Error Detection, Error Correction, Hamming Code, Cyclic Redundancy Check, Check sum and Its idea.	
Module 3	**Data Link Layer Design Issues:**		1
	LOs: Learners will be able to • Analyze design issues in the data link layer, including framing, error control, and flow control. • Understand fundamental data link protocols and their application in	**Module Contents:** Data Link Layer Design issues: Framing, error control, Flow Control, Error Detection and correction; Elementary Data Link Protocols, Sliding Windows Protocols; Medium Access Control: Aloha, CSMA protocols, Collision	

	communication systems. • Differentiate and evaluate medium access control protocols, including Aloha, CSMA, collision-free protocols, and limited contention protocols. • Examine wireless LAN protocols like MACA and standards such as IEEE 802.3 Ethernet, IEEE 802.4 Token Bus, and IEEE 802.5 Token Ring. • Analyze Binary Exponential Backoff algorithm and digital cellular communication protocols like GSM and CDMA.	free protocols, Limited Contention Protocols; Wave length division Multiple access protocol, Wireless LAN Protocol: MACA; IEEE 802.3Ethernet, IEEE 802.4 Token Bus; IEEE 802.5 Token ring, Binary Exponential Back off algorithm, Digital Cellular, Radio: Global System for Mobile Communication (GSM), Code Division Multiple Access (CDMA)	
Module 4	**Network Layer, Design Issues**		1
	LOs: Learners will be able to • Understand design issues in the network layer, including the concepts of virtual circuit and datagram subnets. • Explore various routing algorithms, including the optimality principle, shortest path routing, flooding, distance vector routing, and link-state routing. • Understand hierarchical routing principles and their role in optimizing network efficiency. • Analyze broadcast and multicast routing strategies, considering their applications and implications. • Understand congestion control algorithms, including general principles, traffic shaping, leaky bucket, token bucket, choke packets, and load shedding.	**Module Contents:** Network Layer, Design issues, Virtual circuit and Datagram Subnet, Routing Algorithms, Optimality principle, Shortest path routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast and Multi Cast Routing, RoutingforMobilehosts,RoutinginAdhocNetworks,congestionControlAlgorithm,GeneralPrincipalsTraffic Shaping, Leaky Bucket, Token Bucket, choke packets, Load Shedding	
Assignments/ Activities towards CCE			
	• Analyze network topologies and protocols to design an efficient network. • Implement a practical wireless LAN setup. • Simulate a data link layer scenario to understand key protocols. • Compare and analyze routing algorithms in a network.		

Bibliography:

Behrouz A. Forouzan. Data Communications and Networking (4thEdition).McGraw Hill. ©2007.ISBN:0-07-296775-7.

Data and Computer Communications,10th ed.,by William Stallings, Pearson

Computer Networks, Andrew S. Tanenbaum 5th edition.

SN	Courses, Modules and Outcomes	Course Contents	Cr
	Semester I		
116413	**Data Structures and Analysis of Algorithm** **Major (Core)**		**2**
	Course Outcomes: **Learners will be able to:** • Master fundamental concepts of data structures, including abstract data types and algorithm analysis. • Apply linear data structures (lists, stacks, queues) in practical scenarios like polynomial representation and job scheduling. • Demonstrate proficiency in non-linear data structures (trees, graphs) and their applications in problem-solving. • Analyze and implement searching and sorting algorithms, understanding their efficiency in different scenarios. • Explore advanced data structures (B-trees, B+ trees, tries) and their applications in file structures. • Understand complexity classes, including polynomial time, verification, and NP-Completeness, applying them to solve real-world problems.		
Module 1	**Introduction**		
	LOs: Learners will be able to • Define and classify data types. • Understand Abstract Data Types (ADT) and their applications. • Analyze algorithms, emphasizing best case, average case, and worst case. • Develop problem-solving skills through the application of data types and ADTs.	**Module Contents:** Data types, ADT, data structure: Definition &classification Analysis of algorithms (recursive and non-recursive) with emphasis on best case, average case and worst case	
Module 2	**Linear Data Structures with applications:**		

	LOs: Learners will be able to • Implement linear data structures such as lists, stacks, and queues using both array and linked list representations. • Utilize stacks for function call management, recursion, and balancing of parentheses. • Implement queues for job scheduling and understand their variations, including circular queues and deque. • Apply practical skills in converting infix expressions to postfix notation and evaluating postfix expressions. • Develop an understanding of the practical implications and applications of linear data structures in software development.	**Module Contents:** Linear Data structures with applications: List: Introduction, implementation using array & linked list (singly, doubly, circular, multi-list), Applications: Polynomial representation, Sparse matrix Stack: Introduction, implementation using array & linked list, Applications: Function call, Recursion, balancing of parenthesis, Polish Notation: infix to post fix conversion and evaluation of post fix expression Queue: Introduction (queue, circular queue, deque, priority queue), implementation using array &linked list, Applications: Job Scheduling.	
Module 3	**Non Linear data structures**		
	LOs: Learners will be able to • Understand the fundamentals of non-linear data structures, including trees and graphs. • Implement tree structures and comprehend various tree traversal techniques. • Represent and traverse binary trees using both array and linked list implementations. • Comprehend the basics of graph theory, including representations and traversal methods (BFS, DFS). • Apply graph algorithms for solving real-world problems, such as finding the shortest path and constructing minimal spanning trees.	**Module Contents:** Non Linear data structures: Tree: Introduction and representation, Forest, Tree traversal, Binary Tree (representation using array and links): Binary tree traversal (recursive & non-recursive implementation), Expression tree Graph: Introduction, representations, Traversal (BFS, DFS),Applications: Shortest path (Single source-all destinations), Minimal spanning tree (Prim's algorithm, Kruskal's algorithm)	
Module 4	**Searching and Sorting, Hash Tables**		

	LOs: Learners will be able to • Implement and analyze various searching algorithms, including linear search and binary search. • Understand and apply advanced search structures like binary search trees and heap trees. • Comprehend the principles of balanced trees, including AVL trees and Splay trees. • Implement and analyze M-way search trees and B-trees, with a focus on insertion operations. • Understand the role of hash tables in efficient data retrieval, including hash functions and collision resolution strategies. • Analyze and implement diverse sorting algorithms, evaluating their performance in best, worst, and average cases.	**Module Contents:** Linear Search, Binary Search, Transpose sequential search, Binary search tree, Heap tree (application in priority queue and sorting), AVL tree, Splay tree, M-way search tree, B tree (insertion), B+ tree (Definition and introduction), B*tree (Definition and introduction), Tries, Application of B tree and B+ tree in File Structures Hash Tables: Introduction, hash functions and hash keys, Collisions, Resolving collisions, Rehashing Sorting with algorithm analysis(best case, worst case, average):Bubble, Selection, Insertion, Shell, Merge, Quick, Heap, Radix NP-Completeness and the P & NP Classes Introduction, Polynomial Time & Verification, NP-Completeness and Reducibility, The Vertex Cover Problem, The Traveling Salesman Problem, The Set Covering Problem	
Assignments/ Activities towards CCE			
	None		

Bibliography:

1 Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", PearsonEducation,2nd edition(2003)

2 G. A. V. PAI, "Data structures and algorithms, concepts,TechniquesandApplications",1st edition(2008)

3 Horowitz, Sahni, Anderson-Freed, "Fundamentals of Data Structures in C", University Press (2nd edition-2007)

4 Jean-PaulTremblay,PaulG.Sorenson,"AnIntroductiontoDataStructureswith Applications",TataMcGraw-Hill,2Edition,(2007)

5 Cormen,Leiserson,Rivest,Stein,"IntroductiontoAlgorithm",PHI(2003),2ndEdition

6 Gilberg&Forouzan,"DataStructures:APseudo-codeApproachwithC",ThomsonLearning

7 Parag Dave & Himanshu. Dave, "Design and Analysis of Algorithms ", Pearson Education(2008)

8 Tanenbaum," Data Structures Using C & C++",PHI.

9 MichelGoodrich,RobertoTamassia,"Algorithmdesign-foundation,analysis&internetexamples",Wiley
10 AVAho, JEHopcroft, JDUllman,"Data Structures & Algorithms", Addison-Wesley Publishing(1983).
11 Michael Berman, "Data Structures Via C++: Objects by Evolution", Oxford Univ. Press(2004)

12 DEKnuth,"Sorting&Searching-TheArtofComputerProgramming",Vol.3, Addison-Wesley Publishing(1973).
13 Seymour Lipschutz, "Data Structures with C"McGrawHill,2017.
14 YashawantKanetkar, Data Structures Through C,BPB publications.

SN	Courses, Modules and Outcomes	Course Contents	Cr
	Semester I		
116424	**Data Structures And Algorithms – LAB** **Major (Core) Practical**		**2**
	Course Outcomes: **Learners will be able to:** • By learning this course, learners will be able to • Understand the implementation of linear data structures using arrays. • Implement and analyze searching and sorting algorithms efficiently. • Implement linear data structures using linked lists, demonstrating practical applications. • Implement stack, queue, enqueue, and dequeue operations, understanding their applications. • Implement tree data structures and apply traversal techniques for efficient data organization. • Implement graph traversal algorithms, including Depth-First Search (DFS) and Breadth-First Search (BFS).		
Module 1			
	LOs: Learners will be able to • Implement linear data structures using arrays, showcasing practical proficiency. • Apply searching and sorting algorithms effectively, demonstrating problem-solving skills in diverse scenarios.	**Module Contents:** • Implementation of linear data structure Array. • Implementation of Searching and Sorting Algorithms	
Module 2			
	LOs: Learners will be able to • Implement linear data structures using linked lists with proficiency. • Apply linked lists to solve practical problems, emphasizing their advantages.	**Module Contents:** • Implementation of linear data structure Linked List.	
Module 3			

	LOs: Learners will be able to • Proficiently implement stack and queue data structures, demonstrating the ability to perform enqueue and dequeue operations effectively. • Demonstrate mastery in implementing tree data structures, showcasing proficiency in tree organization and traversal techniques	**Module Contents:** • Implementation of stack, queue, enqueue, dequeue. • Implementation of Tree data structure.	
Module 4			1
	LOs: Learners will be able to • Implement Depth-First Search (DFS) and Breadth-First Search (BFS) algorithms for graph traversal. • Apply DFS and BFS practically to solve problems in diverse applications, demonstrating proficiency in navigating and exploring graphs.	**Module Contents:** DFS, BFS.	
Assignments/ Activities towards CCE			
	• Coding assignments for algorithm implementation and data structure manipulation. • Viva voce exams to assess theoretical understanding of data structures and algorithms.		

Bibliography:

Data Structures Using C and C++:Langsam Y, PHI,2ndEd.

Magnifying Data Structures: Arpita Gopal, PHIL earning.

DataStructuresthroughC:Y.P.Kanetkar,BPBPublications,2nd Ed

<table>
<tr><th>SN</th><th>Courses, Modules and Outcomes</th><th>Course Contents</th><th>Cr</th></tr>
<tr><td></td><td colspan="2">Semester I</td><td></td></tr>
<tr><td>116425</td><td colspan="2">Operating Systems – Lab
Major (Core) Practical</td><td>2</td></tr>
<tr><td></td><td colspan="2">Course Outcomes:
Learners will be able to:

• Install operating systems on virtual machines.
• Execute essential file commands proficiently.
• Access and manipulate file contents using various commands.
• Perform file system operations for effective storage management.
• Manage processes and monitor system performance.
• Master Bash shell programming, covering input, arithmetic, conditional constructs, loops, functions, and debugging.</td><td></td></tr>
<tr><td>Module 1</td><td colspan="2"></td><td></td></tr>
<tr><td></td><td>LOs: Learners will be able to

• Successfully install an operating system on a virtual machine (VM or Oracle BOX).
• Demonstrate proficiency in essential file commands (ls, cp, mv, rm, ln, cd, mkdir, rmdir, chown, chgrp, chmod, gzip, tar, updated, find).
• Efficiently access and manipulate file contents using commands like cat, less, and diff.
• Understand and perform file system operations, including mounting and unmounting (mount, umount).
• Utilize system commands (df, du, free, date) for effective gathering and display of system information.
• Proficiently manage processes using commands like top, ps, kill, killall.
• Use network-related commands (ping, nslookup, telnet) for diagnostics.</td><td>Module Contents:

Installation of OS on Virtual Machine (VM, Oracle BOX etc)
FileCommands:ls,cp,mv,rm,ln,cd,mkdir,rmdir,chown,chgrp,chmod,gzip,tar,updated,find.
Commands to Access File Contents: cat, less, diff
File Systems: Mount, umount
System Commands: System Information: df, du, free,
Date
Processes: top, ps, kill, killall
Network: ping, nslookup, telnet
Other: IOSTAT, SAR, Pstat, Netstat command and its parameters.</td><td></td></tr>
</table>

	• Apply commands (IOSTAT, SAR, Pstat, Netstat) and their parameters for system monitoring and analysis.		
Module 2			
	LOs: Learners will be able to • Master the usage of the grep command for text pattern matching. • Apply regular expressions effectively in grep commands for advanced pattern searching. • Understand and utilize various options available with the grep command for specific functionalities. • Apply egrep (Extended grep) for more complex and flexible pattern matching. • Utilize fgrep (Fixed grep or Fast grep) for faster pattern matching without interpreting regular expressions.	**Module Contents:** The grep Family: The grep Command, grep Examples with Regular Expressions, grep with Pipes, grep with Options, egrep(Extended grep),Fixed grep or Fast grep	
Module 3			
	LOs: Learners will be able to • Understand the definition and function of UNIX shells and their significance in system operations. • Gain proficiency in system startup and the login shell, emphasizing its role in initializing the user environment. • Execute commands effectively from scripts, showcasing practical scripting skills. • Gain hands-on experience with interactive shells, including the Bourne Shell, C Shell, KornShell, and Bash Shell. • Master and Combine regular expression meta-characters to create complex and versatile search patterns.	**Module Contents:** Introduction to UNIX Shells: Definition and Function, System Startup and the Login Shell, Processes and the Shell, The Environment and Inheritance, Executing Commands from Scripts. The Interactive Bourne Shell, The C Shell, The KornShell, The Interactive bash Shell Regular Expressions, Combining Regular Expression Meta characters	

Module 4			
	LOs: Learners will be able to • Acquire a foundational understanding of Bash shell programming concepts. • Demonstrate proficiency in reading user input and performing arithmetic operations. • Understand the use of positional parameters and command-line arguments. • Acquire the ability to trap signals and handle them appropriately. • Apply the getopts command to process command-line options in Bash scripts. • Understand the eval command and parsing the command line execution. • Explore Bash options and utilize built-in commands	**Module Contents:** ProgrammingwiththebashShell:IntroductionSection,ReadingUserInput,Arithmetic,PositionalParametersandCommandLineArguments,ConditionalConstructsandFlowControlSection,LoopingCommands,FunctionsSection,TrappingSignals,Debugging,ProcessingCommandLineOptionswithgetopts,TheevalCommandandParsing The Command Line, bash Options, Shell Built –In Commands.)	
Assignments/ Activities towards CCE			
	• Check correctness of implementation as per practical instructions. • Examine code documentation for clarity and completeness. • Evaluate understanding demonstrated during viva voce or oral exams. • Assess timely completion of tasks to gauge efficiency and time management.		

Bibliography:

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"IntroductiontoUnixandShellProgramming",PearsonEducation,M.G.Venkateshmurthy

Advanced Linux Programming, Mark Mitchell, Jeffrey Oldham, and Alex Samuel, New Riders Publishing

Unix/Linux Programming by Sumitabha Das, PHP

SN	Courses, Modules and Outcomes	Course Contents	Cr
	Semester I		
136411	**Research Methodology** **Minor stream (RM) Theory**		**4**
	Course Outcomes: **Learners will be able to:** • To equip the students with basic elements of research methodology. • To enhance students' understanding of various approaches in research • To understand the tools used in hypothesis testing.		
Module 1	**Research Methodology**		1
	LOs: Learners will be able to • Research Methodology and Types of Research. • Need for research Design and sampling Fundamentals.	**Module Contents:** Research methodology: An Introduction Objectives of Research, Types of Research, Research Methods and Methodology, Defining a Research Problem, Techniques Involved in Defining a Problem. Research Design Need for Research Design, Features of Good Design, Different Research Designs, Basic Principles of Experimental Designs, Sampling Design, Steps in Sampling Design, Types of Sampling Design, Sampling Fundamentals, Estimation, Sample size Determination,Random sampling.	
Module 2	**Measurement and Scaling Techniques and Methods of Data Collection and Analysis**		1

	LOs: Learners will be able to • Measurement and Scaling Techniques. • Data collection and analysis of primary and secondary data collection.	**Module Contents:** • Measurement and Scaling Techniques Measurement in Research, Measurement Scales, Sources in Error, Techniques of Developing Measurement Tools, Scaling, Meaning of Scale, Scale Construction Techniques. • Methods of Data Collection and Analysis Collection of Primary and Secondary Data, Selection of appropriate method Data Processing Operations, Elements of Analysis, Statistics in Research, Measures of Dispersion, Measures of skewness, Regression Analysis, Correlation.	
Module 3	**Techniques of Hypotheses**		1
	LOs: Learners will be able to • Techniques of hypothesis test used for hypothesis testing	**Module Contents:** • Techniques of Hypotheses, Parametric or Standard Tests Basic concepts, Tests for Hypotheses I and II, Important parameters limitations of the tests of Hypotheses, Chi-square Test, Comparing Variance, As a non-parametric Test, Conversion of ChitoPhi, Caution in using Chi-square test.	
Module 4	**Analysis of Variance and Co-variance**		1
	LOs: Learners will be able to • Analysis of variance and co-variance and other different techniques.	**Module Contents:** • Analysis of Variance and Co-variance ANOVA, One way ANOVA, Two Way ANOVA, ANOCOVA Assumptions in ANOCOVA, Multivariate Analysis Technique Classification of Multivariate Analysis, factor Analysis, R-type Q Type Factor Analysis, Path Analysis	
Assignments/ Activities towards CCE			

	• Define research methodology and distinguish between types of research. • Discuss the importance of research design and explore fundamental principles of sampling. • Explore measurement and scaling techniques used in research studies. • Compare primary and secondary data collection methods, analyzing their strengths and weaknesses. • Explain the concept of hypothesis testing and discuss various techniques. • Define and explain analysis of variance and co-variance in research. • Introduce additional research techniques beyond hypothesis testing and variance analysis. • Provide examples to illustrate the application of different research concepts and techniques.	

Bibliography:

"Research Methodology", C.R. Kothari, Wiley Eastern.

"Formulation of Hypothesis",Willkinson K. P, L Bhandarkar, Hymalaya Publication, Bombay.

"Research in Education", John WBestandV. Kahn,PHI Publication.

"Research Methodology-A step by step guide for beginners", Ranjit Kumar, Pearson

"Management Research Methodology-Integration of principles, methods and

Techniques",K.N.Krishna swami and others, Pearson Education

SN	Courses, Modules and Outcomes	Course Contents	Cr
	Semester I		
126411	**Principles and Practices of Management** **Major (Elective) Theory**		**4**
	Course Outcomes: **Learners will be able to:** • Identify and apply appropriate management techniques for managing business • Have a conceptual knowledge about the planning and decision making • Apply the concept of organizing for the effective functioning of a management • Evaluate leadership style to anticipate the consequences of each leadership style • Demonstrate the techniques for controlling and coordination		
Module 1	**Basic Concepts and competencies**		1
	LOs: Learners will be able to • Explain management, organization and the roles of managers. • Evaluate the need for management in an organization. • Justify the need for planning across management levels and global operations.	**Module Contents:** Basic Concepts: Definition of Management, Contribution of F.W.Taylor, Henri Fayol, Elton Mayo, Mary Parker Follet, Rensis Likert, Chestard Bernard, Douglas McGregor, Peter Drucker, Michael Porter and C.K. Prahlad; Approaches to Management: Scientific Approach, Systems Approach and Contingency Approach; Managerial Competencies: Communication, team work, planning and administrative, strategic and global competencies.	
Module 2	**Organization and Culture**		1

	LOs: Learners will be able to • Discuss the components of a strategic plan. • Outline the steps of the decision-making process. • Discuss organizational structures.	**Module Contents:** Organization: Formal and Informal, Line and staff relationship, Centralization Vs. Decentralization, Basic issues in organizing, work specialization, chain of common delegation, span of management, Organization Structure - bases for departmentation; Organizational Culture: Cultural Diversity, Multi Ethnic Workforce, Organizing Knowledge Resource.	
Module 3	**Planning, Planning Premises**		1
	LOs: Learners will be able to • Outline the components of human resource planning. • Describe the importance of communication and information technology. • Assess different leadership theories. • Discuss how to motivate employees.	**Module Contents:** Planning: Nature & elements of planning, planning types and models, planning in learning organizations; Types, Steps, MBO, MBE, Planning Premises; Decision Making: Risk and Uncertainty, Decision Trees, Decision making process, models of decision making, increasing participation in decision-making, decision-making creativity	
Module 4	**Controlling**		1
	LOs: Learners will be able to • Evaluate effective team development and management. • Discuss the control process and its elements • Discuss the current business landscape and trends.	**Module Contents:** Controlling: Process, Standards and Bench Marking - Co-ordination-Principles of Co- ordination-Inter-dependence Challenges in Management: Change Management - Timing of Change- Reaction to change-Planning organizational Change-Technological Change-Effective use of Communication	

		Devices and IT	
Assignments/ Activities towards CCE			
	• Define and explain management, organization, and managerial roles. • Evaluate the necessity of management in an organizational context. • Justify the importance of planning across management levels and in global operations. • Discuss components of a strategic plan and outline steps in the decision-making process. • Explore various organizational structures and analyze their suitability. • Outline components of human resource planning and emphasize its significance. • Assess different leadership theories for contemporary business settings. • Discuss motivational strategies for employees. • Evaluate effective team development and management strategies. • Describe the importance of communication in organizational management. • Analyze the role of information technology in facilitating effective communication. • Discuss the control process and its essential elements.	

Bibliography:

1.Fundamentals of Management by Robbins,
2. S.P. and Decenzo, D.A.,
3. Pearson Education Asia, New Delhi;Management by Koontz and Wechrich, TMGH;Management - Text & Cases by Satya Raju, PHI,
4. New Delhi; Reference Books: The Frontiers of Management by Peter Drucker, Harvard Business
5. Review Press; The Definitive Drucker by Elizabeth Haas Edersheim, TMGH.

SN	Courses, Modules and Outcomes	Course Contents	Cr
	Semester I		
126412	**Fundamentals of Organization Behavior** **Major (Elective) Theory**		**4**
	Course Outcomes: **Learners will be able to:** • Understand the importance of Organizational Behavior (OB) in workplaces. • Assess the impact of personality and attitude on individual and group performance. • Develop strategies to overcome resistance during organizational change. • Evaluate team dynamics, formation, and management for effective teamwork. • Apply change management approaches like Lewin's Three-Step and Kotter's Eight-Step for successful organizational transformations.		
Module 1	**Fundamentals of OB**		1
	LOs: Learners will be able to • Define Organizational Behavior (OB) and its significance in organizations. • Explore the connection between OB and individual behavior in the workplace. • Trace the historical evolution of OB, noting shifts from classical to contemporary perspectives. • Apply cognitive, behavioristic, and social cognitive frameworks to analyze organizational behavior. • Recognize and critically assess limitations and challenges in applying OB theories, considering cultural variations and the complexity of human behavior.	**Module Contents:** Fundamentals of OB: Definition, scope and importance of OB, Relationship between OB and the individual, Evolution of OB, Theoretical framework(cognitive, behavioristic and social cognitive),Limitations of OB.	

<table>
<tr><td>Module 2</td><td colspan="2">Introduction to Individual Process And Behavior and Personality & Attitude</td><td>1</td></tr>
<tr><td></td><td>LOs: Learners will be able to

• Define personality and its significance in organizational contexts, acknowledging its impact on individual performance.
• Apply personality assessment tools like The Myers-Briggs Type Indicator and The Big Five model for understanding individual dynamics.
• Utilize Transaction Analysis principles to enhance interpersonal communication in the workplace.
• Recognize the importance of attitude in organizational settings, emphasizing the role of the right attitude in fostering a positive work environment.</td><td>Module Contents:

Introduction to Individual Process And Behavior: Personality & Attitude, Perception, Motivation. Personality & Attitude: Definition Personality, importance of personality in Performance, The Myers-Briggs Type Indicator and The Big Five personality model, Johari Window , Transaction Analysis , Definition Attitude Importance of attitude in an organization, Right Attitude, Components of attitude, Relationship between behavior and attitude</td><td></td></tr>
<tr><td>Module 3</td><td colspan="2">Interpersonal Processes And Behavior, Organization System</td><td>1</td></tr>
<tr><td></td><td>LOs: Learners will be able to

• Understand and analyze group dynamics for effective teamwork.
• Demonstrate team management skills through stages of development.
• Evaluate organizational culture's impact on behavior and effectiveness.
• Apply strategies for work-life balance and stress management in the organization.</td><td>Module Contents:

Interpersonal Processes And Behavior, Team And Leadership Development: Group Behavior, Managing Teams Organization System: Organizational Culture, Work-
Life Balance, Stress Management</td><td></td></tr>
<tr><td>Module 4</td><td colspan="2">Managing Change</td><td>1</td></tr>
</table>

	LOs: Learners will be able to • Overcome resistance to change using effective strategies and communication. • Apply different approaches for managing organizational change. • Implement change models, including Kurt Lewin's Three-Step, Seven-Stage, and Kotter's Eight-Step plans. • Demonstrate leadership skills in leading, facilitating, and dealing with individual and group resistance during organizational change.	**Module Contents:** Managing Change : How to overcome the Resistance to Change, Approaches to managing Organizational Change, Kurt Lewin's- Three step model, Seven Stage model of Change & Kotter's Eight- Step plan for Implementing Change, Leading the Change Process, Facilitating Change, Dealing with Individual & Group Resistance, Intervention Strategies for Facilitating Organizational Change, Methods of Implementing Organizational Change, Developing a Learning Organization	
Assignments/ Activities towards CCE			
	• Develop a strategy to address and overcome resistance during a simulated organizational change scenario. • Analyze and propose suitable approaches for managing change within a given organizational context. • Apply Kurt Lewin's Three-Step, Seven-Stage, and Kotter's Eight-Step models to real-world change situations. • Demonstrate leadership skills by leading, facilitating, and managing resistance in a practical organizational change exercise.		

Bibliography:

1.Organizational Behaviour by Robins,

2. Organizational Behaviour by Fred Luthans;

3. Organizational Behaviour, M N Mishra

4.. Organizational Behaviour, K Ashwathappa

Reference Books: 1.Understanding OB by Uday Pareek,

2.Change &Knowledge Management by Janakiram, Ravindra and Shubha Murlidhar

SN	Courses, Modules and Outcomes	Course Contents	Cr
	Semester II		
216411	**Advanced Java** **Major (Core) Theory**		**4**
	Course Outcomes: **Learners will be able to:** • Understanding of advance web concepts associated with JAVA. • Familiarization with hibernate. • Familiarization with the MVC architecture. • Familiarization with the Spring framework.		
Module 1	**Introduction, Introduction to Event Handling, Introduction to JDBC**		1
	LOs: Learners will be able to • Master Java fundamentals, including Lambda Expressions and Type Annotations. • Apply Object-Oriented Programming, packages, enumerations, and handle multi-threading and exceptions. • Design GUIs using AWT and Swing components, understanding the distinctions between the two. • Implement event handling and JDBC for effective database connectivity and transaction management.	**Modules content:** **Introduction**: History, architecture and its components, Java Class File, Java Runtime Environment, The Java Virtual Machine, JVM Components, The Java API, java platform, java development kit, Lambda Expressions, Methods References, Type Annotations, Method Parameter Reflection. Object Oriented Programming, packages, enumerations, Multi-threading, Exception Handling. Abstract Window Toolkit: Window Fundamentals, Component, Container, Panel, Window, Frame, Canvas. Components – Labels, Buttons, Check Boxes, Radio Buttons, Choice Menus, Text Fields, Text, Scrolling List, Scrollbars, Panels, Frames, JAVA adapter classes. Swing components. AWT vs Swings. **Introduction to Event Handling:** Identifying the source of Event, Event Listeners and Event Handlers, the Delegation Event Model, Event classes, Event Listener Interface, Action Listener interface, Mouse	

		Listener Interface Adapter classes- the Mouse Adapter class, the Mouse Motion Listener Interface. **Introduction to JDBC**: What is JDBC. Database connectivity, JDBC Architecture, JDBC drivers, Using JDBC API – Loading a Driver, connecting and executing JDBC statement, Handling SQL Exceptions. Accessing Result Sets, method of Result Set interface, Methods of Prepared Statement interface, retrieving row, inserting row, Managing Database Transactions, creating and calling stored procedures in JDBC, using Metadata in JDBC.	
Module 2	**Introduction to servlets and Web development using JSP**		**1**
	LOs: Learners will be able to	**Introduction to servlets:** Servlet vs CGI, Servlet API overview, Servlet Life cycle, Generic servlet, HTTP Servlet, ServletConfig, Servlet Context, Handling HTTP Request and response –GET / POST method, request dispatching, Using cookies, Session tracking. **Web development using JSP:** Introduction to JSP, JSP Architecture, JSP Directives, JSP scripting elements, Default objects in JSP, JSP Actions, JSP with beans and JSP with Database, Error handling in JSP, tracking techniques in JSP, Introduction to custom tags, JSTL tags in detail. Introduction to jQuery, JS, JS JSON, jQuery vs JS.	

Module 3	**Introduction to Spring Framework**		1
	LOs: Learners will be able to • Master Spring Framework's architecture and AOP concepts. • Develop web applications with Spring MVC and utilize Spring Boot features. • Implement RESTful web services seamlessly within the Spring environment. • Ensure security using Spring Security and leverage JMS for effective messaging support.	**Module Contents:** **Introduction to Spring Framework:** Spring Architecture, Spring Aspect of Object-Oriented Concepts – Join Point and Point Cuts. Spring web applications with Spring MVC. Features of the Spring Boot. Use of Spring Boot to create and configure a Spring application. Customize Spring Boot features. REST web services with Spring. Spring Data Secure with Spring Security. JMS- Introduction, requirement, JMS Programming model. JMS support of Spring.	
Module 4	**Introduction to Hibernate**		1
	LOs: Learners will be able to • Understand Hibernate's role in overcoming JDBC paradigm issues through ORM. • Implement object persistence in Hibernate using mapping and configuration files. • Efficiently manage transactions and use HQL for flexible querying. • Optimize performance through advanced querying and caching strategies in Hibernate.	**Module Contents:** **Introduction to Hibernate**: Problem with JDBC - paradigm mismatch, ORM. Different components of Hibernate, How to persist objects using Hibernate, mapping files in hibernate, configuration files and Session object, Instance states, Implementing Inheritance in Hibernate, Transactions in Hibernate, Querying with HQL (Hibernate Query Language), Named and native queries, Working with Criteria Interface, Query by example – QBE, Caching and fetching.	
Assignments/ Activities towards CCE			
	• Develop a Java application using AWT and Swing components, illustrating the differences between AWT and Swing. • Create an event-driven Java application, identifying event sources and implementing event listeners, such as mouse events. • Design a Java program demonstrating database connectivity using JDBC, including SQL exception handling, result set access, and transaction management. • Build a dynamic web application using Servlets and JSP, incorporating features like HTTP request/response handling, session tracking, and cookie usage.		

Bibliography:

1. The Complete Reference, Third Edition, by Patrick Naughton and Herbert Schildt, Tata McGraw Hill Edition 1999.
2. Java Enterprise in a Nutshell: A Desktop Quick Reference (Nutshell Handbook) or any other book with similar contents.
3. Mastering Java2 J2SE1.4 by John Zukouski PBP Publication
4. JavaTM How to Program Sixth Edition by H.M Deitel, P.J. Deitel
5. Core Servlets &JavaServer Pages by Marty Hall, Larry Brown
6. Spring Boot in Action 1st Edition by Craig Walls
7. Beginning Hibernate Second Edition by Jeff Linwood, Dave Minter is the third book for Hibernate beginners.

<table>
<tr><th>SN</th><th>Courses, Modules and Outcomes</th><th>Course Contents</th><th>Cr</th></tr>
<tr><td>216412</td><td colspan="2">Semester II</td><td></td></tr>
<tr><td></td><td colspan="2">Database Management Systems
Major (Core) Theory</td><td>4</td></tr>
<tr><td></td><td colspan="2">Course Outcomes:
Learners will be able to:
• Understand and distinguish database systems from file systems.
• Apply various data models and comprehend user and administrator roles.
• Explain the structure of a Database System.
• Apply the Entity-Relational Model for effective database design.
• Demonstrate proficiency in the Relational Model, SQL, and database security concepts.</td><td></td></tr>
<tr><td>Module 1</td><td colspan="2">Introduction, Entity–Relational Model, Relational Model</td><td>1</td></tr>
<tr><td></td><td>LOs: Learners will be able to
• Grasp fundamental concepts of Database Systems and distinguish them from File Systems.
• Recognize the roles of Database Users, Administrators, and the activities of Database Administrators (DBAs).
• Master the Entity-Relational (E-R) Model, including constraints, keys, and schema design.
• Explore the structure of Relational Databases, understanding Relational Algebra and Tuple Relational Calculus.</td><td>Module Contents:

Introduction :Database System Applications
,Database Systems versus File Systems, View of Data, Data Models, Database Languages, Database Users and Administrators, DBA Roles and activity, Database
System Structure
Entity–Relational Model: Basic Concepts, Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, Design of E-R
Database Schema, Reduction of an E-R Schema to Tables.
Relational Model: Structure of Relational Databases, Relational Algebra, Tuple Relational Calculus ,Domain
Relational Calculus</td><td></td></tr>
<tr><td>Module 2</td><td colspan="2">SQL, Relational Database Design</td><td>1</td></tr>
</table>

	LOs: Learners will be able to • Execute SQL commands, functions, and data constraints proficiently. • Explore subqueries, joins, and performance tuning in SQL. • Implement security measures, including privileges, PL/SQL, and Triggers. • Ensure integrity through domain constraints, referential integrity, assertions, and triggers. Master relational database design principles, including normalization from 1NF to 5NF and BCNF.	**Module Contents:** **SQL:**SQL commands, Functions, Data Constraints, Grouping Data, Sub queries, Joins, Performance Tuning, Security Management, PL/SQL, Triggers. Integrity & Security: Domain Constraints, Referential Integrity, Assertions, Triggers, Privileges in SQL. **Relational Database Design:** Functional Dependencies, Decomposition, Normalization–1NF– 5NF, BCNF	
Module 3	**Storage & File Structure, Transactions**		1
	LOs: Learners will be able to • Understand RAID for improved reliability and performance. • Explore indexing and hashing with Ordered Indices, B+ and B Tree Index Files. • Compare static and dynamic hashing and differentiate between Ordered Indexing and Hashing. • Grasp the Transaction Concept, implement Atomicity and Durability, and understand Serializability and Recoverability.	**Module Contents:** **Storage & File Structure** :RAID , Improvement of Reliability & Performance Indexing & Hashing – Basic Concepts, Ordered Indices, B+ & B Tree Index Files, Static & Dynamic Hashing, Comparison of Ordered Indexing & Hashing. Transactions: Transaction Concept & State, Implementation of Atomicity& Durability, Serializability, Recoverability, Testing for Serializability.	
Module 4	**Concurrency Control, Object-Oriented Databases**		1

	LOs: Learners will be able to • Grasp concurrency control protocols: Lock-Based, Timestamp-Based, Validation-Based. • Explore deadlock handling and concurrency recovery systems. • Understand failure classification, storage structure, and recovery mechanisms. • Delve into log-based recovery, shadow paging, recovery with concurrent transactions, and advanced techniques.	**Module Contents:** **Concurrency Control:** Protocols-Lock Based, Timestamp-based, Validation Based, Deadlock Handling & Concurrency Recovery System: Failure Classification, Storage Structure, Recovery & Atomicity, Log based Recovery, Shadow Paging, ecovery with Concurrent Transactions, Buffer management, failure with loss of non volatile storage, advanced recovery techniques. **Object-Oriented Databases :** New Database Applications, Object–Oriented Data Model, Object-Oriented Languages, Persistent Programming Languages, Persistent C++Systems Introduction, Overview of NoSQL Databases –Four Types of NoSQL (Document-oriented, Key Value Pairs, Column-oriented and Graph).	
Assignments/ Activities towards CCE			
	• Design a database system for a fictional company using Entity-Relational Modeling. • Write optimized SQL queries for complex data retrieval requirements. • Analyze a real-world scenario involving concurrent transactions and propose a suitable concurrency control protocol. • Conduct a security audit on a sample database, identifying vulnerabilities and proposing security measures.		

Bibliography:

1. Database System Concepts:Henry Korth,Silberschatz,Sudarshan5th Edition,McGraw-Hill
2. Fundamentals of Database Systems: Elmasri&Navathe3rd Edition , Pearson Education India, 01-Sep-2008-1168pages
3. Database Management Systems; Raghu Ramakrishnan, Johannes Gehrke; McGraw-HillInternationalEdition,2002edition
4. Modern Database Management (Seventh Edition); JeffreyA. Hoffer, Mary Prescott, Fred Mc Fadden;PrenticeHall, 2004
5. Database systems: Design, Implementation and Management; PeterRob, Carlos Coronel; Thomson Publication, 2004
6. Database Processing: Fundamentals, Design, Implementation(tenth Edition); D.M.Kroenke;Prentice-Hall,2005
7. Data Base Principles Programming Performance (Second Edition); Patrick O.Neil; Morgan Kaufmann Publishers, Inc., 2000
8. Oracle8iPL/SQL Programming: Scott Urman

SN	Courses, Modules and Outcomes	Course Contents	Cr
	Semester II		
216413	**Web Technology** **Major (Core) Theory**		**2**
	Course Outcomes: **Learners will be able to:** • Apply HTML, CSS, XML, JavaScript, and JQuery for web development. • Demonstrate proficiency in AngularJS for dynamic web applications. • Master PHP for server-side scripting and MySQL database operations. • Gain expertise in XML, including DTD, Schema, and entities. • Integrate CGI, JSP, Servlets, and AJAX for Java application deployment.		
Module 1	**Introduction to Web Technologies, HTML, CSS**		
	LOs: Learners will be able to • Master HTML basics, including tags, formatting, and image handling. • Develop AngularJS applications with directives, controllers, and interactive elements. • Proficiently use CSS for styling, covering properties like margin and transitions. • Integrate HTML, AngularJS, and CSS for dynamic and visually appealing web pages.	**Module Contents:** Introduction to Web Technologies: Concepts of Internet, Concepts of World Wide Web, Internet based Services-Email, Telnet, FTP, WWW. Web Server, Web Hosting, DNS, SMTP. HTML: Introduction to HTML, Structure of HTML document, Basic HTML tags, attributes,Formatting tags, MetaTags, Comments, Inserting Image, Image Maps, hyperlink,Tables, Lists, Frames, iframes, Marquee. HTML Form controls. Introduction to HTML5. AngularJS: Environment Setup, Creating and Executing angularjs application, directives, controllers, expressions, filters, tables, modules, forms, views, scopes, services. CSS: Introduction to CSS, Types of CSS-Embedded Stylesheet, Inline Stylesheet, External StyleSheet, CSS Border, margin, Positioning, color, text, link, background, list, table, padding, image, display properties, Use of Id & classes in CSS, use of & in CSS, Introduction of CSS3: Gradients, Transitions, Animations,	

		multiple columns.	
Module 2	**XML, Client Side Scripting Language, JQuery**		
	LOs: Learners will be able to • Master XML basics, including document structure, DTD, and entities. Use XML Schema. • Proficient in JavaScript for variables, arrays, event handling, and DOM manipulation. • Expertise in JQuery for selectors, attributes, CSS, and event handling. Understand AJAX and interactions. • Combine XML, JavaScript, and JQuery for effective client-side scripting in web development	**Module Contents:** XML: Introduction to XML, Valid and Well- Defined Document, Document Type Definition or DTD, uses of DTD, XML Tags, Elements, Attributes, PCDATA, CDATA, Basics of entities, XML Elements, Elements Declaration, usage of #REQUIRED ,usage of #IMPLIED, usage of #FIXED, Internal Entities, External Entities, XML Schema, Defining, Accessing XML Document. Client Side Scripting Language: JavaScript Introduction to JavaScript, Variables, identifiers constants in JavaScript, Types of Operators in JavaScript's, Control and looping structure, arrays in JavaScript, Event handling in JavaScript, JavaScript Objects-Number, Boolean, Strings, Arrays, Date, Math, Regular Expression, JavaScript Document Object Model (DOM), Window Object, Navigator Object, Location Object, History Object. Validations in JavaScript. JQuery: Introduction to JQuery, Selectors, attributes, Traversing, CSS, DOM, Events, AJAX, Effects, Interactions, Widgets, Theming	
Module 3	**Server Side Scripting Language: PHP**		
	LOs: • Master PHP for variables, HTML form processing, and MySQL database operations. • Excel in MySQL connectivity, database creation, and table manipulation using PHP. • Proficiently navigate and customize content in Wordpress for effective website management.	**Module Contents:** **Server Side Scripting Language: PHP** Configuration and Installation of PHP, Variables Types, Constants, Types of Operators, Arrays, Strings, Decision and Looping Statements. Processing HTML form using GET, POST, REQUEST, SESSION, COOKIE variables, Sending E-mail, Database Operations with PHP, Connecting to My-SQL, creating	

	• Apply PHP skills practically to handle HTML forms, interact with databases, and manage content using Wordpress.	database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables. CMS: Wordpress	
Module 4	**Introduction to CGI Programming**		
	LOs: Learners will be able to • Implement CGI, JSP, Servlet, and AJAX for dynamic Java applications. • Create .jar projects for efficient Java application packaging. • Deploy Java applications on app servers with proficiency. • Apply integrated skills for seamless web development.	**Module Contents:** Introduction to CGI Programming, JSP, Servlet, AJAX. Creation of .jar project. Deployment of Java application on App server.	
Assignments/ Activities towards CCE			
	• Build a dynamic website with HTML, CSS, and JavaScript, incorporating image maps and forms. • Develop an AngularJS app showcasing directives, controllers, and services for dynamic content. • Create a PHP script for MySQL operations, handling database tasks efficiently. • Implement an XML document with Schema, emphasizing proper use of entities and attributes.		

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1. Beginning Web Programming with HTML, XHTML, CSS & JavaScript by Jon Duckett, Wrox.
2. Web master in a Nutshell by Stephen Spainhour, O'Reilly and Associates.
3. JavaScript: The Definitive Guide by David Flanagan, O'Reilly and Associates.
4. Beginning ASP3.0 by David Buser and Others, Wrox.

SN	Courses, Modules and Outcomes	Course Contents	Cr
	Semester II		
216424	**Advanced Java- Lab** **Major (Core) Practical**		**2**
	Course Outcomes: **Learners will be able to:** • Understanding of advance web concepts associated with JAVA. • Familiarization with hibernate. • Familiarization with the MVC architecture. • Familiarization with the Spring framework		
Module 1			
	LOs: Learners will be able to • Master OOPs principles for Java application design. • Proficiently utilize AWT and Swings for GUI development. • Implement event handling efficiently within Swings. • Gain expertise in JDBC for Java database connectivity.	**Module Contents:** OOPs, AWT and Swings Event Handling with Swings JDBC	
Module 2			

	LOs: Learners will be able to • Master Servlets for dynamic Java web applications. • Develop proficiency in JSP for server-side Java web programming. • Understand the basics of jQuery, JavaScript, and JSON. • Differentiate between jQuery and pure JavaScript, grasping their respective strengths and applications.	**Module Contents:** Servlet JSP Introduction to jQuery, JS, JS JSON, jQuery vs JS	
Module 3			
	LOs: • Gain a comprehensive understanding of the Spring Framework. • Learn how Spring integrates and supports Java Message Service (JMS). • Master the application of Spring Framework in diverse software development scenarios. • Demonstrate proficiency in utilizing JMS within the Spring ecosystem for effective messaging support.	**Module Contents:** Introduction to Spring Framework JMS support of Spring.	
Module 4			

	LOs: Learners will be able to • Grasp Hibernate basics, emphasizing Object-Relational Mapping (ORM) principles. • Develop expertise in crafting queries using Hibernate Query Language (HQL). • Recognize HQL's pivotal role in database interactions within Hibernate. • Demonstrate practical skills in data retrieval and manipulation using HQL.	**Module Contents:** Introduction to Hibernate, Querying with HQL	
Assignments/ Activities towards CCE			
	• Develop a Java GUI application using AWT and Swings, applying OOPs principles. • Implement database connectivity through Servlets and JDBC, enabling user interactions. • Create a dynamic web page with JSP, integrating jQuery for enhanced user experience. • Build a Java application integrating Spring Framework and Hibernate, showcasing JMS support.		

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SN	Courses, Modules and Outcomes	Course Contents	Cr
	Semester II		
216425	**Database Management Systems - Lab** **Major (Core) Practical**		**2**
	Course Outcomes: **Learners will be able to:** • Learn database management, table creation, schema definition, and normalization. • Master SQL basics for writing queries, implementing joins, and using clauses. • Gain proficiency in executing PLSQL scripts with a focus on procedures and functions. • Extend knowledge with advanced database operations, including stored procedures, functions, packages, and cursor and trigger utilization.		
Module 1			
	LOs: Learners will be able to • Efficiently create and manage databases and tables. • Demonstrate the ability to define schema, implement constraints, and ensure normalization for optimal data organization.	**Module Contents:** Database, Table Creation Defining Schema, Constraints, Normalization	
Module 2			

	LOs: Learners will be able to • Master fundamental SQL queries for data retrieval. • Demonstrate proficiency in joining tables and implementing clauses for advanced data manipulation.	**Module Contents:** SQL Basic Queries Joining, and Clauses implementation	
Module 3			
	LOs: Learners will be able to • Execute procedures and functions with precision. • Showcase proficiency in PLSQL script execution for effective database operations.	**Module Contents:** Procedure, Function execution PLSQL Script Execution	
Module 4			
	LOs: Learners will be able to • Execute stored procedures, functions, and packages proficiently. • Demonstrate the ability to write and utilize cursors and triggers for advanced database operations.	**Module Contents:** Stored Procedure, Function, Packages Execution Cursor, Trigger Writing	
Assignments/ Activities towards CCE			
	• Design and implement a business database using SQL. • Showcase SQL proficiency with basic queries and joins. • Demonstrate PLSQL application through script execution. • Execute advanced database operations with stored procedures, functions, and triggers.		

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SN	Courses, Modules and Outcomes	Course Contents	Cr
	Semester I		
226411	**Digital Business** **Major (Elective) Theory**		**4**
	Course Outcomes: **Learners will be able to:** • Describe the conceptual framework of e-commerce, mobile commerce and social commerce. • Summarize the impact of information, mobile, social, digital, IOT and related technologies on society, markets & commerce. • Illustrate value creation & competitive advantage in a digital Business environment. • Examine the changing role of intermediaries, changing nature of supply chain and payment systems in the online and offline world. • Elaborate upon the various types of digital business models and OUTLINE their benefits and limitations. • Discuss the various applications of Digital Business in the present day world.		
Module 1	**Electronic Commerce**		1
	LOs: Learners will be able to • Understand and implement the conceptual framework of e-commerce, mobile commerce and social commerce.	**Module Contents:** The Digital Revolution and Society, The Digital and Social Worlds - The Digital Economy, The Digital Enterprise, Virtual Communities, Online Communities, Defining Electronic Commerce, Emerging E-Commerce Platforms. E-Business, Electronic Markets and Networks; The Content and Framework of E-Commerce, Classification of E-Commerce by the Nature of the Transactions and the Relationships Among Participants, E-Commerce Business Models, Integrating the Marketplace with the Market space, Web 2.0. Drivers, Benefits and Limitations of E-Commerce, Impact of E-Commerce on business, government, customers, citizens and society.	
Module 2	**Mobile Commerce, Social Commerce and IoT**		1

	LOs: Learners will be able to • Application of the learning and information, mobile, social, digital, IOT and related technologies on society, markets & commerce. • Illustrate value creation & competitive advantage in a digital Business environment.	**Module Contents:** Mobile Commerce, Social Commerce and IoT: Mobile Commerce, Attributes Applications and Benefits of MCommerce, Mobile Marketing - Shopping and Advertising. Social Commerce: Social Commerce, Social Business (Enterprise), Social Business Networks and Social Enterprise, Social Media, Platforms for Social Networking; Social Media Marketing, Enterprise 2.0, Improved Business Models. Entrepreneur Networks, Enterprise Social Networks, The Benefits and Limitations of Social Commerce, Benefits to Customers, Retailers, Employees, players in the ecosystem. Social Collaboration (Collaboration 2.0) - Essentials of Social Collaboration, Consumer-to-Consumer Electronic Commerce (C2C), Person-to-Person models. Internet of Things: Concept of IoT, Smart Homes and Appliances, Smart Cities, Smart Cars, Wearable Computing and Smart Gadgets.	
Module 3	Digital Business Ecosystem		1
	LOs: Learners will be able to • Illustrate value creation & competitive advantage in a digital Business environment. • Examine the changing role of intermediaries, changing nature of supply chain and payment systems in the online and offline world. • Elaborate upon the various types of digital business models and Outline their benefits and limitations.	**Module Contents:** Electronic Commerce Mechanisms, Online Purchasing Process, E-Marketplaces - Types, Components and Participants, Disintermediation and Re-intermediation; Customer Shopping Mechanisms – Web-stores, Malls, and Portals, Web-stores, Electronic Malls , Web (Information) Portals. Intermediaries: Roles of Intermediaries in E-Marketplaces, Merchant Solutions: Electronic Catalogs, Search Engines, and Shopping Carts, Electronic Catalogs, E-Commerce Search Activities, Auctions - Traditional Auctions Versus E-Auctions, Dynamic Pricing. Changing Supply Chains: Structure of the Supply Chain, EC Order Fulfillment Process, Speeding Up Deliveries, Partnering Efforts and Outsourcing Logistics, Order Fulfillment in Make-to- Order (MTO) and Mass	

		Customization. Digital Payments: Smart Cards, Stored-Value Cards, EC Micropayments, Payment Gateways, Mobile Payments, Digital and Virtual Currencies, Security, Ethical, Legal, Privacy, and Technology Issues.	
Module 4	Digital Business Applications: Electronic Retailing and Online Travel and Tourism Services		1
	LOs: Learners will be able to • Operate and work upon the various applications of Digital Business in the present day world.	**Module Contents:** B2C Electronic Retailing, Characteristics, Advantages, Limitations, E-Tailing Business Models, Classification of Models by Distribution Channel, Referring Directories, Malls with Shared Services. Social Shopping – Concept, Benefits and Drivers, Social Shopping Aids – Recommendations, Reviews, Ratings, and Marketplaces, Real-Time Online Shopping. The Online Versus Off-Line Competition, Click-and-Brick models, Product and Service Customization and Personalization. Fin-tech: E-Banking, Mobile Banking, Pure Virtual Banks, Insurance, and Stock Trading, Other Mobile Finance Applications. Digital Government: Government-to-Citizens, Government-to-Business, Government-to-Government, Government-to-Employees Models, Internal Efficiency and Effectiveness, E-Government and Social Networking, M-Government. E-Learning, E-Training, and E-Books: Basics of ELearning, Characteristics, Advantages, Limitations, Distance Learning and Online Universities, Online Corporate Training, Social Networks and E-Learning, E-Learning Management Systems, Electronic Books. Characteristics of Online Travel, Benefits, Limitations, and Competition in Online Travel Services. E-Employment: Online Job Market, Social Networks Based Job Markets, Social Recruiting, Virtual Job Fairs and Recruiting Events, Benefits and Limitations of the Electronic Job Market. E-Health: Definition, Electronic Medical Record Systems (EMR), Doctors' System, Patients Services, Medical Devices and Patients	

		Surveillance. Entertainment, Media & Gaming: Service Industry Consumer Applications. Digital Products, Internet TV and Internet Radio, Social Television (TV) Mobile Entertainment, Mobile Marketing, Mobile Streaming Music and Video Providers, Entertainment in Cars; Gaming - Mobile Games, Social Games and Gamification, Business of Social Games, Educational Social Games; Mobile Gambling, Mobility and Sports; Social Entertainment.	
Assignments/ Activities towards CCE			
	1. Create an affiliate account on any e-commerce platform. 2. Understand the digital ecosystem and perform practical on affiliate marketing using the account created.		

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SN	Courses, Modules and Outcomes	Course Contents	Cr
	Semester I		
226412	**Entrepreneurship Development** **Major (Elective) Theory**		**4**
	Course Outcomes: **Learners will be able to:** • Define the key terms, LIST the Attributes and Characteristics of Entrepreneurs features and enumerate the Factors influencing Entrepreneurship Growth. • Discuss various theories of entrepreneurship and the entrepreneurship development ecosystem in Indian context. • Apply the theories of entrepreneurship and entrepreneurship development framework to analyze and identify entrepreneurial opportunities. • Discriminate between potential options available for entrepreneur for embarking on establishing a Start Up • Evaluate the start up ecosystem and the entrepreneurial opportunities in light of requirements of a business plan. • Create a business plan that captures entrepreneurs and variety of entrepreneur motivations, entrepreneur culture and sectoral opportunities and financing options.		
Module 1	**Entrepreneurship**		1
	LOs: Learners will be able to Define the key terms, LIST the Attributes and Characteristics of Entrepreneurs features and enumerate the Factors influencing Entrepreneurship Growth.	**Module Contents:** • Concept of Entrepreneur. Intrapreneur, Entrepreneurship and Manager. Difference between Entrepreneur and Intrapreneur, Entrepreneur and Entrepreneurship. Attributes and Characteristics of successful entrepreneurs. Functions of an Entrepreneur, Classification of Entrepreneurs. Role of Entrepreneur in Indian Economy, Developing entrepreneurial culture, Factors influencing Entrepreneurship Growth - Economic, Non-Economic Factors, For profit or Not for profit entrepreneurs, Constraints for the Growth of Entrepreneurial Culture, Entrepreneurship as a career, Entrepreneurship as a style of management, Emerging Models of Corporate Entrepreneurship, India's start up revolution– Trends, Imperatives, benefits; the players involved in the ecosystem, Business	

		Incubators-Rural entrepreneurship, social entrepreneurship, women entrepreneurs, Cases of Tata, Birlas, Kirloskar and new generation entrepreneurs in India.	
Module 2	**Theories of entrepreneurship and Entrepreneurship development**		1
	LOs: Learners will be able to Discuss various theories of entrepreneurship and the entrepreneurship development ecosystem in Indian context and apply the theories of entrepreneurship and entrepreneurship development framework to analyze and identify entrepreneurial opportunities.	**Module Contents:** Innovation Theory by Schumpeter & Imitating, Theory of High Achievement by McClelland, X-Efficiency Theory by Leibenstein, Theory of Profit by Knight, Theory of Social change by Everett Hagen. Entrepreneurial Competencies, Developing Competencies. Concept of entrepreneurship development, Entrepreneur Training and developing, Role of Entrepreneur Development Programs (EDP), Role of DIC, SISI , EDII , NIESBUD, NEDB, EDP - Objectives – contents – methods - execution. Role of Mentors. Innovation and Entrepreneurship, Design Thinking Process. Role of consultancy organizations in promoting Entrepreneurs, Problems and difficulties of Entrepreneurs - Marketing Finance, Human Resource, Production; Research - external problems, Mobility of Entrepreneurs, Entrepreneurial change, occupational mobility - factors in mobility	
Module 3	**Role of Central Government and State Government in promoting Entrepreneurship**		1
	LOs: Discriminate between potential options available for entrepreneur for embarking on establishing a Start Up and evaluate the start up ecosystem and the entrepreneurial opportunities in light of requirements of a business plan.	**Module Contents:** Introduction to various incentives, subsidies and grants, Export Oriented Units, Fiscal and Tax concessions available, Women Entrepreneurs - Role, Problems and Prospects, Reasons for low women Entrepreneurs, Assistance Programme for Small Scale Units – Institutional Framework – Role of SSI Sector in the Economy – SSI Units – Failure, Causes and Preventive Measures –	

		Turnaround Strategies. Future of Entrepreneurship Development and Government, Start Up India, Make in India.	
Module 4	**Enterprise Promotion**		1
	LOs: Learners will be able to Create a business plan that captures entrepreneurs and variety of entrepreneur motivations, entrepreneur culture and sectoral opportunities and financing options.	**Module Contents:** Creating Entrepreneurial Venture, Entrepreneurship Development Cycle, Business Planning Process, The business plan as an entrepreneurial tool, Elements of Business Plan, Objectives, Market Analysis, Development of product / idea - Resources, Capabilities, and strategies, identifying attributes of strategic resources, Opportunity Analysis, innovator or imitator, SWOT analysis, Internal and External Environment Analysis, Industry Analysis, Embryonic Companies and Spin off's, Porter's five forces model, Identifying the right Business Model Canvas, Seven Domains of John Mullins, Opportunities in Emerging/Transition/Decline industries, Opportunities at the bottom of the pyramid, Opportunities in social sector, Opportunities arising out of digitization, Marketing, Finance, Organization & Management, Ownership - Franchising, networking and alliances, Buying an existing business, Critical risk contingencies of the proposal, Scheduling and milestones.	
Assignments/ Activities towards CCE			
	• Create a B-Plan considering all the verticals of business. • Identify the schemes from central and state government for women entrepreneur		

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