



K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2026-28 and 2027-29 Batch
Department of Computer Applications

Curriculum Structure and Evaluation Scheme To be implemented for **2026-28** and **2027-29** Batch **Master of Computer Applications** **(MCA)**



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Curriculum Structure and Evaluation Scheme
 To be implemented for 2026-28 and 2027-29 Batch
 Department of Computer Applications

Class: First Year MCA

Semester: I

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)		
							Max	Min. for passing	Max.	Min. for passing	
MCA1011	Mathematical Foundation	*2	-	-	2	ISE	20	40	40	----	----
						UT1	15			----	
						UT2	15			----	
						ESE	50	40		----	
MCA1031	Data Structures using Python	3	-	-	3	ISE	20	40	40	----	----
						UT1	15			----	
						UT2	15			----	
						ESE	50	40		----	
MCA1051	Database Management Systems	3	-	-	3	ISE	20	40	40	----	----
						UT1	15			----	
						UT2	15			----	
						ESE	50	40		----	
MCA1071	Computer Networks	3	-	2	4	ISE	20	40	40	----	----
						UT1	15			----	
						UT2	15			----	
						ESE	50	40		----	
MCA1091	Operating System Concepts	3	-	2	4	ISE	20	40	40	----	----
						UT1	15			----	
						UT2	15			----	
						ESE	50	40		----	
MCA1111	Research Methodology	2	-	-	2	ISE	20	40	40	----	----
						UT1	15			----	
						UT2	15			----	
						ESE	50	40		----	
MCA1131	Data Structures using Python Lab	-	-	*2	1	ISE	----	----		50	50
						ESE	----	----		50	50
MCA1151	Database Management Systems Lab	-	-	2	1	ISE	----	----		50	50
						ESE	----	----	50	50	
MCA1171	Basics of Programming & Computer Organization	3	-	2	Audit Course	ISE	20	40	40	---	---
						UT1	15			---	
						UT2	15			---	
						ESE	50	40		---	
MCA1191	MOOC**	-	-	-	1	ISE	--	--	--	100	50
	TOTAL	19	-	10	21						
	TOTAL CONTACT HOURS	29									

ISE = In Semester Evaluation,

UT1 = Unit Test -I,

UT-II = Unit Test-II

ESE = End Semester Exam

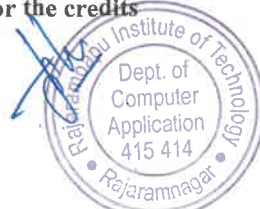
Total Contact Hours/week : 29

Total Credits : 21

Audit Course: Bridge course For Non-Computer Science students. No credits are assigned but compulsory passing is necessary

***Extra hours to be allocated in the regular timetable for practical 2 hours and for theory 1 hour.**

Note:** MOOC Course certification marks will be carried out for the credits





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Department of Computer Applications

Class: First Year MCA

Semester: II

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)		
							Max	Min. for passing	Max	Min.for passing	
MCA1021	Object Oriented Programming Using Java	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50			40	---
MCA1041	Web Technology	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50			40	---
MCA1061	Software Engineering and Project Management	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50			40	---
MCA1081	Big Data Paradigm	3	-	2	4	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50			40	---
	Professional Elective-I	3	-	2	4	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50			40	---
MCA1161	Object Oriented Programming Using Java Lab	-	-	2	1	ISE	---	---		50	50
						ESE	---	---		50	50
MCA1181	Web Technology Lab	-	-	2	1	ISE	---	---		50	50
						ESE	---	---		50	50
MCA1201	Professional Communication and Employability Skills	-	-	2	1	ISE	---	---		50	50
						ESE	---	---		50	50
MCA1221	Mini Project	-	-	-	2	ISE	--	--		100	50
	TOTAL	15	-	10	22						
	TOTAL CONTACT HOURS	25									

ISE = In Semester Evaluation, UT1 = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam
Total Contact Hours/week : 25
Total Credits : 22



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Professional Elective -1

Specialization	Course Code	Courses
Cyber Security	MCA1101	Principles of Information Security
Data Science	MCA1121	NoSQL
Modern Application Development Framework	MCA1141	Software Testing



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Class: Second Year MCA

Semester: III

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)		
							Max	Min. for Passing	Max	Min. for passing	for
MCA2011	Machine Learning	3	--	--	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50			---	---
MCA2031	Cloud Computing	3	--	2	4	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50			---	---
	Professional Elective-2	3	--	2	4	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50			---	---
	Professional Elective-3	3	--	2	4	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
MCA2171	Innovation, Business Models and Entrepreneurship	3	--	--	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50			---	---
MCA2191	Machine Learning Lab	--	--	2	1	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
MCA2211	Full Stack Development lab	*1	--	2	1	ISE	---	---	---	50	50
						ESE	--	---	---	50	50
MCA2231	Capstone Project	--	--	--	2	ISE	--	--	--	100	50
TOTAL		16	-	10	22						
TOTAL CONTACT HOURS		26									

ISE = In Semester Evaluation, UT1 = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam

Total Contact Hours/week : 26
Total Credits : 22

*Extra Lectures for lab courses



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Professional Elective-2

Specialization	Course Code	Courses
Cyber Security	MCA2051	Cyber Security and Forensics
Data Science	MCA2071	Data Mining
Modern Application Development Framework	MCA2091	Advanced Java and J2EE

Professional Elective-3

Specialization	Course Code	Courses
Cyber Security	MCA2111	Blockchain Technology
Data Science	MCA2131	Deep Learning
Modern Application Development Framework	MCA2151	Dot Net Framework for Application Development





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Choice based Internship Model

Model I: Industry Internship (II)

Class: Second Year MCA

Semester: IV

Class: Second Year MCA		Semester IV									
Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max.	Min. for passing		Max.	Min. for passing
MCA2021	Basics of Finance (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40	---	---	
MCA2041	Principles of Management & Economics (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40	---	---	
MCA2061	Industry Internship & Project	-	-	-	16	ISE	---	---		50	50
						ESE	---	---		50	50
	TOTAL	4	-	-	20						

ISE = In Semester Evaluation, UT-I = Unit Test - I, Semester Exam

UT-II = Unit Test-II ESE = End

Total Contact

Hours/week : 04

Total Credits

: 20

Note:

1] Weekly Contact hours are not mentioned as a student is expected to be in the industry regularly for 20 weeks. However, students need to report to institute mentors as and when required.

2] For online courses, lecture videos of each unit will be made available to the students through the college platform. For each unit, there will be separate assignments. Students need to submit all assignments within the specified time.

Weightage: 25% weightage for unit-wise assignments + 75% weightage for final exam. The final exam will be held at a college campus.



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Model II: Research Internship (RI)

Class: Second Year MCA

Semester: IV

Course Code		Course		Teaching Scheme				Evaluation Scheme							
		L		T		P		Credits		Scheme		Theory (Marks %)		Practical (Marks %)	
												Max.	Min. for passing	Max.	Min. for passing
MCA2081	Project Management (Online Course)	2	-	-	2	ISE	25	40	40	---	---				
							ESE	75		40	---	---			
MCA2101	Intellectual Property Rights (Online Course)	2	-	-	2	ISE	25	40	40	---	---				
							ESE	75		40	---	---			
MCA2121	Research Internship	-	-	-	16	ISE	---	---		50	50				
							ESE	---		---	50	50			
TOTAL		4	-	-	20										

ISE = In Semester Evaluation,

UT-I = Unit Test-I,

UT-II = Unit Test-II

ESE = End Semester Exam

Total Contact Hours/week Total : 04

Credits : 20

Note:

1] Weekly Contact hours are not mentioned as students are expected to regularly be in an outside research organization for 20 weeks. However, students need to report to institute mentors as and when required.

2] For online courses, lecture videos of each unit will be made available to the students through the college platform. For each unit, there will be separate assignments. Students need to submit all assignments within the specified time.

Weightage: 25% weightage for unit-wise assignments + 75% weightage for final exam. The final exam will be held at a college campus.



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Model III: Entrepreneurial Internship (EI)

Class: Second Year MCA

Semester: IV

Course Code	Course	Teaching Scheme			Credits	Evaluation Scheme					
		L	T	P		Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min. for passing		Max	Min. for passing
MCA2081	Project Management (Online Course)	2	-	-	2	ISE	25	40	40	-	-
						ESE	75	40		-	-
MCA2041	Principles of Management & Economics (Online Course)	2	-	-	2	ISE	25	40	40	-	-
						ESE	75	40		-	-
MCA2141	Entrepreneurial Internship	-	-	-	16	ISE				50	50
						ESE				50	
	TOTAL	4	-	-	20						

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test-II, ESE = End Semester Exam

Total Contact

Hours/week : 04

Total Credits : 20

Note:

1] Weekly Contact hours are not mentioned as student is expected to be in outside research organization regularly for 20 weeks. However, students need to report to institute mentors as and when required.

2] For online courses, lecture videos of each unit will be made available to the students through the college platform. For each unit, there will be separate assignments. Students need to submit all assignments within the specified time.

Weightage: 25% weightage for unit-wise assignments + 75% weightage for final exam. The final exam will be held at a college campus.

3] A one-week Entrepreneurship Development Program (EDP) will be conducted after the completion of 3rd semester and before the start of 4th semester



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Class:- First Year MCA	Semester- I	L	T	P	Credits
Course Code: MCA1011	Course Name : Mathematical Foundation	2	-	-	2

Course Description:

This course aims to equip students with a solid foundation in essential mathematical concepts that are pivotal in computer applications. The curriculum covers various topics including mathematical logic, set theory, combinatory, graph theory, linear algebra, probability, statistics, and optimization techniques. Through this course, students will develop the mathematical skills necessary for problem-solving and analysis in various areas of computer science.

Course Learning Outcomes:

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

1. Apply principles of mathematical logic and set theory to solve computational problems.
2. Utilize combinatorial techniques and graph theory to model and analyze complex networks and structures.
3. Perform matrix operations and analyze vector spaces to support computational applications in linear algebra.
4. Apply probability and statistical methods to model and interpret data.
5. Formulate and solve optimization problems using linear and nonlinear programming techniques.

Prerequisite:

Basics of Mathematics

Course Content

Unit No	Description	Hrs
1	Mathematical Logic: Propositional Logic: Syntax and Semantics, Logical Connectives, Truth Tables, Tautologies, Contradictions. Predicate Logic: Quantifiers, Logical Equivalences, Validity.	04
2	Sets and Relations Set Theory: Basic Definitions, Venn Diagrams, Operations on Sets, Cartesian Products. Relations and Functions: Types of Relations, Equivalence Relations, Functions and their Properties.	04
3	Combinatory and Graph Theory: Combinatory: Permutations, Combinations, Binomial Theorem, Pigeonhole Principle. Graph Theory: Basic Definitions, Graph Representations, Paths and Circuits, Eulerian and Hamiltonian Graphs.	04
4	Linear Algebra: Matrices: Definitions, Types, Operations, Inverse of a Matrix. Determinants: Properties and Applications. Vector Spaces: Subspaces, Linear Independence,	04





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	Basis, Dimension.	
5	Probability and Statistics: Probability Theory: Basic Concepts, Conditional Probability, Bayes' Theorem. Random Variables: Discrete and Continuous, Probability Distributions, Expectation and Variance. Statistical Inference: Sampling, Hypothesis Testing, Confidence Intervals.	04
6	Optimization Techniques: Linear Programming: Formulation, Graphical Method, Simplex Method. Nonlinear Programming: Unconstrained and Constrained Optimization. Dynamic Programming: Principle of Optimality, Applications. Introduction to Metaheuristics: Genetic Algorithms, Simulated Annealing.	04

References -

Text Books:

- Kenneth H. Rosen, Discrete Mathematics and Its Applications, McGraw-Hill Education.
- Richard L. Burden and J. Douglas Faires, Numerical Analysis, Cengage Learning.

Reference Books:

- E. Kreyszig, Advanced Engineering Mathematics. Wiley.
- G. Strang, Linear Algebra and Its Applications. Wellesley-Cambridge Press.
- J. L. Devore, Probability and Statistics for Engineering and the Sciences. Cengage Learning.





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Class: -First Year MCA	Semester- I	L	T	P	Credits
Course Code: MCA1031	Course Name : Data Structures using Python	3	-	-	3

Course Description:

This course introduces students to the fundamental concepts of Python programming and the implementation of various data structures. It is designed for students with no prior knowledge of Python and covers essential programming constructs, advanced Python features, and practical applications of data structures.

Course Learning Outcomes:

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

1. Implement control structures and functions in the basic of python programming.
2. Develop Python applications using advanced language features.
3. Apply arrays and lists effectively to solve computational problems.
4. Apply stack and queue operations, including their implementation and use cases.
5. Implement various types of linked lists, such as singly, doubly, and circular linked lists.
6. Implement trees and fundamental sorting algorithms, enhancing their problem-solving and computational thinking skills.

Prerequisite:

Basics of Computers and Mathematics.

Course Content

Unit No	Description	Hrs
1	Introduction to Python Programming: Introduction to Python and its features, Setting up the Python environment, Basic syntax, variables, and data types. Control Structures: Conditional statements (if, else, else if), Looping constructs (for, while), List comprehensions. Functions: Defining and calling functions, Lambda functions, Function arguments, and return values.	06
2	Advanced Python Programming & Data Structures in Python, Modules and Packages: Lists, tuples, sets, dictionaries, String manipulations, List comprehensions, and generator expressions, importing modules and using standard libraries, creating and using custom modules, Introduction to virtual environments.	06
3	Arrays and Lists: Overview of Data Structures: Importance and types of data structures (linear and non-linear), Abstract Data Types (ADT), Definition and operations,	06





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	Implementing arrays in Python, Array applications. List operations and methods, Dynamic arrays and their implementation, Applications of lists.	
4	Stacks and Queues: Definition and operations (push, pop, peek), Implementation of stacks using lists, Applications of stacks (e.g., expression evaluation, backtracking). Definition and operations (enqueue, dequeue), Implementation of queues using lists, Circular queues, and Applications of queues (e.g., scheduling, buffering).	06
5	Linked Lists: Singly Linked Lists: Definition and operations (insertion, deletion, traversal), Implementation of singly linked lists, Applications of singly linked lists. Doubly Linked Lists: Definition and operations (insertion, deletion, traversal), Implementation of doubly linked lists, Applications of doubly linked lists. Circular Linked Lists: Definition and operations (insertion, deletion, traversal), Implementation of circular linked lists, Applications of circular linked lists	06
6	Trees, Graph, Searching and Sorting: Trees: Tree terminology (root, leaf, node, etc.), Binary trees and binary search trees (BST), Tree traversal methods (in-order, pre-order, post-order), Implementation of binary trees and BST, Applications of trees, Graph Algorithms, Searching Algorithms, Sorting Algorithms: Bubble sort, selection sort, insertion sort, Merge sort, quick sort, Analysis of sorting algorithms (time and space complexity)	06

References -

Text Books:

- M. T. Goodrich, R. Tamassia, and M. H. Goldwasser, *Data Structures and Algorithms in Python*, Wiley.
- B. Baka, *Python Data Structures and Algorithms*, Packt Publishing.

Reference Books:

- <https://nptel.ac.in/courses/106106145> NPTEL, Python Programming Course. (Python)
- <https://nptel.ac.in/courses/106102064> NPTEL, Data Structures Course.





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Class:- First Year MCA	Semester- I	L	T	P	Credits
Course Code: MCA1051	Course Name : Database Management Systems	3	--	–	3

Course Description:

A database is an organized collection of data. A relational database, more restrictively, is a collection of schemas, tables, queries, views, and other elements. It defines data models, relational models, and constraints that can be used in the design of the relational database, also it focuses on file structure, transaction management and recovery of databases. The course also provides an overview of SQL which is used for implementation of relational databases. Applications include inventory management, supply chain management, healthcare, banking, education, and library management systems. It also covers PL/SQL Programming concepts like PL/SQL Queries, Functions, Procedures, Exception handling, Triggers and Cursors.

Course Learning Outcomes:

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

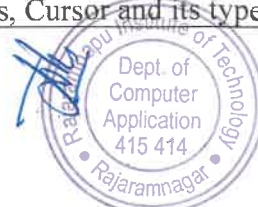
1. Normalize databases by drawing ER diagrams with required constraints and cardinality.
2. Design ER models to represent simple database application scenarios.
3. Write SQL queries to perform various operations on the database.
4. Apply concepts of integrity constraints, Hashing, and Indexing on databases.
5. Analyze transaction management techniques, concurrency control, and crash recovery.
6. Analyze the NoSQL (MongoDB) Database System, its features and operations.

Prerequisite:

Data Structures

Course Content

Unit No	Description	Hrs
1	Introduction to Database Concepts: Purpose of Database Systems, Data abstraction, Data Models, Entities and Entity sets, Mapping Constraints, E-R Diagram, Reducing E-R Diagrams to Tables, Generalization and Aggregation.	06
2	Relational Model: Structure of Relational Databases, the Relational Algebra, the Tuple Relational Calculus, Structured Query Language (SQL)	06
3	Integrity Constraints: Domain Constraints, Referential Integrity, Functional Dependencies, Canonical Cover, Pitfalls in Relational Database Design, Decomposition and Normalization using Functional Dependencies.	06
4	PL/SQL: PL/SQL Block, Control and Loops, Queries and Clauses, Operators, Procedures and Functions. Exception handling in PL/SQL, Triggers, Cursor and its types.	06





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5	Transaction and Concurrency Control: Transaction concept, Transaction state, Concurrent Executions, Serializability, Testing for Serializability, Lock-Based Protocols, Graph-Based Protocols, Time-Stamp Based Protocols, Crash Recovery: Failure Classification, Log-Based Recovery.	06
6	NoSQL: Fundamentals of NoSQL (NoSQL Features, Data Models, and Distribution Models), Introduction to MongoDB, MongoDB CRUD operations.	06

References -

Text Books:

- Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, Database System Concepts, McGraw Hill Education.
- Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw Hill Education.
- Ivan Bayross, SQL, PL/SQL – The Programming Language of Oracle, BPB Publications.

Reference Books:

- J. D. Ullman, Principles of Database Systems, Galgotia Publications.
- Gio Wiederhold, Database Design, McGraw Hill International.
- Kristina Chodorow, MongoDB: The Definitive Guide: Powerful and Scalable Data Storage, O'Reilly Media.





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Class:- First Year MCA	Semester- I
Course Code: MCA1071	Course Name : Computer Networks

L	T	P	Credits
3	--	2	4

Course Description:

Computer networking is the engineering discipline concerned with the communication between computer systems or devices. A computer network is any set of computers or devices connected to each other with the ability to exchange data. This course examines principles, design, implementation, and performance of computer networks. A focus will be placed on TCP/IP models, data link layer, Network layer, Transport layer, Application Layer & Topics include- Addressing, Routing methods & protocols, congestion control algorithm, Internet protocols, TCP, peer-to-peer networking, UDP, and application layer protocols like DHCP, DNS, FTP, HTTP.

Course Learning Outcomes:

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

1. Analyze the various network components and topologies.
2. Illustrate the concepts, services, protocols, and algorithms used in Computer Networks.
3. Implement client-server programs using Berkeley socket programming.
4. Solve problems related to routing, framing, error correction, detection, and IPv4 Addressing.
5. Compare the different services, protocols, and algorithms used in Computer Networks.

Prerequisite:

Basics of Computers

Course Content

Unit No	Description	Hrs
1	Data Communication Fundamentals and Network Models: Data communications, Transmission Media Guided media, Unguided media, Network topologies, Introduction to LAN, WAN, MAN, Manageable Switches, Bridges, Routers, Hubs, Repeaters, ISO's OSI model, and TCP/IP reference model.	06
2	Data Link Layer and Medium Access Control Sublayer: Data Link Layer: Design issues for Data Link Layers, Error control: detection and correction, Elementary Data Link protocols, sliding window Protocols, Go back n , Selective repeat, MAC Sublayer: The Channel allocation problem, Multiple Access protocols, ALOHA, CSMA, Collision Free Protocols.	06

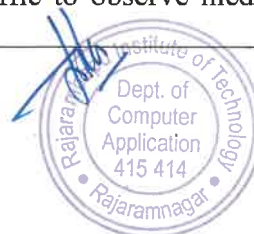




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3	Network Layer: Network layer design issues, Routing algorithms: The Optimality Principles, shortest path, flooding, And distance vector, Congestion control algorithms: Principles, Congestion prevention policies, congestion control in virtual circuit subnet, choke packets, Load Shedding, Jitter Control.	06
4	Internet Layer Addresses and Protocols: IPv4 Addresses: Introduction, Classful Addressing, And other Issues: Subnetting and Super netting, Classless Addressing, Special Addresses. IP Datagram format, Fragmentation and reassembly models, ARP, RARP, ICMP.	06
5	Transport Layer: Internet Sockets address structure, Socket system call for connection-oriented protocol (TCP) and connectionless protocol (UDP), Concurrent Server, Iterative server. UDP: Process-to-Process communication, User Datagram Format, Operation and uses of UDP. TCP: TCP Services and Features, TCP segment format, TCP Connections, Flow and error control in TCP, TCP Timers.	06
6	Application Layer: Host Configuration: DHCP, Domain Name System (DNS), World Wide World Wide Web and Hyper Text Transfer Protocol, Electronic mail, File Transfer Protocol.	06

Practical Course Content		
Exp. No	Description	Hrs
1.	Create a simple star topology network with switches, PCs, and a router using Cisco Packet Tracer.	02
2.	Configure IP addressing on network devices and ensure connectivity across devices.	02
3.	Design and configure a network with subnetting and implement VLSM for efficient IP allocation.	02
4.	Set up routing protocols like RIP or OSPF in a multi-router network and observe routing behavior.	02
5.	Simulate Data Link Layer protocols and observe collision detection using CSMA/CD.	02
6.	Implement TCP and UDP socket communication between client and server machines.	02
7.	Configure DHCP and DNS servers in a network and test client-server interactions.	02
8.	Simulate network congestion, troubleshoot using Packet Tracer tools, and implement QoS policies.	02
9.	Create and configure VLANs on switches and test inter-VLAN routing using routers.	02
10.	Analyze MAC layer operations and simulate traffic to observe medium access control.	02





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References -

Text Books:

- A. S. Tanenbaum, *Computer Networks*, Pearson Education.
- B. A. Forouzan, *TCP/IP Protocol Suite*, McGraw-Hill Education.

Reference Books:

- W. Richard Stevens, Bill Fenner, and Andrew M. Rudoff, *Unix Network Programming*, Pearson.
- Douglas E. Comer and David L. Stevens, *Internetworking with TCP/IP Volume III: Client-Server Programming and Applications*, Prentice Hall of India Pvt. Ltd.
- Nader F. Mir, *Computer and Communication Networks*, Prentice Hall.





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Class:- First Year MCA	Semester- I	L	T	P	Credits
Course Code: MCA1091	Course Name : Operating System Concepts	3	--	2	4

Course Description:

This course provides an elementary introduction to operating systems and their principles. It elaborates on the basic structure and functioning of the operating system. Design paradigms are explored in greater depth, and more advanced techniques for solving computational problems are presented. It covers various algorithms used in operating systems. It makes students aware of an operating system and various design techniques.

Course Learning Outcomes:

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

1. Utilize basic functions, system calls, interface with the operating system, and comprehend the implementation of system programs.
2. Implement process concepts, and scheduling algorithms, and develop multi-threaded applications.
3. Apply synchronization techniques, solve critical section problems, and manage deadlocks effectively.
4. Analyze memory management strategies, including paging, segmentation, and virtual memory management
5. Manage files, and directories, and understand disk scheduling and RAID structures.
6. Perform Linux system administration tasks with Linux operating system commands, file and directory management, shell scripting, and user management.

Prerequisite:

Basics of Computers

Course Content

Unit No	Description	Hrs
1	Introduction to operating systems: System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments.	06
2	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 debugging, Operating System	06





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	generation; System boot.	
3	Process Management: Process concept; Process scheduling; Operations on processes; Inter-process communication. Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Thread scheduling, and Multiple-processor scheduling.	06
4	Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.	06
5	Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.	06
6	File Management and Secondary Storage Structure: File Management- File concept, Access Methods, Directory Structure, Protection, File System Structure, File System Implementation, Allocation Methods, Overview of Mass-Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap Space Management, RAID Structure.	06

Experiments		
Experiment No	Description	Hrs
1.	Develop a C program to implement the Process system calls (fork (), exec(), wait(), create process, terminate process)	02
2.	Simulate the following CPU scheduling algorithms to find turnaround time and waiting time a) FCFS b) SJF c) Round Robin d) Priority.	02
3.	Develop a C program to simulate producer-consumer problems using semaphores.	02
4.	Develop a C program that demonstrates inter-process communication between a reader process and a writer process. Use mkfifo, open, read, write, and close APIs in your program.	02
5.	Develop a C program to simulate the Bankers Algorithm for DeadLock Avoidance.	02
6.	Develop a C program to simulate the following contiguous memory allocation Techniques: a) Worst fit b) Best fit c) First fit	02
7.	Develop a C program to simulate page replacement algorithms: a) FIFO b) LRU	02
8.	Simulate the following File Organization Techniques	02





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	a) Single-level directory b) Two-level directory	
9.	Develop a C program to simulate the Linked file allocation strategies.	02
10.	Develop a C program to simulate the SCAN disk scheduling algorithm.	02

References -

Text Books:

- Abraham Silberschatz, Peter B. Galvin, and Greg Gagne, *Operating System Concepts*, Wiley Publication.

Reference Books:

- Milan Milenkovic, *Operating Systems: Concepts and Design*, Tata McGraw-Hill (TMGH) Publication.
- Andrew S. Tanenbaum, *Operating Systems: Design and Implementation*, PHI Publication.





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Class:- First Year MCA	Semester- I	L	T	P	Credits
Course Code: MCA1111	Course Name : Research Methodology	2	-	-	2

Course Description:

This course provides an in-depth understanding of research methodologies with a focus on technical and experimental learning in the field of computer applications. It covers the complete research cycle from problem identification to data collection, analysis, and interpretation, with an emphasis on practical applications and the use of computational tools.

Course Learning Outcomes:

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

1. Utilize concepts and processes of research methodology applicable to computer applications.
2. Formulate research problems and hypotheses relevant to technical and experimental scenarios.
3. Design robust research studies utilizing appropriate technical research methods and tools.
4. Employ advanced data collection and analysis techniques, leveraging statistical and computational software.
5. Compose comprehensive research reports and technical papers.
6. Uphold ethical standards in conducting and reporting research in the field of computer applications.

Prerequisite:

Basics of Computers

Course Content

Unit No	Description	Hrs
1	Introduction to Research Methodology in Computer Applications: Definition and Objectives of Research, Types of Research: Descriptive, Analytical, Applied, Fundamental, Quantitative, Qualitative, Research Approaches: Experimental, Survey, Case Study in Computer Applications Significance of Research in the Field of Computer Science, Research Process and Steps in Research.	04
2	Research Problem Formulation in Technical Contexts: Defining and Formulating Research Problems in Computer Applications, Literature Review and Identifying Research Gaps in Technical Fields, Setting Objectives and Hypotheses for Technical Research, Research Design and its Types, Characteristics of a Good Technical Research Design	04
3	Data Collection Methods for Technical Research: Primary and Secondary Data in Computer Science Research, Sampling Methods and	04





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	Techniques: Probability and Non-Probability Sampling, Data Collection Tools: Surveys, Experiments, Simulations.	
4	Data Analysis and Interpretation in Computer Applications: Descriptive and Inferential Statistics, Data Processing: Data Cleaning, Data Transformation, Coding, Statistical Analysis Techniques: Correlation, Regression, ANOVA, Chi-Square, Use of Software Tools for Data Analysis: SPSS, R, Python, MATLAB, Interpretation of Computational Results.	04
5	Research Report Writing for Technical Audiences: Structure and Components of a Research Report, Writing the Introduction, Literature Review, Methodology, Results, and Discussion for Technical Papers, Referencing and Citation Styles: IEEE, ACM, APA, Reference Management Software, Preparing Abstracts and Summaries for Technical Conferences and Journals.	04
6	Ethical Considerations in Technical Research: Research Ethics and Integrity in Computer Science, Plagiarism and How to Avoid It, Plagiarism Detection Tools, Ethical Issues in Data Collection and Reporting in Technical Research, Intellectual Property Rights and Copyrights, Role of Institutional Review Boards (IRB) in Technical Research.	04

References -

Text Books:

- C. R. Kothari, Research Methodology: Methods and Techniques, New Age International Publishers.
- Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, SAGE Publications.
- John W. Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, SAGE Publications.

Reference Books:

- Deepak Chawla and Neena Sondhi, Research Methodology: Concepts and Cases, Vikas Publishing House.
- Vijay K. Garg, Research Methodology: A Practical Approach, Alpha Science International Ltd.
- Raj Jain, The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation, and Modeling, Wiley-Interscience.

Electronic References:

- Prof. Edamana Prasad and Prof. Prathap Haridoss, Research Methodology, IIT Madras.
- Dr. Sadananda Sahoo, MGPE-015: Introduction to Research Methods (Elective Course), Indira Gandhi National Open University, New Delhi.
- https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ge79





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Class:- First Year MCA	Semester- I	L	T	P	Credits
Course Code: MCA1131	Course Name : Data Structures using Python Lab	--	--	2	1

Course Description:

This course introduces students to the fundamental concepts of Python programming and the implementation of various data structures. It is designed for students with no prior knowledge of Python and covers essential programming constructs, advanced Python features, and practical applications of data structures.

Course Learning Outcomes:

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

1. Implement control structures and functions in the basics of Python programming.
2. Develop Python applications using advanced language features.
3. Implement arrays and lists effectively to solve computational problems.
4. Apply stack and queue operations
5. Implement various types of linked lists, such as singly linked lists.
6. Implement trees and fundamental sorting algorithms.

Prerequisite:

Basics of Computers and Mathematics.

Course Content

Exp. No.	Description	Hrs
1	Write programs using basic Python syntax, variables, data types, control structures, and loops.	02
2	Implement functions, lambda expressions, and list comprehensions for arithmetic and data creation.	02
3	Work with advanced data structures and perform string manipulation using Python.	02
4	Use Python modules and packages, including both standard and custom modules.	02
5	Implement arrays and perform various list operations including dynamic resizing.	02
6	Implement stack data structure and solve problems using stack operations.	02
7	Implement queue operations and simulate real-world scenarios like ticket booking.	02
8	Perform insertion, deletion, and traversal in singly linked lists.	02
9	Implement a binary search tree (BST), graph and perform traversal operations.	02





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10.	Write programs to implement and compare Searching(linear, binary search) and sorting algorithms(bubble sort, merge sort)	02
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References -

Text Books:

- M. T. Goodrich, R. Tamassia, and M. H. Goldwasser, *Data Structures and Algorithms in Python*, Wiley.
- B. Baka, *Python Data Structures and Algorithms*, Packt Publishing.

Reference Books:

- NPTEL, Programming, Data Structures and Algorithms Using Python.
<https://nptel.ac.in/courses/106106145>
- NPTEL, Data Structures and Algorithms. <https://nptel.ac.in/courses/106102064>





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Class:- First Year MCA	Semester- I	L	T	P	Credits
Course Code: MCA1151	Course Name : Database Management Systems Lab	-	-	2	1

Course Description:

The course Database Management Systems Lab includes Database Schema Diagram designing for given problem statement using open-source tool. With this course, students will be able to understand the basic syntax of DDL, DML, DCL commands and apply these commands on a given problem statement. It also includes PL-SQL (Stored Procedure, Triggers, Functions, Cursors) and practically implements it. It also covers the implementation of integration of database and software application. At the end, it explores NoSQL database MongoDB.

Course Learning Outcomes:

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

1. Sketch E-R diagram for given Case Study/ Problem Statement.
2. Write SQL query for various operations like retrieval, insertion and manipulation of data etc.
3. Apply PL/SQL for implementing Cursor, Procedure/Function and Trigger.
4. Design databases for given applications.
5. Demonstrate basic commands of MongoDB with installation.

Prerequisite:

Basics of DBMS and Set theory.

Course Content

Exp. No	Description	Hrs
1	Draw the ER Diagram & Schema Diagram using an open-source tool.	02
2	Implement the DDL and DML Commands.	02
3	Implement the Constraints & Referential Integrity.	02
4	Implement String, Set operations, aggregate functions, Group by, Order by clause.	02
5	Implement the Queries based on all types of joins.	02
6	Implement user administration: create user, give permission, remove permissions.	02
7	Implement PL/SQL queries, clauses, operators.	02
8	Implement Stored Procedure & Functions with Exception handling.	02
9	Implement Triggers & Cursors.	02
10	Install - Mongo-DB and execute Aggregation commands.	02





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References -

Text Books:

- Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, *Database System Concepts*, McGraw Hill Education.
- Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, McGraw Hill Education.
- Ivan Bayross, SQL, PL/SQL – The Programming Language of Oracle, BPB Publications.

Reference Books:

- J. D. Ullman, Principles of Database Systems, Galgotia Publications.
- Gio Wiederhold, Database Design, McGraw Hill International.





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Class: -First Year MCA	Semester- I	L	T	P	Credits
Course Code: MCA1171	Course Name : Basics of Programming & Computer Organization	3	--	2	--

Course Description:

This course provides a comprehensive introduction to the fundamentals of computer organization and programming using the C language. Students will learn the essential concepts of computer hardware and software, as well as how to write, compile, and execute C programs. The course covers various programming constructs, including control structures, functions, arrays, pointers, and file handling, equipping students with the skills necessary for problem-solving and application development in C.

Course Learning Outcomes:

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

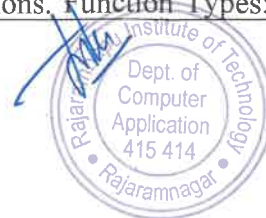
1. Write simple C programs using input and output operations.
2. Use decision-making and loops to control the flow of C programs.
3. Use control structures, functions, arrays, and pointers in C programs.
4. Perform data handling using structures and file operations in C.

Prerequisite:

Basics of mathematics.

Course Content

Unit No	Description	Hrs
1	Computer Organization: Introduction to Computers: Definition, Characteristics, and Applications. Basic Computer Organization: Input and Output Devices, Memory Units, CPU Data Representation: Number Systems (Binary, Octal, Hexadecimal), Conversions, Binary Arithmetic. Memory Hierarchy: Primary and Secondary Storage, Cache Memory, Virtual Memory. Introduction to Operating Systems: Functions, Types, and Examples.	06
2	Introduction to C Programming: Overview of C Programming Language: History, Features, and Structure of a C Program. Writing and Executing C Programs: Compilation and Execution Process. Basic Syntax: Keywords, Identifiers, Constants, Variables, and Data Types. Operators and Expressions: Arithmetic, Relational, Logical, Bitwise, Assignment, and Miscellaneous Operators. Input and Output Operations. printf() and scanf() Functions.	06
3	Control Structures: Decision Making: if, if-else, nested if, switch-case Statements. Looping Constructs: for, while, do-while Loops. Jump Statements: break, continue, goto. Nested Loops and Conditional Statements.	06
4	Functions and Arrays: Functions: Definition, Declaration, and Calling Functions. Function Types: User-	06





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	defined and Standard Library Functions. Parameter Passing: Call by Value and Call by Reference. Arrays: Definition, Declaration, and Initialization. Multi-dimensional Arrays: Working with 2D Arrays.	
5	Pointers and Strings: Pointers: Introduction, Declaration, and Usage. Pointer Arithmetic: Operations on Pointers. Pointers and Arrays: Relationship and Usage. Strings: Definition, Declaration, Initialization, and Standard Library Functions. Working with Strings and Pointers.	06
6	Structures and File Handling in C: Structures: Definition, Declaration, Initialization, and Accessing Members. Nested Structures and Arrays of Structures. File Handling: Opening, Reading, Writing, and Closing Files. File Modes: Text and Binary Files.	06

Practical Course Content

Exp. No	Description	Hrs
1	Write a C program to demonstrate the structure of a C program, use variables, data types, and perform input/output operations using printf() and scanf().	02
2	Write a C program to perform arithmetic operations and demonstrate the use of arithmetic, relational, logical, assignment, and bitwise operators.	02
3	Write a C program to perform decimal, binary, octal, and hexadecimal number system conversions.	02
4	Write a C program to implement decision-making statements using if, if-else, nested if, and switch-case.	02
5	Write a C program to solve problems using looping constructs (for, while, do-while) and jump statements (break and continue).	02
6	Write a C program to implement user-defined functions using call by value and call by reference.	02
7	Write a C program to perform searching, sorting, and matrix operations using one-dimensional and two-dimensional arrays.	02
8	Write a C program to demonstrate pointer declaration, pointer arithmetic, and the relationship between pointers and arrays.	02
9	Write a C program to perform string operations using standard library functions and pointers.	02
10	Write a C program to store and manage student records using structures and perform file operations such as creating, reading, writing, and appending data.	02

References -

Text Books:

- E. Balagurusamy, *Programming in ANSI C*, McGraw-Hill Education.
- Brian W. Kernighan and Dennis M. Ritchie, *The C Programming Language*, Prentice Hall.
- William Stallings, *Computer Organization and Architecture*, Pearson.

Online Resources:

- NPTEL, *Introduction to C Programming*. <https://nptel.ac.in/courses/106104128>





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Class:-First Year MCA	Semester- I	L	T	P	Credits
Course Code: MCA1191	Course Name : Massive Open Online Course (MOOC)	-	-	-	1

Course Description:

Online courses offered through platforms like NPTEL, SWAYAM, NASSCOM Coursera, and Udemy provide Master of Computer Applications (MCA) students with valuable opportunities to advance their understanding of modern computing concepts and technologies. These courses cover key domains such as algorithms and data structures, software engineering, database systems, operating systems, computer networks, cybersecurity, cloud computing, and emerging fields like Artificial Intelligence, Machine Learning, and Data Science. By combining strong theoretical foundations with hands-on practical applications, they help students enhance problem-solving abilities, work with state-of-the-art tools, and prepare for real-world, industry-oriented challenges. The objective of such courses is to cultivate skills and mindsets that encourage continuous learning, adaptability to new technologies, and readiness to thrive in an ever-evolving tech landscape.

Course Learning Outcomes:

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

1. Explain fundamental principles, core concepts, and commonly used technologies in computer science and engineering.
2. Analyze basic computing problems using mathematical reasoning and engineering principles, and develop algorithms to solve them effectively.
3. Implement simple computer programs and system components using standard programming languages and software tools, demonstrating an ability to test and debug them.

Note:

1. The student will get the credits for the respective course under the following conditions. In the case of a course selected from NPTEL/SWAYAM/NASSCOM Coursera, and Udemy platforms, students have to compile the timely assignments, pass the exam and secure the certificate.
2. While selecting an online course, the following points must be taken care of:
3. Selected course must be approved by the Departmental Programme Committee (DPC).
4. The duration of each online course must be at least FOUR weeks for NPTEL/SWAYAM & minimum 12 to 20 hours for NASSCOM.

E-References -

- NPTEL (National Programme on Technology Enhanced Learning). <https://nptel.ac.in>
- SWAYAM (Study Webs of Active Learning for Young Aspiring Minds). <https://swayam.gov.in>
- NASSCOM MOOCs. <https://www.nasscom.in>
- Coursera <https://www.coursera.org/>
- Udemy www.udemy.com





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Class: -First Year MCA	Semester- II	L	T	P	Credits
Course Code: MCA1021	Course Name: Object Oriented Programming using Java	3	-	-	3

Course Description:

This course introduces the principles of Object-Oriented Programming (OOP) using Java, a versatile and widely-used programming language. The course covers the fundamental concepts of OOP, including classes, objects, inheritance, polymorphism, encapsulation, and abstraction. Students will learn how to design and implement robust, maintainable, and scalable Java applications. The course also delves into advanced topics such as exception handling, file I/O, collections framework, generics, and multithreading. Practical lab sessions provide hands-on experience, reinforcing theoretical knowledge through real-world programming exercises and projects. By the end of the course, students will be proficient in Java programming and capable of applying OOP principles to solve complex software problems.

Course Learning Outcomes:

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

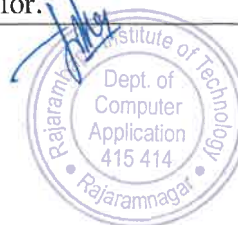
1. Apply Java data types, operators, control structures, methods, and arrays in programming solutions.
2. Implement object-oriented concepts such as classes, objects, constructors, inheritance, polymorphism, abstraction, and encapsulation in Java.
3. Use strings, packages, exception handling, and wrapper classes in Java applications.
4. Develop Java programs using multithreading, thread synchronization, and inter-thread communication.
5. Implement file handling, thread synchronization and inter-thread communication.
6. Develop Java applications by integrating object-oriented concepts and standard Java libraries to solve real-world problems.

Prerequisite:

Basic Programming Knowledge

Course Content

Unit No	Description	Hrs
1	Introduction to Java: Java Basics: Features of Java, History of Java, Installations of JDK and Eclipse as IDE, Writing and executing the first Java program. Understanding the role of Java compiler, JVM, understanding how Java is independent and secure platform. Java data types, variables, operators, expressions, type conversion, and casting in Java. Control structures in Java: if, if-else, and switch statements, using iterative/looping statements in Java: while, do-while, and for.	06





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2	Class and Object Concepts: Introduction to Object-Oriented concepts, defining a class, creating objects from a class, adding attributes and methods to the class, using constructors, Java naming conventions for class, properties, and methods/functions. Passing values to the functions – pass by value, pass by reference, Function overloading. Modifiers – public, private, protected, default, static, final Understanding use of Wrapper classes and Garbage collection in Java.	06
3	Arrays and Strings: One-dimensional array, Multidimensional arrays, exploring String class and methods, String Buffer class. Packages - creating and accessing a package, importing, packages, creating user-defined packages, Concept of package. Introduction to Exception Handling and user-defined exceptions	06
4	Inheritance and Polymorphism: Concept and importance of inheritance, is-a relationship, types of inheritance, Polymorphism – function overriding, dynamic method dispatch. Overriding methods with throws clause, Using abstract and final keywords with the class declaration, Concept of interface, Comparison of Interface, and class. Access modifiers and data accessibility in derived classes, method access modifiers, and method overriding.	06
5	Concurrent Programming: Concept of threads, lifecycle of threads, creating threads, Thread class, Runnable interface, Thread synchronization, Inter-thread communication– wait(), notify(), notifyAll() methods.	06
6	Java Input/Output: Concept of streams, types of streams – byte streams, character streams, The Console: System.out, System.in, and System.err. Understanding File class, InputStreamclass, OutputStreamclass, FileInputStreams, FileOutputStream, Using character-oriented Reader and Writer class, FileReader, FileWriter. Introduction to Buffered streams – DataInput and DataOutput Streams using BufferedReader, BufferedWriter. Making use of Object Streams for Serialization and deserialization,	06





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References -

Textbooks:

- E. Balagurusamy, Programming with Java: A Primer, McGraw-Hill Education.
- Herbert Schildt, Java: The Complete Reference, McGraw-Hill Education.

Reference Books:

- Kathy Sierra and Bert Bates, Head First Java, O'Reilly Media.
- Joshua Bloch, Effective Java, Addison-Wesley.
- Bruce Eckel, Thinking in Java, Prentice Hall.

e-References:

- Oracle Java Documentation, Oracle Corporation.
- Prof. Debasis Samanta, Object-Oriented Programming using Java, IIT Kharagpur (NPTEL).
- Java Programming Courses, Coursera.
- Java Programming Courses, Udemy.
- Java Programming Courses, edX.





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Class:-First Year MCA	Semester- II
Course Code: MCA1041	Course Name :Web Technology

L	T	P	Credits
3	--	--	3

Course Description:

This course provides a comprehensive introduction to the fundamental technologies used in web development. Students will learn about the basics of internet and web communication, HTML for structuring web content, CSS (including Bootstrap and Tailwind CSS) for styling and layout, and JavaScript (including jQuery) for client-side scripting. The course will also cover server-side scripting with PHP, including the implementation of CRUD (Create, Read, Update, Delete) operations for database management. Through a series of lectures and hands-on exercises, students will gain practical experience in building responsive and dynamic web applications.

Course Learning Outcomes:

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

1. Create structured web pages using HTML.
2. Apply styles to web pages using CSS, Bootstrap, and Tailwind CSS.
3. Develop interactive web pages using JavaScript and jQuery.
4. Implement server-side functionalities by applying PHP for CRUD operations.

Prerequisite:

Basics of Computers

Course Content

Unit No	Description	Hrs
1	Web Technologies, Internet Basics, and Web Communication: Introduction to Web Technologies, Overview of the Internet and World Wide Web, History and Evolution of the Internet, Internet Protocols (TCP/IP, DNS, DHCP), Web Browsers and Search Engines, Understanding URLs and Domain Names, Client-Server Architecture, Web Servers and Hosting, Web Standards and W3C. Web Communication: Understanding HTTP/HTTPS Protocols, HTTP Methods (GET, POST, PUT, DELETE), Status Codes and Their Meanings, Cookies, Sessions, and Local Storage, RESTful Web Services, WebSockets and Real-Time Communication	06
2	HTML Basics: Elements, Tags, and Attributes, Forms and Input, Handling, Semantic HTML, Multimedia Elements: Audio, Video, and Images	06
3	Styling Webpages: CSS, Bootstrap, Tailwind CSS: CSS Fundamentals: Syntax, types, Selectors, and Properties, CSS Box Model, Layout Techniques: Flexbox and Grid, Responsive Web Design and Media Queries, CSS Frameworks (Bootstrap, Tailwind)	06





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4	JavaScript and jQuery: Introduction to JavaScript, Variables, Data Types, and Operators, Control Structures and Functions, DOM Manipulation and Events, jQuery: Introduction to jQuery, Basics of jQuery syntax, Manipulating the DOM with jQuery, AJAX: Understanding AJAX, Implementing AJAX for dynamic content loading, Combining JavaScript, jQuery, and AJAX	06
5	PHP Basics: Introduction to PHP: Syntax and Variables, Control Structures and Loops, Functions, Form Handling in PHP, Session Management and Cookies	06
6	PHP CRUD: Connecting to a Database using PHP, Performing CRUD Operations (Create, Read, Update, Delete), Using PDO for Database Interactions, Building a Simple CRUD Application	06

References -

Text Books:

- Jon Duckett, HTML and CSS: Design and Build Websites, Wiley Publication.
- Luke Welling and Laura Thomson, PHP and MySQL Web Development, Addison-Wesley.

Reference Books:

- Eric Freeman and Elisabeth Robson, Head First HTML and CSS, O'Reilly Media.
- Kevin Yank, PHP & MySQL: Novice to Ninja, SitePoint Publication.





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Class: -First Year MCA	Semester- II	L	T	P	Credits
Course Code: MCA1061	Course Name : Software Engineering and Project Management	3	--	-	3

Course Description:

This course provides an in-depth understanding of software engineering principles, methodologies, and project management practices. It covers various aspects of software development, from requirements analysis and design to testing and maintenance, with a strong emphasis on modern software process models and project management tools. Through case studies and practical examples, students will learn to apply theoretical concepts to real-world software engineering projects.

Course Learning Outcomes:

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

1. Prepare Software Requirement Specification (SRS) documents by applying requirement engineering techniques.
2. Apply software process models for the development of software systems.
3. Design function-oriented and object-oriented models using UML diagrams and modern tools.
4. Compare different software testing techniques and strategies for Software Quality Assurance.
5. Develop software project Plans by applying project planning, scheduling, and risk management techniques.
6. Apply modern project management tools to plan, monitor, and manage software projects.

Prerequisite:

Fundamentals programming and software development process.

Course Content		
Unit No	Description	Hrs
1	Software Requirements, Analysis and Specification: Software Engineering Problem and Approaches, Software requirement analysis and specification, problem analysis, Requirement Specification, Validation, Case study to prepare SRS.	06
2	Software Process Models: Waterfall model, V model, Evolutionary, Prototyping, Spiral model, Agile software development, Agile methodologies, Agile model: principle techniques, Extreme programming (XP): planning, design, coding, testing, XP practices, Scrum: framework, Sprint: product backlog, sprint backlog, burn down charts, Case study on Agile model.	06
3	Function-oriented and Object-oriented Design: Design principles, module level concepts, Design notation and specification,	06





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	structured design methodology, Verification, Case study on DFD for Hospital Management System, Library Management System, Railway Reservation System and Online Shopping System. Object Oriented Analysis and Object-Oriented Design, Object Oriented concepts, Unified Modelling Language, A Design Methodology, case study on Class, Object and Sequence and Collaboration diagrams for Banking system, college management system, online food ordering system.	
4	Software Testing Techniques and Strategies: Software Testing Fundamentals, Black box testing, White box testing, Gray box testing, Unit Testing, Integration Testing, Verification & Validation, case study on modern tools and techniques for software testing, test cases writing.	06
5	Project Planning: Project Management, Characteristics and constraints of Project, The project planning Infrastructure: Process database, process capability baseline, process asset and the body of knowledge system, Estimation and scheduling concepts and techniques. Quality Planning: Quality concepts, Quantitative Quality management planning, Defect prevention planning. Risk Management: Concepts of risk and risk management assessment Risk control, Maintenance and Reengineering	06
6	Project Managing, Monitoring and Control: Processes and project management and the CMM project management process, Training for project managers, SEPG support to projects, Review: The Reviews, Review process, Data collection, Project tracking, milestone analysis, Monitoring and control, Defect Analysis and prevention, Project management tools: Asana, Bitrix24, Zapier.	06

References -

Text Books:

- Pankaj Jalote, Software Project Management in Practice, Pearson Education.
- Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publication House.

Reference Books:

- Roger S. Pressman, Software Engineering: A Practitioner's Approach, Tata McGraw-Hill.
- Ian Sommerville, Software Engineering, Pearson Education.

e-References:

- Prof. Rajib Mall, *Software Engineering* (NPTEL), IIT Kharagpur. <https://nptel.ac.in>





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Class:- First Year MCA	Semester- II	L	T	P	Credits
Course Code: MCA1081	Course Name : Big Data Paradigm	3	--	2	4

Course Description:

Big data is a field that treats ways to analyze, systematically extract information from, or otherwise deal with data sets that are too large or complex to be dealt with by traditional data- processing application software. Data with many cases (rows) offer greater statistical power, while data with higher complexity (more attributes or columns) may lead to a higher false discovery rate. Big data challenges include capturing data, data storage, data analysis, search, sharing, transfer, visualization, querying, updating, information privacy and data source.

Course Learning Outcomes:

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

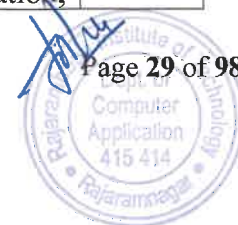
1. Identify characteristics of Big Data and key terminologies.
2. Apply Hadoop architecture concepts with HDFS and MapReduce.
3. Analyze Hadoop ecosystem components, focusing on YARN and Hadoop 2.0 features.
4. Use Hive, HBase, and Pig for querying large datasets.

Prerequisite:

Basic Knowledge of Programming and Data Management.

Course Content

Unit No	Description	Hrs
1	Introduction to Big Data: Types of Digital Data, Classification of Digital Data, Structured Data, Semi-Structured Data, Unstructured data, Terminologies Used in Big Data Environments. Introduction to Big Data, Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, what is Big Data? Volume, Velocity, Variety of Big data applications, Terminologies used in Big data environment.	06
2	Introduction to Hadoop & Architecture: Apache Hadoop & Hadoop Architecture, Hadoop core components, Hadoop Distributions, Developing enterprise Applications with Hadoop, Hadoop Configuration.	06
3	Hadoop Storage & MapReduce: Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read, Name Node, Secondary Name Node, and Data Node, Hadoop Map Reduce paradigm, understanding inputs and outputs of MapReduce, Map and Reduce tasks, Job and Task trackers	06
4	Hadoop Ecosystem AND YARN: Hadoop Ecosystem, Hadoop ecosystem components, Schedulers, Fair and Capacity, Hadoop 2.0 New Features, High Availability, HDFS Federation,	06





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	MRv2, YARN.	
5	HIVE AND HIVEQL: Hive Architecture, Comparison with Traditional Database HiveQL, Querying Data - Sorting and Aggregating, Joins & Sub queries.	06
6	HBase and Pig: HBase concepts, Advanced Usage, Schema Design, Advanced Indexing - PIG, Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper. Spark- stream processing, streaming systems, applications.	06

Practical Course Content

Experiment No.	Description	Hours
1.	Install a single-node Hadoop cluster for running basic distributed applications.	2
2.	Configure a single-node Hadoop cluster for running basic distributed applications.	2
3.	Perform file operations in HDFS using Hadoop shell commands.	2
4.	Demonstrate the roles of NameNode, DataNode, and Secondary NameNode in HDFS architecture.	2
5.	Write and execute a basic MapReduce program to count word occurrences in a text file.	2
6.	Configure and run a MapReduce job while understanding the role of JobTracker and TaskTracker.	2
7.	Explore YARN and Hadoop 2.0 features including HDFS Federation and NameNode High Availability.	2
8.	Set up Hive and perform data querying using HiveQL with sorting, aggregation, joins, and subqueries.	2
9.	Configure HBase, perform CRUD operations, and understand the role of ZooKeeper in cluster coordination.	2
10.	Use Pig for analyzing HBase data and explore the basics of Spark for stream processing applications.	2

References -

Text Books:

- Boris Lublinsky, Kevin T. Smith, and Alexey Yakubovich, Professional Hadoop Solutions, Wiley.
- Seema Acharya and Subhashini Chellappan, Big Data and Analytics, Wiley.

Reference Books:

- Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, and Paul Zikopoulos, Understanding Big Data, McGraw Hill.
- Tom White, Hadoop: The Definitive Guide, O'Reilly Media.





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Class:-First Year MCA	Semester-II
Course Code: MCA1101	Course Name : Principles of Information Security (PE -1)

L	T	P	Credits
3	--	2	4

Course Description:

This course provides an in-depth understanding of the principles and practices of information security. It covers fundamental concepts such as the history of information security, security models, the need for security, security technologies (firewalls, VPNs, IDS, IPS), cryptography, and physical security. The course includes practical exercises using open-source tools to give students hands-on experience in various aspects of information security.

Course Learning Outcomes:

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

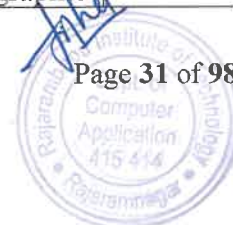
1. Explain the principles and history of information security.
2. Assess security needs and threats in business environments.
3. Implement security technologies like firewalls, VPNs, and intrusion detection systems.
4. Apply cryptography and design physical security measures.

Prerequisite:

Basic understanding of computer networks and operating systems.

Course Content

Unit No	Description	Hrs
1	Introduction to Information Security: Introduction, The History of Information Security, what is Security? CNSS Security Model, Components of an Information System, Balancing Information Security and Access, Approaches to Information Security Implementation, The Systems Development Life Cycle, The Security Systems Development Life Cycle, Security Professionals and the Organization, Communities of Interest, Information Security: Is it an Art or a Science?	07
2	The Need for Security: Introduction, Business Needs First, Threats, Attacks, Secure Software Development.	05
3	Security Technology: Firewalls and VPNs: Introduction, Access Control, Firewalls, Protecting Remote Connections	05
4	Security Technology: Intrusion Detection and Prevention Systems, and Other Security Tools: Introduction, Intrusion Detection and Prevention Systems, Honeypots, Honeynets, Padded Cell Systems, Scanning and Analysis Tools, Biometric Access Controls.	07
5	Cryptography: Introduction, Foundations of Cryptology, Cipher Methods, Cryptographic	07





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	Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems.	
6	Physical Security and Implementing Information Security: Introduction., Physical Access Controls, Fire Security and Safety, Failure of Supporting Utilities and Structural Collapse, Interception of Data, Mobile and Portable Systems, Special Considerations for Physical Security. Implementing Information Security - Introduction., Information Security Project Management, Technical Aspects of Implementation, Nontechnical Aspects of Implementation.	05

Practical Course Content		
Experiment No.	Description	Hours
1	Capture and analyze live network traffic using Wireshark to identify suspicious activities.	02
2	Identify and explain common network protocols and their functions with Wireshark analysis.	02
3	Install and configure pfSense firewall, including setting up rules to block or allow specific traffic.	02
4	Test and verify pfSense firewall configurations using network scanning tools.	02
5	Set up OpenVPN server and client to establish a secure VPN connection.	02
6	Test OpenVPN functionality by securely transmitting data between server and client.	02
7	Install and configure Snort intrusion detection system for network monitoring.	02
8	Create and apply Snort rules to detect suspicious activities and analyze alerts and logs.	02
9	Generate cryptographic keys with OpenSSL and perform encryption/decryption using symmetric and asymmetric methods.	02
10	Create and verify digital signatures using OpenSSL, and perform vulnerability scanning using OpenVAS.	02

References -

Text Books:

- Boris Lublinsky, Kevin T. Smith, and Alexey Yakubovich, Professional Hadoop Solutions, Wiley.
- Seema Acharya and Subhashini Chellappan, Big Data and Analytics, Wiley.

Reference Books:

- Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, and Paul Zikopoulos, Understanding Big Data, McGraw Hill.
- Tom White, Hadoop: The Definitive Guide, O'Reilly Media.





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Class:- First Year MCA	Semester- II	L	T	P	Credits
Course Code: MCA1121	Course Name : NoSQL (PE-1)	3	--	2	4

Course Description:

NoSQL is an approach to database management that can accommodate a wide variety of data models, including key-value, document, columnar, and graph formats. A NoSQL database generally means that it is non-relational, distributed, flexible, and scalable. The main objective of this course is to cover core concepts of NoSQL databases, along with an example database for each of the key-value, document, column family, and graph databases.

Course Learning Outcomes:

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

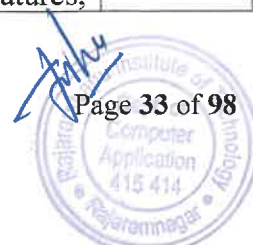
1. Analyse different types of NoSQL databases and their features.
2. Compare relational databases with NoSQL databases.
3. Demonstrate the architecture and performance tuning of Document-oriented NoSQL databases.
4. Apply NoSQL development tools on various types of NoSQL databases.

Prerequisite:

Basic Knowledge of DBMS, SQL

Course Content

Unit No	Description	Hrs
1	Why NoSQL: Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL	06
2	Distribution Models: 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	06
3	Document Databases: What Is a Document Database? Features, Consistency Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, e-commerce Applications, and When Not to Use.	06
4	Graph Databases: What Is a Graph Database? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use.	06
5	Key-Value Databases: Key-Value Databases: What Is a Key-Value Store, Key-Value Store Features,	06





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	Suitable Use Cases, When Not to Use.	
6	Column-Family Stores: What Is a Column-Family Data Store, Features, Suitable Use Cases, When Not to Use.	06

Practical Course Content		
Experiment No.	Description	Hrs
1	Install MongoDB and perform basic CRUD operations using MongoDB Query Language.	02
2	Query MongoDB documents using filters and projections to retrieve specific data.	02
3	Set up a sharded MongoDB cluster to distribute data across multiple shards.	02
4	Configure MongoDB replication for high availability and test read/write operations.	02
5	Install Apache Cassandra, create keyspaces and column families, and perform CRUD operations.	02
6	Install and set up Redis, and perform basic CRUD operations on key-value pairs.	02
7	Explore advanced Redis features such as data expiration, publish/subscribe messaging, and transactions.	02
8	Install Neo4j, create graph nodes and relationships, and perform CRUD operations on graph data.	02
9	Execute Cypher queries in Neo4j to explore and retrieve graph pattern data.	02
10	Design and test a simple application scenario integrating at least two NoSQL databases for data storage.	02

References -

Text Books:

- Sadalage, P. and Fowler, M., NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addison-Wesley.

Reference Books:

- Sullivan, D., NoSQL for Mere Mortals, Pearson Education India.
- McCreary, D. and Kelly, A., Making Sense of NoSQL: A Guide for Managers and the Rest of Us, Manning Publications / Dreamtech Press.





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Class:- First Year MCA	Semester- II	L	T	P	Credits
Course Code: MCA1141	Course Name : Software Testing (PE -1)	3	--	2	4

Course Description:

This course provides a basic introduction to software testing and its fundamentals. Topics cover software testing at the unit, module, subsystem, and system levels, automatic and manual techniques for generating and validating test data, the testing process, static vs. dynamic analysis, functional testing, web application testing, and reliability assessment.

Course Learning Outcomes:

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

1. Analyze fundamentals and types of software testing.
2. Design test cases using test case design techniques.
3. Use automation tools to test software systems.
4. Produce test reports from manual and automated testing.

Prerequisite:

Basics of Software Engineering

Course Content

Unit No	Description	Hrs
1	Software Testing Fundamentals: SDLC Process, Failure, Error, Fault and Defect, Objectives of testing, Verification and validation, Correctness versus reliability, Testing and debugging, Testing activities, and Software Quality.	06
2	Software Testing Types: Test levels, Software Testing Life Cycle (STLC), Testing and verification, White Box Testing - Unit testing, Control flow testing, Data flow testing, Black Box testing - Functional Testing, Integration Testing, System Testing, Acceptance Testing, Monkey Testing/Gorilla Testing, Regression Testing, Performance Testing (Non-Functional) - Load Testing, Stress Testing, Soak Testing, Volume Testing, Spike Testing	06
3	Test Generation from Requirements: Introduction, Test selection problem, Software testing process, improving software testing process, Test Case Design Technique – Equivalence partitioning, boundary value analysis, Category-partition method, Cause-effect graphing.	06
4	Defect Management: Basic terms, Defect life cycle, Types of defects, Defect management, Implementing defect management process, Defect prevention process, Static testing techniques.	06
5	Software Test Automation: Types of software tests, Automation testing: what to automate, when to automate, and how to automate, Automated software testing, Test Tool/Framework– Selenium, JUnit, TestNG, Postman	06





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6	Case Studies: Testing metrics, best practices and benchmarks, Case study on testing of Web applications, Case study on testing of Embedded Software systems, Case study on testing of Mobile applications, Case study on testing of IoT applications	06
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Practical Course Content		
Exp. No.	Description	Hrs
1	Write a JUnit program to test the methods of a Java Calculator application using assertions and test annotations.	02
2	Write a TestNG program to execute multiple test cases, use annotations (@BeforeMethod, @AfterMethod), and generate an HTML execution report.	02
3	Write a Selenium WebDriver program to automate the Login functionality of a web application and verify successful login.	02
4	Write a Selenium WebDriver program to automate the Registration Form, validate user inputs, and handle different web elements (text box, radio button, checkbox, dropdown).	02
5	Write a Selenium WebDriver program to automate Search functionality, validate search results, and identify web elements such as links, images, buttons, and text boxes.	02
6	Write a Selenium WebDriver program to handle Alerts, Frames, Multiple Browser Windows, and Web Tables, and validate the extracted data.	02
7	Develop a Data-Driven Testing framework using Selenium WebDriver and Apache POI to read test data from an Excel file and execute test cases.	02
8	Develop Selenium WebDriver scripts using the Page Object Model (POM) with TestNG, implement automatic screenshot capture for failed test cases, and generate execution reports.	02
9	Create and execute REST API requests (GET, POST, PUT, DELETE) using Postman, validate response codes, response body, and response time.	02
10	Develop an End-to-End Automation Testing Suite (Login → Search → Logout) using Selenium WebDriver, TestNG, and POM, prepare a defect report, and generate the final HTML execution report.	02

References -
Text Books:

- Renu Rajani and Pradeep Oak, Software Testing: Effective Methods, Tools and Techniques, Tata McGraw-Hill.
- Kshirsagar Naik and Priyadarshi Tripathy, Software Testing and Quality Assurance: Theory and Practice, Wiley.

Reference Books:

- Mauro Pezzè and Michal Young, Software Testing and Analysis: Process, Principles and Techniques, John Wiley & Sons.





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Class:-First Year MCA	Semester- II	L	T	P	Credits
Course Code: MCA1161	Course Name : Object-Oriented Programming Using Java Lab	-	-	2	1

Course Description:

This lab aims to deepen students' understanding of Object-Oriented Programming (OOP) concepts using Java. Students will create various systems, such as an expense tracker, grade management system, and Fibonacci sequences. They will also develop systems for managing a library, simulating bank account operations, employee records, and a fleet of vehicles. The lab also includes creating a drawing application, simulating a chat application, and managing file operations. These hands-on assignments provide a comprehensive learning experience, reinforcing theoretical knowledge through practical application. The lab emphasizes robust error handling, efficient data processing, and user interface development, preparing students for advanced coursework and professional software development.

Course Learning Outcomes:

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

1. Apply Object-Oriented Programming concepts in Java.
2. Implement File Handling and Data Persistence.
3. Utilize Multithreading for Concurrent Programming.
4. Design and Develop Interactive Applications

Prerequisite:

Core Java Theory.

Practical Course Content

Unit No	Description	Hrs
1	Create an expense tracker with a class Expense to add, subtract, and calculate total expenses. Compare daily expenses to determine the highest expense day using relational operators.	2
2	Implement a grade management system to input and determine letter grades using if-else statements. Provide a menu using a switch statement to choose between entering grades, displaying grades, and exiting the program.	2
3	Generate and display the first n terms of the Fibonacci sequence using while, do-while, and for loops. Compare the efficiency of each loop in generating the sequence.	2
4	Manage a library system with a class Book having attributes like title, author, ISBN, and availability. Include methods to add a book, display details, check out, and return a book. Create multiple Book objects and demonstrate functionalities in the main method.	2
5	Simulate a bank account management system with a class BankAccount having private attributes accountNumber, accountHolderName, and balance. Include	4





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	methods to set/get attributes, deposit/withdraw money, and calculate interest. Demonstrate functionalities with BankAccount objects in the main method.	
6	Manage employee records with methods to store/display employee details using a two-dimensional array, search by name using linear search, sort by salary using bubble sort, concatenate employee names with designations and find the length of resulting strings. Demonstrate functionalities in the main method.	2
7	Manage a fleet of vehicles with a superclass Vehicle and subclasses Car and Bike overriding the start() method. Include methods to add/display vehicles and demonstrate method overriding and polymorphism by calling start() on objects of Vehicle, Car, and Bike in the main method.	2
8	Simulate a drawing application with an abstract class Shape and concrete classes Circle and Square implementing draw(). Define an interface Color and implement it in Circle and Square classes. Demonstrate usage by creating objects and calling methods in the main method.	2
9	Simulate a chat application using multithreading with a Chat class allowing multiple users to send/receive messages. Ensure thread synchronization, handle thread priorities, and implement inter-thread communication using wait() and notify(). Demonstrate functionalities with user threads in the main method.	2
10	Manage files and directories with methods to read from a file using FileInputStream, write to a file using FileOutputStream, read from the console and write to a file using BufferedWriter, read from a file using BufferedReader, and serialize/deserialize objects. Demonstrate functionalities in the main method.	4

References -

Text Books:

- E. Balagurusamy, Programming with Java: A Primer, McGraw-Hill Education.
- Herbert Schildt, Java: The Complete Reference, McGraw-Hill Education.

Reference Books:

- Kathy Sierra and Bert Bates, Head First Java, O'Reilly Media.
- Joshua Bloch, Effective Java, Addison-Wesley.
- Bruce Eckel, Thinking in Java, Prentice Hall.





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Class:- First Year MCA	Semester- II	L	T	P	Credits
Course Code: MCA1181	Course Name : Web Technology Lab	--	--	2	1

Course Description:

This course provides a comprehensive introduction to the fundamental technologies used in web development. Students will learn about the basics of internet and web communication, HTML for structuring web content, CSS (including Bootstrap and Tailwind CSS) for styling and layout, and JavaScript (including jQuery) for client-side scripting. The course will also cover server-side scripting with PHP, including the implementation of CRUD (Create, Read, Update, Delete) operations for database management. Through a series of lectures and hands-on exercises, students will gain practical experience in building responsive and dynamic web applications.

Course Learning Outcomes:

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

1. Apply styles to web pages using CSS, Bootstrap, and Tailwind CSS.
2. Develop interactive web pages using JavaScript and jQuery.
3. Implement basic server-side functionalities using PHP.
4. Perform CRUD operations in PHP for database management

Prerequisite:

Basics of Computers

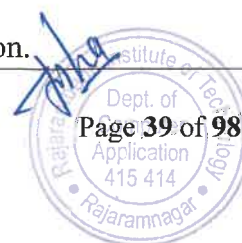
Course Content

Experiment No	Description	Hrs
1	Create a basic HTML web page with headings, paragraphs, images, and links.	02
2	Create an HTML form and use semantic HTML elements.	02
3	Apply basic CSS styles to an HTML page.	02
4	Implement advanced CSS layouts using Flexbox and Grid.	02
5	Create a responsive web page using Bootstrap.	02
6	Style a web page using Tailwind CSS	04
7	Use JavaScript for DOM manipulation and event handling.	02
8	Enhance web pages with jQuery for easier DOM manipulation and AJAX.	02
9	Write PHP scripts to handle form data.	02
10	Develop a PHP CRUD application and host it on a local server and a web hosting server.	04

References -

Text Books:

- Jon Duckett, HTML and CSS: Design and Build Websites, Wiley Publication.





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- Luke Welling and Laura Thomson, PHP and MySQL Web Development, Addison-Wesley.

Reference Books:

- Eric Freeman and Elisabeth Robson, Head First HTML and CSS, O'Reilly Media.
- Kevin Yank, PHP & MySQL: Novice to Ninja, SitePoint Publication.





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Class:- First Year MCA	Semester- II	L	T	P	Credits
Course Code: MCA1201	Course Name : Professional Communication And Employability Skills	-	-	2	1

Course Description:

The course with its interactive and need-based sessions helps students know and manage themselves, set and pursue meaningful goals, and develop interpersonal and professional skills for sustainability in today's global world. This course aims to empower students towards technical communication, presentation skills, and job-readiness skills.

Course Learning Outcomes:

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

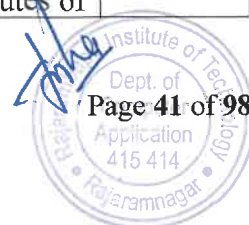
1. Analyze the aspects of nature and process of technical Communication
2. Develop interpersonal skills beneficial in business meetings, teamwork, decision-making, and group discussion.
3. Apply presentation skills to prepare and deliver a presentation as per the audience and context requirements.
4. Demonstrate professional skills as per context.
5. Demonstrate improved reading and writing skills.

Prerequisite:

English language

Course Content

Unit No	Description	Hrs
1	Self-Awareness: Know thyself, Self-concept, Self-Assessment, Values and Belief Systems, Personality typing, Goal Setting (SMART) and SWOT/C analysis.	02
2	Nature and process of technical communication: Meaning, Concept, importance of Technical Communication, Distinction between General and Technical Communication, Language as a tool of Communication, Organizational communication, the flow of Organizational Communication, Barriers of Organizational Communication, and how to overcome them. Role of feedback.	02
3	Interpersonal Skills: Presenting interpersonal skills by being amiable and respecting individuals, effective listening, bonding and developing rapport, Teamwork, Roles and Responsibilities in Teams, and Strategies for Team Development.	02
4	Business Meetings: Formal meeting & Decision Making: Objectives of meeting, preparing agenda for the meeting, how to write minutes of	





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	the meeting, decisions, team decision & meeting etiquette.	02
5	Reading Comprehension Reading strategies, Graphic organizers, Summarizing, Interpretation, and Review writing.	02
6	Technical Writing Skills I: Precise writing, Official Correspondence (letter writing, Email Writing), Technical Paragraph Development.	02
7	Technical Writing Skills II: Technical Report Writing, Proposal Writing.	02
8	Presentations Skills: Preparing oneself & delivery Preparation, Voice Modulation, Body Language, Content & Visual Aids, Audience Management, QA session Formal Presentations: Practicing presentation skills through individual and group presentations.	02
9	Emotional Intelligence: Meaning, Components of Emotional Intelligence, Significance of managing Emotional intelligence, how to develop Emotional Quotient, Stress Management Techniques.	02
10	Decision Making: Importance of correct decision making, Analytical thinking/mind, Information processing ability, Making sound judgment and confident decisions, Time management.	02
11	Group Discussion: Structured and un-structured GD, Dos' and don'ts, types of topics, showing agreement and disagreements, initiation, contribution, conclusion of GD, skills required to participate in GD, Evaluation components.	02
12	Interview Skills: Preparing for most common questions, kinds of interviews, mock interviews, Interview Techniques, Pre-Interview Preparation, Conduct during the interview, Verbal and non-verbal communication, and common mistakes. Resume drafting.	02

References -

Text Books:

- Barun K. Mitra, Personality Development & Soft Skills, Oxford Publishers.
- Jeff Butterfield, Soft Skills for Everyone, Cengage Learning India Private Limited.
- John Seely, Oxford Guide to Effective Writing and Speaking, Oxford University Press.
- Krishna Mohan and Meera Banerji, Developing Communication Skills, Macmillan India Ltd.
- Meenakshi Raman and Sangeeta Sharma, Technical Communication: Principles and Practices, Oxford University Press.
- Pravil S. R. Bhatia, Professional Communication Skills, S. Chand & Co.
- R. K. Chaddha, Communication Techniques and Skills, Dhanpat Rai Publication.
- Stephen P. Robbins, Organizational Behaviour, Prentice Hall India.





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Class:- First Year MCA	Semester- II	L	T	P	Credits
Course Code: MCA1221	Course Name : Mini Project	-	-	-	2

Course Description:

During the semester, Master of Computer Applications (MCA) students will undertake a mini project encompassing the complete development cycle of a system or application. The project will be carried out in four main phases: problem analysis to understand and define the problem statement, solution design to plan and architect an effective approach, building and testing which may include software development, hardware integration, or both, and finally, demonstration and reporting of the project outcomes. Students are expected to deliver a functional and efficient design that meets the technical specifications of their assigned project. They must clearly showcase their learning through implementation and comprehensive documentation. Importantly, each mini project should correspond to at least one Sustainable Development Goal (SDG), which must be explicitly stated in the project synopsis, final report, and all assessments.

Course Learning Outcomes:

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

1. Identify and select a suitable mini project topic, define simple and clear objectives, and mention the relevant Sustainable Development Goals (SDGs) it relates to.
2. Analyze requirements and develop a basic software program or system design, simulate and implement it using standard tools, meeting given specifications.
3. Prepare and present a well-structured report and presentation explaining the project work, results, and conclusions.

Guidelines for Mini Project

1. Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
2. Students should do survey and identify needs, which should be converted into a problem statement for the mini-project in consultation with the faculty supervisor/head of department/internal committee of faculties.
3. A Mini Project Diary to be prepared by each group, wherein the group can record weekly work progress, and a guide/supervisor can verify and record notes/comments.
4. Faculty supervisors may give input to students during mini-project activities; however, the focus shall be on self-learning.
5. Students in a group shall understand the problem effectively, propose multiple solutions and select the best possible solution in consultation with a guide/ supervisor.
6. Students shall convert the best solution into a working model using various components of their domain areas and demonstrate.





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Evaluation Scheme for Mini Project (MCA)

Assessment Matrix (Total = 100 Marks)

Sr. No.	Evaluation Component	Assessment Focus	Marks
1	Review I	Problem definition, objectives, SDG mapping, literature survey	10
2	Review II	Requirement analysis, system architecture, database & design	15
3	Review III	Implementation progress, testing strategy, tool usage	15
4	Final Demonstration	Functionality, technical depth, usability & performance	20
5	Project Report	Structure, technical content, SDG impact, results	25
6	Viva-Voce	Concept clarity, individual contribution, communication	15
	Total		100





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Class:- Second Year MCA	Semester- III	L	T	P	Credits
Course Code: MCA2011	Course Name : Machine Learning	3	-	-	3

Course Description:

The course also delves into neural networks, deep learning fundamentals, and the deployment of ML models using industry-standard tools. Through case studies in domains such as finance, healthcare, and e-commerce, students will gain hands-on experience in applying ML concepts to real-world problems while addressing ethical considerations and biases in machine learning systems.

Course Learning Outcomes:

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

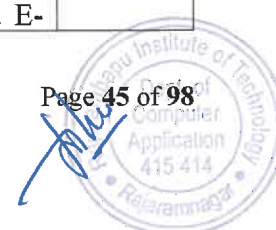
1. Implement ML algorithms (Decision Trees, k-Means, PCA) using Python.
2. Analyze model performance using evaluation metrics.
3. Assess ML models and justify algorithm selection.
4. Develop an end-to-end ML application using cloud platforms.

Prerequisite:

Basic Programming Knowledge, Statistics, Probability

Course Content

Unit No	Description	Hrs
1	Introduction to Machine Learning: Definition, Scope, and Applications of ML, Types of ML: Supervised, Unsupervised, Reinforcement Learning, ML Workflow and Lifecycle.	5
2	Supervised Learning Regression Models: Linear & Logistic Regression, Classification Models: Decision Trees, k- NN, Naïve Bayes, Model Evaluation: Confusion Matrix, Precision, Recall, F1-score	7
3	Unsupervised Learning: Clustering: k-Means, Hierarchical Clustering, Dimensionality Reduction: PCA, t-SNE, Applications of Unsupervised Learning	6
4	Neural Networks and Deep Learning: Basics of Neural Networks & Activation Functions, Introduction to Deep Learning (CNN Basics), Applications in Image and Speech Recognition	6
5	Reinforcement Learning & Model Optimization: Reinforcement Learning Basics & Markov Decision Process (MDP), Q-Learning Algorithm, Hyper parameter Tuning & Optimization	4
6	ML Deployment & Case Studies: Model Deployment Strategies (Flask, Docker), ML in Cloud Platforms (AWS, Google Cloud), Case Studies in Finance, Healthcare, and E-	8





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	commerce, Ethical Considerations and Bias in ML	
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References -

Text Books:

- Tom M. Mitchell, Machine Learning, McGraw-Hill.
- Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press.
- Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer.
- Sebastian Raschka and Vahid Mirjalili, Python Machine Learning, Packt Publishing.





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Class:-Second Year MCA	Semester- III	L	T	P	Credits
Course Code: MCA2031	Course Name: Cloud Computing	3	-	2	4

Course Description:

This course introduces students to the fundamental concepts, technologies, and applications of cloud computing. It provides a comprehensive understanding of cloud computing architectures, service models, virtualization technologies, and their practical implementations. Through a detailed exploration of cloud platforms, storage systems, security practices, and real-world applications, students will gain hands-on experience with leading cloud technologies and services.

Course Learning Outcomes:

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

1. Analyze basic cloud computing concepts, service, and deployment models.
2. Demonstrate virtualization and resource management in cloud environments.
3. Evaluate cloud security challenges, including access management and data encryption.
4. Develop cloud applications using AWS, Azure, or Google Cloud.

Prerequisite:

Basic Programming Knowledge, Networking Fundamentals

Course Content

Unit No.	Description	Hrs
1	Introduction to Cloud Computing: Overview of cloud computing. Evolution, key characteristics and benefits of cloud technologies. Use cases and real-world applications in various industries (e.g., healthcare, finance, and ecommerce), Cloud computing challenges and future directions.	6
2	Cloud Computing Architecture and Service Models: Cloud computing architecture and components (e.g., front-end, back-end, and cloud infrastructure). Detailed explanation of service models: IaaS, PaaS, SaaS, and their use cases. Deployment models: Public, Private, Hybrid, and Community clouds. Comparative analysis of leading cloud service providers (AWS, Azure, GoogleCloud, etc.).	6
3	Virtualization in Cloud Computing: Introduction to virtualization and its role in cloud computing, Types of virtualizations: Server, Storage, and Network. Hypervisors: Types and their use in cloud environments. Virtual Machines (VMs) and their management, Resource allocation, management, and performance optimization in virtualized cloud environments.	6



4	Cloud Security and Privacy: Security challenges in cloud computing: Data breaches, vulnerabilities, and threats. Identity and Access Management (IAM) in the cloud, Legal and regulatory compliance in cloud services (GDPR, HIPAA, etc.). Encryption techniques for ensuring cloud data security, Security frameworks and best practices for cloud environments.	6
5	Cloud Storage and Databases: Cloud storage models: File storage, Block storage, and Object storage. Cloud Database services: Relational Databases (SQL), NoSQL Databases (e.g., MongoDB, Cassandra). Big Data storage and management in the cloud. Data replication, consistency models, and high availability techniques in cloud storage systems.	6
6	Cloud Computing Platforms and Applications: Overview and features of popular cloud platform: AWS, Google Cloud, and Microsoft Azure. Cloud based application development: Tools, frameworks, and deployment strategies. Serverless computing and its benefits for cloud applications. Introduction to Edge computing and its impact on cloud services (e.g. IOT, low latency), Case studies and real - word applications of cloud-based system.	6

Practical Course Contents		
Experiment No.	Description	Hrs
1	Explore cloud fundamentals and set up virtualization using VirtualBox and free-tier cloud accounts.	02
2	Launch and configure virtual machines and deploy a web app using IaaS and PaaS platforms.	02
3	Install Docker and deploy a containerized application with networking support.	02
4	Implement a CI/CD pipeline using Jenkins integrated with GitHub and Docker.	02
5	Configure cloud IAM roles and apply security policies including encryption.	02
6	Use cloud storage services and set up a managed cloud database.	02
7	Deploy a serverless function using AWS Lambda and simulate basic IoT integration.	02
8	Monitor cloud application performance using built-in analytics and logging tools.	02
9	Set up load balancing and auto-scaling for a cloud-hosted web application.	02
10	Estimate and compare cloud service costs using provider calculators and billing tools.	02



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References -

Text Books:

- Rajkumar Buyya, James Broberg, and Andrzej Goscinski, Cloud Computing: Principles and Paradigms, Wiley.
- Kai Hwang, Geoffrey C. Fox, and Jack J. Dongarra, Distributed and Cloud Computing, Elsevier.
- Dan C. Marinescu, Cloud Computing: Theory and Practice, Elsevier.

Reference Books:

- Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter, Cloud Computing: A Practical Approach, Tata McGraw-Hill.
- Gautam Shroff, Enterprise Cloud Computing, Cambridge University Press.





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Class:- Second Year MCA	Semester- III	L	T	P	Credits
Course Code:- MCA2051	Course Name : Cyber Security and Forensics (PE-2)	3	-	2	4

Course Description:

This course provides a comprehensive introduction to cyber security, cybercrime, and digital forensics. It covers the fundamental principles, threats, and countermeasures in cyber security while exploring forensic methodologies for investigating cybercrimes.

Course Learning Outcomes:

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

1. Apply the basic terminology of cybercrimes.
2. Apply a number of different computer forensic tools to a given scenario.
3. Demonstrate the basics of computer forensics.
4. Analyze digital evidence, validate its integrity, evaluate acquisition methods used for system security investigations.

Prerequisite:

Information Security

Course Content

Unit No	Description	Hrs
1	Introduction to Cyber Security: Cybercrime overview, nature, scope, Types of cybercrime: against individuals, property, governments, Cyber extortion, trafficking, terrorism, Need for information security, threat landscape, Concepts: Information Assurance, Risk Analysis, Cyber Law, Role of CERT-In And cybercrime cells in India, Types of threat actors: insiders, hackers, state-sponsored.	06
2	Cyber Crime Issues and Cyber-attacks: Unauthorized access, system intrusions, Malware: viruses, worms, Trojans, Internet hacking, exploitation, software piracy, Application security: database, email, web, Data security: backups, archival, secure disposal, Security tech: Firewalls, VPNs, OS Hardening, Buffer overflow and privilege escalation attacks, Case studies of real-world security breaches (e.g., Equifax, Yahoo).	06
3	Introduction to Digital Forensics: Importance of forensics in law enforcement and HR cases, Forensics methodology: identification, preservation, analysis, Forensics technologies: military, law enforcement, business, Data recovery concepts and tools, Backup and recovery operations, Forensic analysis	06





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	of mobile devices and removable media, Overview of digital chain of events in an Investigation.	
4	Evidence Collection and Data Seizure: Why and how to collect evidence, Evidence rules: volatile, non-volatile, General procedures, artifacts, contamination control, Chain of custody documentation, Digital image verification, hashing methods (MD5, SHA256), Handling live systems during seizure, File system analysis: NTFS, FAT, ext4 basics.	06
5	Computer Forensics analysis and validation: What data to collect and validate, Data hiding techniques (steganography, encryption), Remote acquisitions, network forensics, Tools for live acquisition and honeynet analysis, Processing private and law enforcement crime scenes, Analyzing memory dumps using Volatility framework, Timeline analysis in digital forensics.	06
6	Current Computer Forensic tools: Evaluating and validating software/hardware forensic tools, Email analysis: tracing origins, identifying forged content, Client-server email architecture, Specialized tools: MailXaminer, FTK Imager, Autopsy, Case studies on real investigations, Report writing tools and templates (e.g., FTK report builder), Use of cloud-based forensic tools and challenges.	06

Practical Course Content		
Experiment No.	Description	Hrs
1	Email header analysis and tracing sender IP.	02
2	CAPTCHA generation and verification program.	02
3	Wi-Fi intrusion detection using IEEE 802.11 simulation.	02
4	Deleted file and partition recovery with forensic tools.	02
5	Log capturing and correlation with system activity.	02
6	Vulnerability scanning using Wireshark/SNORT.	02
7	Steganography hiding and extraction using OpenStego.	02
8	Disk imaging, hashing, and evidence preservation.	02
9	Setup and study of honeypot (Honeyd or T-Pot).	02
10	Case-based investigation with forensic report creation.	02





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References -

Text Books:

- John R. Vacca, Computer Forensics and Computer Crime Investigation, Firewall Media.
- Nelson, Phillips, Enfinger, and Steuart, Computer Forensics and Investigations, Cengage Learning.

Reference Books:

- Keith J. Jones, Richard Bejtlich, and Curtis W. Rose, Real Digital Forensics, Addison-Wesley Pearson Education.
- Tony Sammes and Brian Jenkinson, Forensic Computing: A Practitioner's Guide, Springer.
- Christopher L. T. Brown, Computer Evidence Collection & Presentation, Firewall Media.
- Jesus Mena, Homeland Security: Techniques & Technologies, Firewall Media.





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Class:- Second Year MCA	Semester- III	L	T	P	Credits
Course Code: MCA2071	Course Name : Data Mining (PE-2)	3	--	2	4

Course Description:

Data Mining is a process of discovering patterns, correlations, and trends in large datasets using machine learning, statistical techniques, and artificial intelligence. This course focuses on the fundamental principles, methodologies, and data mining methods, enabling students to extract meaningful insights and knowledge from raw data. The course will cover classification, clustering, association rule mining, and anomaly detection, with practical applications using industry-standard tools.

Course Learning Outcomes:

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

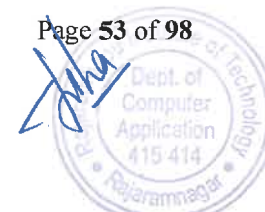
1. Apply data pre-processing techniques to prepare dataset for data mining.
2. Apply association rule mining, clustering, and specialized data mining techniques to analyze large datasets and extract patterns.
3. Evaluate the performance of different data mining models using validation, visualization and interestingness measures.
4. Implement data mining solutions using appropriate tools for real-world problem-solving.

Prerequisite:

Basic Knowledge of DBMS and Machine Learning

Course Content

Unit No	Description	Hrs
1	Introduction to Data Mining: Definition, Scope, Applications, Knowledge Discovery in Databases (KDD), Data Mining Tasks and Functionalities, Data Warehousing vs. Data Mining, OLAP vs OLTP, challenges, Issues and applications in Data Mining.	06
2	Data Preprocessing and Cleaning: Data Collection and cleaning, Noise handling, Handling Missing Values, Data Integration and Transformation, Data Reduction, Feature Selection and Feature Engineering, Data Normalization and Scaling, EDA and Data Visualization.	06
3	Association Rule Mining: ARM, Interestingness Measures (Support, Confidence, Lift, Conviction) Apriori Algorithm, FP-Growth Algorithm, Market Basket Analysis, Applications of ARM.	06





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4	Advanced Pattern Discovery and Clustering: Clustering concept, K-Means, Hierarchical Clustering, DBSCAN, Evaluation of Clusters, Outlier Detection, Pattern Interpretation and Knowledge Extraction, Case Studies.	06
5	Specialized Data Mining Techniques: Sequential Pattern Mining, Time-Series Data Mining, Text Mining, Web Mining, Spatial and Spatio-Temporal Mining, Graph and social Network Mining, Big Data Mining.	06
6	Data Mining Applications and Emerging Trends: Data Visualization for Knowledge Discovery, Fraud Detection and Intrusion Detection, Recommendation Systems, Business Intelligence and Decision Support, Ethical Issues, Privacy, and Data Governance, Emerging Trends in Data Mining.	06

Practical Course Content		
Experiment No.	Description	Hours
1.	Explore Python-based data mining libraries such as Pandas, NumPy, and Scikit-Learn and perform EDA.	02
2.	Perform data cleaning and preprocessing, transformation, normalization and feature engineering using Python techniques.	02
3.	Perform association rule mining using Apriori and analyze frequent item sets.	02
4.	Implement FP-Growth algorithm and compare its performance with Apriori.	02
5.	Apply clustering techniques (K-Means, Hierarchical, and DBSCAN) and compare clustering results using suitable evaluation measures.	02
6.	Detect anomalies and outliers in datasets using appropriate techniques and interpret the results.	02
7.	Perform text mining or web mining using Python libraries on a sample dataset.	02
8.	Visualize data mining results using Python libraries like Matplotlib, Seaborn or Plotly dashboard.	02
9.	Analyze a domain-specific dataset (Healthcare, Finance, Retail, or Social Media) using suitable data mining techniques and prepare a report.	02
10.	Develop a mini project applying multiple data mining techniques on a chosen dataset.	02





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References -

Text Books:

- Jiawei Han, Micheline Kamber, and Jian Pei, Data Mining: Concepts and Techniques, Morgan Kaufmann.
- Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, Introduction to Data Mining, Pearson.

Reference Books:

- Ian H. Witten, Eibe Frank, Mark A. Hall, and Christopher J. Pal, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann.
- Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, Introduction to Data Mining, Addison-Wesley.

MOOC

- NPTEL – Data Mining Course-
<https://archive.nptel.ac.in/courses/106/105/106105174/>





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Class:- Second Year MCA	Semester- III	L	T	P	Credits
Course Code: MCA2091	Course Name : Advanced Java and J2EE (PE-2)	3	-	2	4

Course Description:

Java Advanced Programming focuses on building robust, scalable, and distributed applications. This course covers advanced Java concepts, including database connectivity, graphical user interfaces, networking, distributed computing, web technologies, and enterprise reporting. Students will develop hands-on expertise in building applications using JDBC, Java GUI frameworks, RMI, CORBA, Servlets, and Java reporting tools. The course provides essential programming skills for software development, emphasizing practical implementation in real-world scenarios.

Course Learning Outcomes:

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

1. Implement database-driven applications using JDBC for efficient data management.
2. Create interactive GUI applications using Java GUI frameworks such as AWT, Swing, SWT, and SwingX.
3. Develop network-based applications using Java Socket programming and communication protocols.
4. Utilize Java-based reporting tools for generating structured enterprise reports.

Prerequisite:

Basic knowledge of Core Java and Object-Oriented Programming (OOP).

Course Content

Unit No	Description	Hrs
1	JDBC (Java Database Connectivity): Java Database Connectivity, Types of JDBC Drivers, Writing JDBC Applications, Statement, Prepared Statement, Callable Statement, Result Set, Connection Pooling, JDBC with AWT.	06
2	Java GUI Programming: Introduction to GUI Frameworks (AWT, Swing, SWT, SWINGX), Basic Components and Events, Layouts, Menus, Dialogs, JList, JTable, Case Study on GUI Applications.	06
3	Networking (Socket Programming): Networking Basics, Sockets, Ports, Proxy Servers, Internet Addressing, URL, java.net Classes, TCP/IP-based Server & Client, Datagrams, URL Connections, Multicasting.	06
4	Distributed Computing (RMI & CORBA): Introduction to Distributed Computing, RMI and CORBA Architecture, java.rmi and CORBA Interfaces, Remote Method Invocation (Marshalling & Unmarshalling), CORBA IDL, ORB, and Implementing	06



	RMI & CORBA Applications.	
5	Servlets: Servlets vs CGI, Servlet API Overview, Lifecycle, HTTP Servlet, ServletConfig, Handling GET/POST Methods, Session Management, Cookies, Servlet & JDBC, Types of Session Management.	06
6	Java Report Designing: Java Reporting Frameworks, Introduction to iReport and JasperReports, Enterprise Reporting in Java Applications.	06

Practical Course Content

Exp. No.	Description	Hrs
1.	Implement a CRUD (Create, Read, Update, and Delete) application using JDBC for storing student details such as Name, Roll Number, Marks, and Course. Use MySQL or PostgreSQL for the database.	02
2.	Develop a banking application where users can check their balance, deposit money, withdraw money, and view transaction history. Use JDBC with connection pooling for efficient database management.	02
3.	Design a GUI-based payroll system using Swing, allowing HR to enter employee details, calculate salaries based on work hours, and generate salary slips. Implement event-driven programming for UI interactions.	02
4.	Build a real-time chat system where multiple clients can connect to a server and exchange messages using Java socket programming (TCP/IP).	02
5.	Develop a Java application that fetches real-time weather data from an open API (e.g., OpenWeatherMap) and displays temperature, humidity, and forecast details using Java Networking (URL and API integration).	02
6.	Implement a remote Task Manager application, where clients can add, delete, and check the status of tasks running on a remote server using Remote Method Invocation (RMI).	02
7.	Develop an e-commerce shopping cart using Servlets with session tracking (cookies or HttpSession). Customers can add/remove items and proceed to checkout.	02
8.	Build an online attendance system using Servlets and JDBC where faculty can mark attendance, and students can view their attendance records.	02
9.	Generate monthly hospital reports using JasperReports and iReport, including patient records, billing details, and doctor schedules.	02



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10.	Develop a banking application where customers can perform transactions (transfer funds, check balance) remotely using CORBA (Common Object Request Broker Architecture) for distributed computing.	02
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References -

Text Books:

- Herbert Schildt, Java: The Complete Reference, McGraw-Hill Education.
- Cay S. Horstmann, Core Java Volume I & II, Pearson.

Reference Books:

- Elliotte Rusty Harold, Java Network Programming, O'Reilly Media.
- H. M. Deitel and P. J. Deitel, Java How to Program, Pearson Education.
- Subrahmanyam Allamaraju, Professional Java Server Programming, Wrox Press.
- Roy U. K., Advanced Java Programming, Oxford University Press.





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Class:- Second Year MCA	Semester- III	L	T	P	Credits
Course Code: MCA2111	Course Name : Blockchain Technology (PE-3)	3	-	2	4

Course Description:

This course provides an in-depth exploration of blockchain technology, covering its mathematical foundations, architecture, consensus mechanisms, cryptocurrency applications, smart contract development, and real-world use cases. Students will gain hands-on experience with blockchain platforms, cryptographic principles, and decentralized applications.

Course Learning Outcomes:

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

1. Analyse fundamentals and architecture in Blockchain.
2. Compare the working of different blockchain platforms, cryptocurrencies, and consensus protocols.
3. Implement Smart contracts and decentralized applications using Ethereum and Solidity.
4. Assess blockchain solutions in different domain by considering security, scalability, privacy and implementation challenges.

Prerequisite:

Computer Networks and Security.

Course Content

Unit No	Description	Hrs
1	Cryptographic Foundations of Blockchain: Cryptography: Symmetric Key Cryptography and Asymmetric Key Cryptography, Elliptic Curve Cryptography (ECC), Cryptographic Hash Functions: SHA256, Digital Signature Algorithm (DSA), PKI, Merkel Trees.	06
2	Blockchain Fundamentals and Architecture: History, Centralized Vs. Decentralized Systems, Layers of Blockchain: Application Layer, Execution Layer, Semantic Layer, Propagation Layer, Consensus Layer, why is Block chain important? Benefits and Limitations of Blockchain, Blockchain Adoption and Challenges.	06
3	Blockchain Platforms and Consensus in Blockchain: Types of Blockchain Platforms (Public, Private, Consortium), Bitcoin, Ethereum, Hyperledger Fabric, Corda, IOTA; Consensus Mechanisms: Proof of Work (PoW), Proof of Stake (PoS), Proof of Authority (PoA), Proof of Elapsed Time (PoET), Practical Byzantine Fault Tolerance (PBFT), Byzantine Generals Problem, Selection of Consensus	06



	Mechanisms.	
4	Cryptocurrencies, Tokens, and Digital Wallets: Bitcoin and Ethereum, Types of Cryptocurrencies, Cryptocurrency Transactions, Utility and Security Tokens, Non-Fungible Tokens (NFTs), Digital Wallets (MetaMask, Coinbase, Binance Wallet), Applications of Cryptocurrencies and Tokens.	06
5	Ethereum, Smart Contracts, and Decentralized Applications: Ethereum Architecture, Ethereum Virtual Machine (EVM), Ethereum Networks, Smart Contracts, Solidity Programming, Deploying Smart Contracts using Remix IDE, Web3.js, Decentralized Applications (dApps), InterPlanetary File System (IPFS) for decentralized storage.	06
6	Blockchain Applications and Emerging Trends: Blockchain Applications in Banking, Healthcare, Supply Chain, Retail, Government, IoT, Energy and Utilities, Blockchain Integration with AI and Cloud Computing, Security, Scalability, Privacy Challenges, Emerging Trends in Blockchain.	06

Practical Course Content		
Experiment No.	Description	Hrs
1	Create Ethereum accounts using MetaMask and perform test cryptocurrency transactions.	02
2	Install and configure Node.js, Ganache, Remix IDE, and Web3.js for blockchain development.	02
3	Configure a private Ethereum blockchain network using Ganache.	02
4	Develop and deploy basic Solidity smart contracts.	02
5	Interact with deployed smart contracts using Web3.js.	02
6	Develop a simple decentralized application (dApp).	02
7	Store and retrieve files using IPFS and integrate IPFS with a smart contract.	02
8	Create and deploy a basic NFT smart contract (ERC-721 or ERC-1155) on an Ethereum test network.	02
9	Deploy sample chaincode on Hyperledger Fabric and compare permissioned and public blockchains.	02
10	Design and implement a blockchain-based mini project (e.g., Supply Chain, Voting, Healthcare, or Asset Management).	02



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References -

Text Books:

- Chris Dannen, Introducing Ethereum and Solidity: Foundations of Cryptocurrency and Blockchain Programming for Beginners, Apress.
- Kumar Saurabh and Ashutosh Saxena, Blockchain Technology: Concepts and Applications, Wiley.
- Asharaf S., Neelima Sivadas, Adarsh S., and Franklin John, Blockchain Technology: Algorithms and Applications, CRC Press.
- Ambadas Tulajadas Choudhari, Arshad Sarfarz Ariff, and Sham M. R., Blockchain for Enterprise Application Developers, Wiley.

Online Recourses:

- Emerging Trends in Blockchain Technology and Applications: A Review and Outlook.
- Blockchain Basics (Coursera) <https://www.coursera.org/learn/blockchain-basics>





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Class:- Second Year MCA	Semester- III	L	T	P	Credits
Course Code: MCA2131	Course Name : Deep Learning (PE-3)	3	-	2	4

Course Description:

This course provides a comprehensive study of deep learning techniques, covering neural network architectures, optimization methods, convolutional and recurrent neural networks, transfer learning, transformer models, and their applications in computer vision, natural language processing, speech recognition, and time-series analysis. Students will gain hands-on experience using modern deep learning frameworks to develop, train, evaluate, and deploy intelligent applications.

Course Learning Outcomes:

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

1. Analyze neural network architectures, optimization techniques and algorithms used in deep learning.
2. Develop deep learning models for various practical applications such as image recognition, natural language processing, and time-series forecasting.
3. Evaluate the performance of deep learning models using appropriate optimization, regularization, and evaluation techniques.
4. Design intelligent solutions using advanced deep learning architectures and emerging AI technologies for real-world applications.

Prerequisite:

Machine Learning

Course Content

Unit No	Description	Hrs
1	Introduction to Deep Learning: Overview & Importance of Deep Learning, Machine Learning vs. Deep Learning, Basics of Neural Networks: Perceptron & Multi-Layer Perceptron (MLP), Biological Neuron vs Artificial Neuron, Tensor representation, Computational graphs, Activation Functions & Backpropagation.	06
2	Deep Neural Networks & Optimization: Architecture of Deep Neural Networks (DNNs), Batch Normalization, Early Stopping, Weight Initialization, Loss Functions & Optimization Algorithms (Gradient Descent, Adam, SGD), Overfitting, Prevention: Regularization (L1, L2, Dropout)	06
3	Convolutional Neural Networks (CNNs): CNN Architecture: Convolution, Pooling, Fully Connected Layers, Feature Maps & Kernel Filters, LeNet, AlexNet, VGG, ResNet, Applications: Image Classification & Object Detection	06



4	Recurrent Neural Networks (RNNs): Basics of Sequence Data & RNNs, Bidirectional RNN, Encoder-Decoder Architecture, Sequence-to-Sequence Learning Vanishing Gradient Problem & Solutions, Long Short-Term Memory (LSTM) & Gated Recurrent Units (GRUs), Applications in Time-Series & NLP	06
5	Practical Applications & Model Optimization: Transfer Learning & Model Fine-Tuning, TensorFlow/Keras, PyTorch (Introduction), Model Evaluation Metrics, AI Use Cases: Computer Vision, NLP, Speech Recognition, Ethical Considerations in AI	06
6	Future Trends & Emerging AI Technologies: AI in Healthcare, Autonomous Systems, Attention Mechanism, Transformers, BERT, GPT, Vision Transformers (Introduction), Generative AI, Diffusion Models (Overview), Explainable AI (XAI), Responsible AI, Next Steps in AI Research & Industry Applications	06

Practical Course Content		
Experiment No.	Description	Hrs
1.	Implement Perceptron and Multi-layer Perceptron using NumPy for logic gate classification.	02
2.	Create and train a multi-layer perceptron (MLP) for solving the XOR problem with loss visualization.	02
3.	Implement gradient descent optimization and study the impact of learning rate.	02
4.	Train an MLP with L1/L2 regularization and dropout, and evaluate on the MNIST dataset(Fashion-MNIST or Custom Dataset).	02
5.	Build and train a Convolutional Neural Network (CNN) for image classification on MNIST or CIFAR-10.	02
6.	Use a pre-trained YOLOv8 model for performing object detection on images.	02
7.	Implement an LSTM network to perform time-series forecasting tasks(GRU comparison).	02
8.	Visualize feature maps and filters in CNN layers for interpretability.	02
9.	Apply transfer learning(TensorFlow/Keras or PyTorch) using a pre-trained model such as ResNet or VGG on a custom dataset.	02
10.	Develop and evaluate(Performance Comparison) a deep learning mini-project integrating CNN or LSTM for a real-world problem.	02



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References -

Text Books:

- Ian Goodfellow, Yoshua Bengio, and Aaron Courville, *Deep Learning*, MIT Press.

Reference Books:

- Charu C. Aggarwal, *Neural Networks and Deep Learning*, Springer.
- Rajalingappaa Shanmugamani, *Deep Learning for Computer Vision*, Packt Publishing.





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Class:- Second Year MCA	Semester- III	L	T	P	Credits
Course Code: MCA2151	Course Name : Dot Net Framework For Application Development (PE3)	3	-	2	4

Course Description:

This course provides an in-depth understanding of the .NET Framework and its role in developing modern, scalable, and efficient applications. It covers the core concepts and components of the .NET ecosystem, including the Common Language Runtime (CLR), the Base Class Library (BCL), and the various application models (Web, Desktop). Students will learn how to design, develop, test, and deploy applications using C# and Visual Studio, focusing on both traditional and contemporary .NET development practices.

Course Learning Outcomes:

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

1. Analyze the architecture of the .NET Framework and utilize its components to develop applications.
2. Design console, Windows Forms, and web applications while applying object-oriented programming (OOP) principles.
3. Develop database-driven applications using ADO.NET and integrate them with .NET applications.
4. Deploy applications effectively, ensuring functionality and performance in ASP.NET Web Forms and other .NET environments.

Prerequisite:

Basic programming knowledge

Course Content

Unit No	Description	Hrs
1	Introduction to .NET Framework Overview of .NET Framework: Understanding .NET architecture (Common Language Runtime, Framework Class Library), Managed vs. Unmanaged Code, .NET Languages (C#, VB.NET, F#), Visual Studio IDE setup and basics, Types of Applications in .NET (Console, Windows Forms, Web, and WPF) Introduction to Object-Oriented Programming (OOP) in C#:Classes and Objects	6
2	C# Programming Basics: C# Syntax and Data Types: Variables, Constants, and Enumerations, Control Flow (if-else, loops, switch, etc.) Functions, Parameters, and Return Types, Collections (Arrays, Lists, Dictionaries) Exception	6



	Handling in C#: Try-Catch Blocks, Custom Exception Handling, Error Logging.	
3	Working with Data in .NET: Introduction to ADO.NET: Overview of Data Providers (SQLClient, OLEDB, etc.), Connecting to a Database, CRUD Operations (Create, Read, Update, And Delete), Data Binding and DataGrid, Using DataSets and DataAdapters. LINQ (Language Integrated Query): LINQ Basics (LINQ to Objects, LINQ to SQL), LINQ Queries, Filtering, Ordering, and Grouping, LINQ with Lambda Expressions.	6
4	Windows Forms & Web Forms: Windows Forms Application Development Designing Forms (Buttons, Textboxes, Labels), Event Handling (Button Clicks, Text Changes), Handling User Input and Validation. ASP.NET Web Forms: Introduction to Web Forms, Page Lifecycle in ASP.NET, Working with Controls (Labels, Textboxes, GridViews), State Management in Web Forms (ViewState, Session, Cookies)	6
5	.NET Core MVC & Web API: .NET Core MVC Architecture MVC Pattern: Model, View, Controller, Routing and Controllers, Views and Data Binding with Razor, Validation and Form Handling. Web API Development: Introduction to RESTful APIs, Creating Web APIs in .NET, HTTP Methods (GET, POST, PUT, DELETE), Consuming APIs in Client Applications	6
6	Application Deployment: Deployment Strategies for Console, Web, and Desktop Applications.	6

Practical Course Content		
Exp. No.	Description	Hrs
1	Create a simple C# console application demonstrating .NET architecture, variables, and exception handling.	02
2	Perform CRUD operations using ADO.NET and display data using a DataGrid and DataSet.	02
3	Write LINQ queries to perform data filtering, sorting, grouping, and transformation.	02
4	Design a Windows Forms application with input validation and event handling.	02
5	Build an ASP.NET Web Form with session, view state, and GridView integration.	02
6	Develop a web application using the MVC pattern and integrate REST APIs using HTTP methods.	02
7	Deploy an ASP.NET web application on a local IIS server and verify its functionality.	02



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8.	Use Entity Framework for data access and implement code-first and database-first approaches.	02
9.	Create and consume a Web API in ASP.NET Core and test endpoints with Postman.	02
10.	Build a mini-project combining Windows Forms and ADO.NET for database-driven functionality.	02

References -

Text Books:

- Adam Freeman, Pro .NET Framework, Apress.
- Joseph Albahari and Ben Albahari, C# 9.0 in a Nutshell, O'Reilly Media.
- Sahil Malik, Pro ADO.NET with C#, Apress.

Reference Books:

- Jeffrey Richter, CLR via C#, Microsoft Press.
- Herbert Schildt, The Complete Reference: C#, McGraw-Hill Education.
- Julia Lerman, Programming Entity Framework, O'Reilly Media.
- Fabrice Marguerie, Steve Eichert, Jim Wooley, and Dixon Jones, LINQ in Action, Manning Publications.
- Chris Sells, Windows Forms Programming with C#, Addison-Wesley.





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Class:-Second Year MCA	Semester- III	L	T	P	Credits
Course Code: MCA2171	Course Name : Innovation, Business Models And Entrepreneurship	3	-	-	3

Course Description:

This course provides a comprehensive understanding of innovation, entrepreneurship, and business model development in the digital economy. It covers creativity techniques, innovation management, design thinking, business model innovation, technology commercialization, intellectual property rights, startup ecosystems, sustainability, and emerging entrepreneurial trends. Students will develop entrepreneurial skills through business model design, market validation, and startup planning.

Course Learning Outcomes:

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

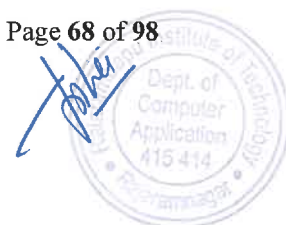
1. Analyze innovation processes, creativity techniques, and entrepreneurial opportunities in the contemporary business environment.
2. Develop innovative business models and value propositions using appropriate entrepreneurial frameworks.
3. Evaluate strategies for technology commercialization, intellectual property management, sustainability, and startup growth.
4. Develop a viable business plan or startup proposal by integrating innovation, market analysis, funding strategies, and commercialization approaches.

Prerequisite:

Basic Business Knowledge, Market Research Skills, Basic Financial Literacy, Entrepreneurial Mindset

Course Content

Unit No	Description	Hrs
1	Introduction to Innovation and Business Environment: Analyzing the Current Business Scenario, Innovation and Creativity: An Introduction, Types of Innovation, Innovation and Startup Ecosystem, Innovation in the Digital Economy, Industry 4.0.	06
2	Innovation Management and Processes: Challenges of Innovation, Steps of Innovation Management, Idea Management System, Divergent vs. Convergent Thinking, Design Thinking for Innovation and Entrepreneurship, Creativity Tools, SCAMPER, Brainstorming, Lean Thinking, Business Problem Identification.	06
3	Collaborative Innovation and Startup Development: Experimentation in Innovation Management, Idea Evaluation and Validation, Collaborative Innovation, Co-creation for Innovation, Prototype Development, Minimum Viable Product (MVP), Customer	06



	Discovery, Lean Startup, Business Validation, Incubation, Accelerators, and Startup Ecosystem.	
4	Entrepreneurship and Business Models: What is Entrepreneurship? Characteristics of an Entrepreneur, Business Models, Business Model Canvas, Value Proposition Canvas, Lean Canvas, Social Entrepreneurship, Blue Ocean Strategy (Parts I & II).	06
5	Technological Innovation and Marketing: Marketing of Innovation, Go-to-Market Strategy, Product Life Cycle, Customer Acquisition, Technology Innovation Process, Technology Innovation Management, Technology Forecasting.	06
6	Sustainability, Intellectual Property, and Future Trends: Sustainability and Circular Economy, Intellectual Property-Patent Filing, Copyright, Trademark, Startup Funding, Angel Investors, Venture Capital, Government Startup Schemes, Startup India, Atal Innovation Mission, and Future Trends.	06

References -

Text Books:

- R. T. Krishnan and Vinay Dabholkar, 8 Steps to Innovation: Going from Jugaad to Excellence, HarperCollins Publishers.
- Peter F. Drucker, Innovation and Entrepreneurship: Practice and Principles, Harper & Row.
- Joe Tidd and John Bessant, Managing Innovation: Integrating Technological, Market and Organizational Change, Wiley.

Reference Books:

- Harvard Business School Press, HBS Series on Innovation and Entrepreneurship, Harvard Business School Publishing.
- Peter A. Thiel and Blake Masters, Zero to One: Notes on Startups, or How to Build the Future, Crown Publishers.



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Class:- Second Year MCA	Semester- III	L	T	P	Credits
Course Code: MCA2191	Course Name : Machine Learning Lab	-	-	2	1

Course Description:

This course provides hands-on experience with fundamental and advanced machine learning techniques. Students will implement and experiment with various ML algorithms, evaluate model performance, and deploy models in real-world applications. This lab emphasizes practical exposure to essential ML tools and libraries such as scikit-learn, TensorFlow/Keras, and Flask.

Course Learning Outcomes:

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

1. Analyze fundamental ML algorithms, including regression, classification, clustering, and dimensionality reduction, using Python and relevant libraries.
2. Analyze key performance metrics such as accuracy, precision, recall, F1-score, and confusion matrices to assess the effectiveness of classification models.
3. Build neural networks and reinforcement learning models using TensorFlow/Keras and deploy trained ML models using Flask and Docker.
4. Utilize Principal Component Analysis (PCA) and t-SNE for feature selection and dimensionality reduction while applying CNNs for image classification tasks.

Prerequisite:

Basics of Programming and Statistics

Practical Course Content

Experiment No	Description	Hrs
1	Implement an end-to-end machine learning workflow including data preprocessing, model training, and evaluation using the Iris dataset.	02
2	Implement Linear Regression and Logistic Regression using sklearn.	02
3	Implement Decision Trees, k-NN, and Naïve Bayes on a dataset	02
4	Calculate the confusion matrix, precision, recall, and F1-score for a classification model.	02
5	Apply k-Means and Hierarchical Clustering on an unlabeled dataset	02
6	Implement PCA and t-SNE for visualization and feature selection	02
7	Build a simple Neural Network using TensorFlow/Keras	02
8	Implement a basic CNN for image classification using MNIST dataset	02
9	Implement a simple Q-learning algorithm in a grid-world	02





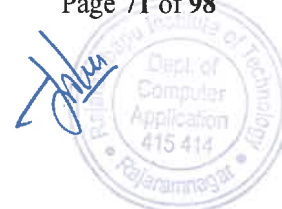
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	environment	
10	Deploy a trained ML model using Flask and Docker	02

References -

Reference Books:

- "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" – Aurélien Géron
- "Python Machine Learning" – Sebastian Raschka & Vahid Mirjalili
- "Pattern Recognition and Machine Learning" – Christopher M. Bishop
- "Deep Learning" – Ian Goodfellow, Yoshua Bengio, Aaron Courville
- "Machine Learning Engineering" – Andriy Burkov





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Class:- Second Year MCA	Semester- III	L	T	P	Credits
Course Code: MCA2211	Course Name : Full Stack Development Lab	1	-	2	1

Course Description:

This course provides an in-depth understanding of full-stack web development using the MERN (MongoDB, Express.js, React.js, and Node.js) stack. It is designed to equip learners with the skills necessary to build and deploy modern web applications. Students will gain hands-on experience in frontend and backend development, database management, and full-stack application deployment.

Course Learning Outcomes:

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

1. Apply structured, visually appealing, and user-friendly web pages using modern web technologies.
2. Implement JavaScript to enhance user experience by managing DOM manipulation and handling events.
3. Integrate user authentication, file handling, and session management effectively within Express.js applications.
4. Efficiently manage MongoDB connections and integrate it with Node.js applications for data.

Prerequisite:

Basic programming knowledge (e.g., understanding of OOP principles)

Course Content

Unit No	Description	Hrs
1	Web Development Fundamentals: Basics of Web Design and Web Applications, HTML (Typography, Images, Tables, Lists, and Hyperlinks), CSS (Syntax, Selectors, and Styling for various elements), W3.CSS Framework.	02
2	JavaScript & ES6: JavaScript Basics (Grammar, Control Flow, Error Handling), Functions, Loops, Objects, and Arrays, Promises, Async/Await, ES6 Features (Let/Const, Template Literals, Arrow Functions).	02
3	Backend Development with Node.js & Express.js: Node.js Overview, Installation, and Command Utilities, Modules, Events, and Database Access, Express.js Basics (Routing, Request/Response, Middleware), File Upload, Cookies, and Scaffolding	02
4	Databases: MySQL & MongoDB: SQL vs NoSQL, CRUD Operations in MySQL & MongoDB, Data Migration to MongoDB, Integrating MongoDB with Node.js, MongoDB Services	02



5	Frontend Development with React.js: React JS Overview & Installation, JSX and Rendering Elements, Components, Props, and State Management, Lifecycle Methods & Handling Events, Lists, Forms, and Lifting State Up	02
6	Full-Stack Project & Deployment: Combining Frontend (React.js) and Backend (Node.js & Express.js), API Integration with MongoDB, Authentication & Authorization, Hosting & Deployment Strategies, Best Practices for Full-Stack Development.	02

Practical Course Content

Exp. No.	Description	Hrs
1.	Create a simple personal portfolio webpage using HTML and CSS. It should include sections for an introduction, skills, projects, and contact details. Apply CSS styling for layout and responsiveness.	02
2.	Write a JavaScript program to create a simple To-Do list where users can add, remove, and mark tasks as completed. Use JavaScript event listeners and DOM manipulation.	02
3.	Implement a JavaScript function using Promises and Async/Await to fetch data from an external API (e.g., JSONPlaceholder) and display it on a webpage	02
4.	Create a simple Express.js server that handles GET and POST requests. The GET request should return a welcome message, and the POST request should accept a JSON payload and return a success response.	02
5.	Develop a basic file upload functionality using Express.js and Multer. The uploaded file should be stored in a specific directory, and its details should be displayed after uploading.	02
6.	Create a MySQL database with a "users" table containing fields for id, name, email, and password. Implement CRUD operations using Node.js and Express.js.	02
7.	Set up a MongoDB database and use Mongoose to define a schema for a blog application. Create API routes for adding, retrieving, updating, and deleting blog posts.	02
8.	Create a React.js application that displays a list of products. Each product should have a name, image, and price. Implement a button that allows users to add products to a shopping cart.	02
9.	Develop a React form with controlled components that allow users to register with their name, email, and password. Validate the form fields before submission.	02



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9.	Develop a React form with controlled components that allow users to register with their name, email, and password. Validate the form fields before submission.	02
10.	Build a simple full-stack MERN application (e.g., a task manager) where users can add, update, and delete tasks. Use MongoDB for storage, Express.js and Node.js for the backend, and React.js for the frontend. Deploy the application on a cloud platform like Vercel or Heroku.	02

References -

Text Books:

- Shama Hoque, MERN Stack Development, Packt Publishing.
- David Choi, Full-Stack React, TypeScript, and Node: Build Cloud-Ready Web Applications, Packt Publishing.
- Andrew Mead and Rob Percival, The Complete Node.js Developer Course, Packt Publishing.





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Class:- Second Year MCA	Semester- III	L	T	P	Credits
Course Code: MCA2231	Course Name : Capstone Project	-	-	--	2

Course Description:

During the final year of the Master of Computer Applications (MCA) program, students will undertake a Capstone Project that serves as an integrative learning experience, combining theoretical knowledge with practical software development skills. The capstone project focuses on the design, development, and deployment of software-intensive systems or applications addressing real-world problems in domains such as web and mobile applications, data analytics, artificial intelligence, cloud computing, cybersecurity, enterprise systems, or decision-support systems. The project will be executed through structured phases including problem identification and requirement analysis, system and database design, algorithm and architecture selection, implementation using appropriate programming frameworks, testing and validation, and final deployment and demonstration. Emphasis is placed on industry-oriented practices, use of modern development tools, version control, and documentation standards. Each capstone project must be aligned with one or more Sustainable Development Goals (SDGs) and the selected SDGs must be clearly mentioned in the project proposal, reviews, final report, and presentation. The course aims to enhance students' employability, research aptitude, and professional competence.

Course Learning Outcomes:

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

1. Formulate a software solution for an identified real-world problem with clearly defined objectives aligned to relevant Sustainable Development Goals (SDGs).
2. Analyze system requirements to design scalable software architectures, databases, and algorithms using appropriate modeling techniques and tools.
3. Develop a software application using appropriate programming languages, frameworks, and development environments.
4. Apply software engineering practices, including version control, documentation, testing strategies, and professional ethics.
5. Evaluate the software solution based on functionality, performance, usability, and project objectives.
6. Present the project through a comprehensive report and demonstration highlighting the design, implementation, results, limitations, and future scope.

Guidelines for Capstone Project

1. Students shall form a group of 3 to 4 students only. Formation of groups with fewer than three or more than four students is not permitted, as the capstone project is a collaborative activity.
2. Students shall conduct a detailed problem study, literature review, or industry survey to identify a relevant software problem, which shall be finalized as a problem statement in consultation with the faculty supervisor / project review committee.





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3. Each group shall maintain a Capstone Project Diary / Repository, documenting weekly progress, design decisions, code versions, testing results, and review feedback. The diary/repository shall be periodically reviewed by the faculty supervisor.
4. Faculty supervisors may provide technical guidance and feedback; however, self-learning, independent implementation, and innovation by students are strongly encouraged.
5. Students shall analyze multiple solution approaches, compare technologies and frameworks, and select the most appropriate solution in consultation with the supervisor.
6. The selected solution shall be implemented as a fully functional software system or application, which may include web, mobile, desktop, cloud-based, or data-driven components.
7. Students are encouraged to follow industry-standard software development practices, such as agile methodologies, use of APIs, security considerations, and performance evaluation.
8. The capstone project shall conclude with periodic evaluations, final project demonstration, technical report submission, and presentation, clearly highlighting SDG alignment and learning outcomes achieved.

Evaluation Scheme for Capstone Project (MCA)

Assessment Matrix (Total = 100 Marks)

Sr. No.	Evaluation Component	Assessment Focus	Marks
1	Review I	Problem definition, objectives, SDG mapping, literature survey	10
2	Review II	Requirement analysis, system architecture, database & design	15
3	Review III	Implementation progress, testing strategy, tool usage	15
4	Final Demonstration	Functionality, technical depth, usability & performance	20
5	Project Report	Structure, technical content, SDG impact, results	25
6	Viva-Voce	Concept clarity, individual contribution, communication	15
Total			100





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Model I: Industry Internship (II)





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Class:- Second Year MCA	Semester- IV	L	T	P	Credits
Course Code: MCA2021	Course Name : Basics of Finance (Online Course)	2	-	--	2

Course Description:

This course introduces the fundamentals of accounting and financial management for students from technical disciplines. It covers the preparation and interpretation of financial statements, financial ratio analysis, cash flow analysis, sources of short-term and long-term finance, working capital management, and investment decisions. The course combines fundamental financial concepts with practical applications to enable informed financial decision-making and effective management of organizational resources.

Course Learning Outcomes:

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

1. Analyze the fundamental concepts of accounting and financial management.
2. Prepare basic financial statements using accounting principles.
3. Analyze financial information using appropriate financial analysis techniques.
4. Evaluate the financial performance of an organization for managerial decision-making.

Prerequisite:

Basic Knowledge of Mathematics.

Course Content

Unit No	Description	Hrs
1	Finance Terminologies & Financial Statement: Key terms of Accounting and Finance, Accounting Principles underlying Preparation of Financial Statements	4
2	Analyzing Health of a Firm: Techniques of Analyzing Health of a Firm, Classification of Ratios – Liquidity, Leverage, Activity, Profitability, Analysis of Cash Flows	4
3	The Management of Working Capital: Need of Working Capital, Operating Cycle of Working Capital, Determinants of Working Capital, Preparation of Working capital statement	4
4	Investment Decision Rules: Investment Decision Rules, Evaluation Criteria for Investment Decision: Payback, ARR, NPV, PI & IRR, Decision Tree Analysis	4
5	Long Term Financing: Long Term Financing: Shares, Debentures, Loan capital, foreign	4





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	capital, FDI, Euro issues & external borrowings, Venture capital financing.	
6	Financing Decisions and Cost of Capital: Risk & Return, Cost of Capital, Cost of Equity, Cost of Debt, Weighted Average Cost of Capital	4

References -

Reference Books:

- Paul D. Kimmel, Jerry J. Weygandt, and Donald E. Kieso, Financial Accounting, Wiley.
- S. N. Maheshwari and S. K. Maheshwari, Problems & Solutions in Advanced Accountancy, Vikas Publishing House.
- M. C. Shukla, T. S. Grewal, and S. C. Gupta, Advanced Accounts, S. Chand.
- M. Y. Khan and P. K. Jain, Financial Management, Tata McGraw-Hill.
- Prasanna Chandra, Financial Management, Tata McGraw-Hill.

Note: - Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.

Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam. Final exam will be held at college campus.





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Class:- Second Year MCA	Semester- IV	L	T	P	Credits
Course Code: MCA2041	Course Name : Principles of Management & Economics(Online Course)	2	-	-	2

Course Description:

This course introduces the fundamental principles of management and economics required for effective planning, decision-making, and resource management in technology-driven organizations. The management module covers management theories, managerial functions, organizational structures, communication, motivation, and project planning tools such as CPM, PERT, Gantt charts, and milestone charts. The economics module focuses on economic analysis, comparison of alternatives, make-or-buy decisions, and depreciation methods to support managerial and financial decision-making. The course equips students with essential managerial and analytical skills applicable to software development and IT project environments.

Course Learning Outcomes:

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

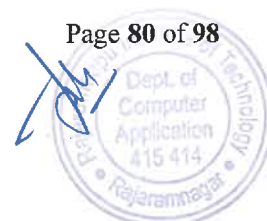
1. Analyze management principles, organizational structures, and managerial functions in technology-driven organizations.
2. Apply project planning and scheduling techniques using CPM, PERT, Gantt charts, and milestone charts.
3. Evaluate engineering economic alternatives using appropriate cost-benefit and financial analysis methods.
4. Calculate depreciation and apply economic decision-making techniques in business and project management scenarios.

Prerequisite:

Basic Knowledge of Mathematics and Business Fundamentals.

Course Content

Unit No	Description	Hrs
1	Managerial skills: Theories of Management Principles of Management (by Henry Fayol), Functions of Management, Planning, Organizing, Staffing, Directing, Co- Ordination, Communication, Motivation and Controlling.	04
2	Organizational skills: Levels of management, Organizations-elements, types and characteristics of organization, Management by Objectives (MBO)	04
3	Planning Tools: Methods of scientific management- Critical Path Method (CPM), Programme Evaluation & Review Techniques (PERT), Network Crashing, Bar Chart, Mile-Stone chart, Gantt Chart.	04





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4	Methods of Economic Analysis: Economic equivalence, Methods of comparison of alternatives- Present Worth Method, Rate of Return method, Benefit-Cost ratio method.	04
5	Make or Buy Decision: Approaches of make or buy decision-Simple cost analysis, Economic analysis, break-even analysis, Payback analysis.	04
6	Depreciation: Methods of Depreciation- Straight line method, Declining balance depreciation, Sum of years digits method, sinking fund method, service output method	04

Note: - Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments as per schedule.

Weightage: 25% weightage for unit wise assignments + 75% weightage for final examination.

References -

Text Books:

- Daniel R. Gilbert, R. Edward Freeman, and James A. F. Stoner, Management, Pearson Education.
- Harold Kerzner, Project Management: A System Approach to Planning, Scheduling and Controlling, John Wiley & Sons.
- B. C. Punmia and K. K. Khandelwal, Project Planning, Scheduling and Controlling with PERT and CPM, Laxmi Publications.
- R. Panneerselvam, Engineering Economics, Prentice Hall India.

Reference Books:

- Mark V. Cannice, Harold Koontz, and Heinz Weihrich, Management, McGraw-Hill Education.
- Leland Blank and Anthony Tarquin, Basics of Engineering Economy, Tata McGraw-Hill.
- D. M. Mithani, Managerial Economics: Theory & Applications, Himalaya Publishing House.





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Class:-Second Year MCA	Semester- IV	L	T	P	Credits
Course Code: MCA2061	Course Name : Industry Internship & Project	-	-	--	16

Course Description:

Internship is designed to expand the depth and breadth of academic learning of students in their particular areas of study. It is an opportunity for students to receive experience in applying theories learned from the classroom to specific experiences with the community and work world. An internship can also heighten awareness of community issues, motivate students to create opportunities, embrace new ideas, and give direction to positive change. A successful internship can give valuable information in making decisions about the direction of future studies or employment. An internship is an opportunity not only to use and develop industry-related knowledge and skills, but also to enhance some of the skills that are transferable to any professional work setting. Students from Final year MCA are eligible to do this internship. Selected candidates by college will be permitted for internship of minimum 20 weeks in 4th semester. During this Internship, it is expected that students should identify the problems arising in the industry and they have to give the solution to the company.

Course Learning Outcomes:

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

Internship

After the successful completion of the IIP- II the student should be able to

1. Examine the functioning of the company on the terms of inputs, transformation process and the outputs (products and services)
2. Develop an attitude to adjust with the company culture, work norms, code of conduct.
3. Recognize and follow the safety norms, Code of conduct.
4. Demonstrate the ability to observe, analyze and document the details as per the industry practices.
5. Interpret the processes, systems and procedures and to relate to the theoretical concepts- studies.
6. Develop the leadership abilities, communication.
7. Demonstrate project management and finance sense

Project

After the successful completion of the project, the student should be able to;

1. Identify the project/problem in the domain of a program relevant for the company.
2. Compile the information to the pertaining to the problem identified.
3. Analyse the information using the statistical tools/ techniques.
4. develop the feasible solution for given problem.
5. Analyse the impact of the project on the performance of company/department.





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Course Content

I. Internship:

During Internship, Students should follow guidelines given below.

1. After joining the industry students should learn all the departments and their workings. Furthermore, student should understand how each department of industry is interlinked with one another.
2. Student should correlate the theoretical aspects learned in academics with industry practices.
3. Students should gain a knowledge of new technologies which industry follows.
4. Students should follow the professional codes and ethics.
5. Students should follow all rules and regulations of industry. Special care should be taken regarding safety.

- **Work Diary:**

Work Diary will be provided to each student, which contains details regarding internship, do's and don'ts and evaluation scheme. Student is required to write the Diary regularly and get it signed by the industry guide periodically. During the visit of Mentor, assigned to the student should be able to go through the Diary to access the work done and write the remarks/ instruction. At the end of internship, student should submit the duly completed diary to the department.

- **Duration:**

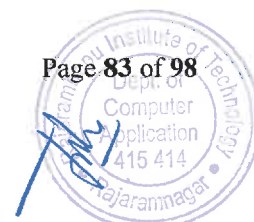
The internship duration is of one complete semester (approximately 20 weeks) between 1st January to 30th May of the respective academic year. Biometric attendance on working days is compulsory.

II. Project:

Students should select technical problems occurring within the industry as a project in consult with industry & Institute mentors.

- **Evaluation**

Faculty Mentor will be assigned to each student by the Institute who will monitor the progress of internship and project and help the student to sort-out any issues/problems arising. Mentor of student from college will visit the industry as per the schedule given below.



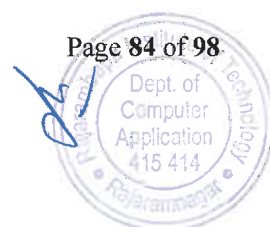


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Sr. No	Evaluation	Period
1.	At the beginning of the program for orienting Students to the company and finalize the project	During 2 nd Week
2.	Review-I (ISE-1)	During 10 th week
3.	Review-II (ISE-2)	During 15 th week
4.	Review-III (ESE)	During 20 th week

*Review-III is end semester examination (ESE), which will be conducted at institute.

*During ESE, students should submit, Project & internship report, Work diary, Internship & project completion certificate issued by industry etc. to respective departments.





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Model II

Research Internship (RI)





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Class:- Second Year MCA	Semester- IV	L	T	P	Credits
Course Code: MCA2081	Course Name : Project Management(Online Course)	2	-	--	2

Course Description:

To improve and update knowledge of new entrepreneurs in the areas of project preparation and appraisal techniques; decision-making process in the sector of industrial, infrastructure and sustainable opportunities that would lead to improved viability, returns and effective investment decisions. Writing a business plan which can gain interest of the fund providers like venture capitalists and other sources of funding.

Course Learning Outcomes:

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

1. Analyze project opportunities using feasibility studies, market analysis, technical analysis, and financial analysis.
2. Assess project risks, sustainability factors, and financing requirements for informed decision-making.
3. Develop a comprehensive business plan for a proposed entrepreneurial project.
4. Evaluate project feasibility using commercial, technical, and financial appraisal techniques.
5. Apply project management tools and techniques for planning, scheduling, budgeting, monitoring, and controlling projects.

Prerequisite:

Software Engineering and Project Management.

Course Content

Unit No	Description	Hrs
1	Project appraisal Introduction: Project Development Cycle, Identifying data requirements and analyzing their suitability for preparation of feasibility studies, project formulation, screening for pre-feasibility studies, stages of feasibility report preparation, Project Analysis including Market Analysis, Technical Analysis & Financial Analysis, applying various techniques and integrating the data gathered into a full-fledged business plan.	4
2	Project Analysis: Environmental Analysis, Risk Analysis, Infrastructure Development & Financing, Risk Management, Risk identification, Qualitative risk analysis, Quantitative risk analysis, Risk planning, Risk control, Evaluating the rewards & risks for sustainable opportunities. National Cost-Benefit Analysis, Financing Sustainable Opportunities.	4



3	Business Plan: What is business plan, Entrepreneurial opportunities and Business Plan? Preparing business plan. (Practical Exercises on preparation of business plan) Components of Business Plan, Executive summary, other components. Project report contents.	4
4	Commercial Appraisal: Economic feasibility and commercial viability, market analysis, Market Research, Industry Analysis, Competitor analysis, defining the target market, market segmentation, market positioning, building a marketing plan, market strategy.	4
5	Technical Appraisal: Operation and Production Plan: Types of production systems, Product design and analysis, New product development, location and layout decisions, project layout, plant and technology choices, product specification and customer needs, production planning and control, Commercializing Technologies	4
6	Financial Appraisal: pro forma income statements, financial projections, working capital requirement, funds flow and Cash flow statements; Ratio Analysis. Project Management Techniques: Identifying organizational structures Estimating costs and budgeting Using critical path project management tools (WBS, Gantt chart, Project Network Diagram) Establishing the critical path Tracking project milestones Using the program evaluation and review technique (PERT tool) Using process improvement tools (Fishbone, SIPOC) Managing time Controlling quality	4

References -

Text Books:

- Dwivedi, A.K.: Industrial Project and Entrepreneurship Development, Vikas Publishing House

Reference Books:

- Bangs Jr., D.H., The Business Planning Guide, Dearborn Publishing Co.
- Katz, J.A. and Green, R.P., Entrepreneurial Small Business, McGraw Hill
- Mullins, J. and Komisar R., Getting to Plan B, Harvard Business Press
- O'Donnell, M., The Business Plan: Step by Step, UND Center for Innovation.
- Scarborough, N.M. and Zimmerer, T.W., Effective Small Business Management, Pearson
- Pickle, H.B. and Abrahamson, R.L., Small Business Management, Wiley
- Desai, V., Dynamics of Entrepreneurial Development & Management, Himalaya Publishing
- Kao, J., Creativity & Entrepreneurship, Prentice Hall
- Singh, Narendra, Project Management & Control, Himalaya Publications



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Class:- Second Year MCA	Semester- IV	L	T	P	Credits
Course Code: MCA2101	Course Name : : Intellectual Property Rights(Online Course)	2	-	-	2

Course Description:

This course provides an understanding of Intellectual Property Rights (IPR) with a focus on applications in the software and IT industry. It covers legal frameworks related to copyrights, trademarks, trade secrets, and cyber law. The course emphasizes the protection of software, digital content, and research innovations. Students will also explore practical aspects such as software licensing, plagiarism, patent search, and case studies relevant to computer applications and emerging technologies like AI and cloud computing.

Course Learning Outcomes:

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

1. Analyze the basic principles of Intellectual Property Rights and their role in safeguarding innovations in the IT domain.
2. Apply cyber law and IPR concepts to software, digital systems, and data protection.
3. Analyze legal issues related to copyrights, trademarks, and trade secrets in computer applications.
4. Evaluate real-world case studies and implement IPR practices in software projects and research work.

Prerequisite:

Basic Knowledge of Computer Applications and Software Development.

Course Content

Unit No	Description	Hrs
1	Introduction to Intellectual Property Rights (IPR): Concept, Need, Objectives, and Importance of IPR; Types of Intellectual Property: Patents, Copyrights, Trademarks, Trade Secrets, Industrial Designs, and Geographical Indications; International IPR Framework: WIPO, WTO, and TRIPS Agreement; Indian Intellectual Property System and Regulatory Authorities; Role of IPR in Innovation, Software Development, Research, and the Digital Economy.	04
2	Cyber Law and Digital Rights: Introduction to cyber law; IT laws and digital signatures; Cybercrimes related to IPR; Trade Related Aspects of IPR(TRIPS); Data protection and privacy. Software Concepts: Legal protection of databases, AI-generated content ownership, cloud application security and compliance.	04
3	Trademarks and Digital Branding: Introduction to trademark; Registration process; Post-registration procedures; Transfer of rights; Infringement and dilution; Ownership	04



	and litigation; International trademark law. Software Concepts: Trademark issues in mobile apps, domain names, websites, and digital branding.	
4	Copyright and Software Protection: Introduction and principles of copyright; Subject matter; Rights under copyright law; Ownership, transfer and duration; Copyright registration and limitations; International copyright law. Software Concepts: Copyright protection of source code, object code, websites; Open-source licenses (GPL, MIT, Apache); Digital Rights Management (DRM).	04
5	Trade Secrets and Research Innovation: Introduction to trade secrets; Maintaining secrecy; Confidentiality agreements; Employee limitations; Unfair competition; Trade secret litigation; Breach of contract. Software Concepts: Protection of algorithms, source code, AI models, research datasets; Secure software practices; Plagiarism issues in research.	04
6	Case Studies and Practical Applications: Case studies on software: copyright, trademark disputes, and patents in IT; IPR in startups and IT industry; Patent search techniques; Practical Tools: Use of Google Patents, Turnitin, GitHub for analysis and learning.	04

References -

Text Books:

- Deborah E.Bouchoux: "Intellectual Property". Cengage learning, New Delhi
- Kompal Bansal & Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press)
- Cyber Law. Texts & Cases, South-Western's Special Topics Collections

Reference Books:

- Prabhuddha Ganguli: 'Intellectual Property Rights' Tata Mc-Graw – Hill, New Delhi
- Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
- R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.
- M. Ashok Kumar and Mohd. Iqbal Ali: "Intellectual Property Right" Serials Pub.



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Class:- Second Year MCA	Semester- IV	L	T	P	Credits
Course Code: MCA2121	Course Name : Research Internship	-	-	--	16

Course Description:

Research experience for postgraduates is important not only for conducting research on a topic that has an impact on a current research activity, but also as a tool to enhance postgraduate education. For the technical students, research experiences allow them to carry out in-depth study of research concepts, while emphasizing hands-on experiences and practical applications. Participating in research projects strengthens the student's resume, and fulfills the requirements of present day employers, who demand sound skills in their employees.

Course Learning Outcomes:

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

1. Investigate the technical literature.
2. Recognize and evaluate theories, practices, and/or research on a chosen topic by conducting a thorough literature review and submitting a written integrative, critical summary of the current literature.
3. Design a research problem and develop a methodology.
4. Develop and implement an advanced original research or creative project.
5. Develop the ability to explain the conceptual viability of the project and describe the major components involved.
6. Develop the ability to explain how the project will impact the relevant body of work.
7. Develop advanced discipline-relevant skills and competencies.
8. Construct an accurate record of research performed.
9. Write a research report and paper

Prerequisite: Course Content

Students should carefully discuss with their research advisor about time expectations to complete the research project.

Degree to which students meet expectations: The following is a minimum set of expectations for every student enrolled for this course for credit:

- i) perform a background literature search and review,
- ii.) Develop a project plan,
- iii.) Perform experimental work or applied experimental work,
- iv.) Write and present a research report.
- v) Write and submit research paper to any reputed journal/international conference.

• To submit or publish the research paper in any reputed journal/international conference is a necessary criterion to become eligible for End Semester Examination (ESE).

Quality of the final report and oral presentation: The research advisor will provide clear expectations of the desired format, content, and deadlines of the final report. The





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research advisors will grade the final report.

Attendance: In order to provide the measure of performance, the research advisor is expected to complete a two mid-term evaluation with the student, accompanied by recommendations for improvement for the remainder of the term. The mid-term evaluation with the student should be accompanied by a one-on-one meeting between the research advisor and the student.

Absences and Make-up Work: Requirements for attendance is as per RR of the Institute

● **Evaluation**

Faculty guide will be assigned to each student by the Institute who will monitor the progress of research project and help the student to sort-out any issues/ problems arising. Schedule of evaluation will be as given below.

Sr. No.	Evaluation	Period
1.	Review-I (ISE-1)	During 10th week
2.	Review-II (ISE-2)	During 15th week
3.	Review-III (ESE)	During 20th week

*Review-III is end semester examination (ESE).

*During ESE, students should submit research Project report, proof of submission of research paper to reputed journal/international conference to respective departments.

*If student is doing research project in outside organization (Research Lab/ institutes), he/she should submit project completion certificate given by outside organization.

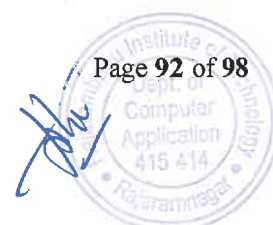




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Model III

Entrepreneurial Internship (EI)





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(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Syllabus of Second Year Master of Computer Applications
To be implemented for 2026-28 Batch and 2027-29 Batch
Department of Computer Applications

Class:- Second Year MCA	Semester- IV	L	T	P	Credits
Course Code: MCA2081	Course Name : Project Management(Online Course)	2	-	--	2

Course Description:

To improve and update knowledge of new entrepreneurs in the areas of project preparation & appraisal techniques; decision-making process in the sector of industrial, infrastructure & sustainable opportunities that would lead to improved viability, returns and effective investment decisions. Writing a business plan which can gain interest of the fund providers like venture capitalists and other sources of funding.

Course Learning Outcomes:

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

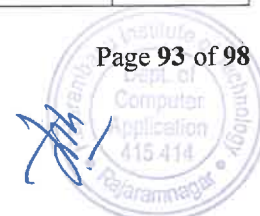
1. Prepare business Plan for selected business.
2. Make risk analysis& market analysis of selected project.
3. Make financial appraisal of selected project.

Prerequisite:

Software Engineering and Project Management

Course Content

Unit No	Description	Hrs
1	Project appraisal Introduction: Project Development Cycle, Identifying data requirements and analyzing their suitability for preparation of feasibility studies, project formulation, screening for pre-feasibility studies, stages of feasibility report preparation, Project Analysis including Market Analysis, Technical Analysis & Financial Analysis, applying various techniques and integrating the data gathered into a full-fledged business plan.	4
2	Project Analysis: Environmental Analysis, Risk Analysis, Infrastructure Development & Financing, Risk Management, Risk identification, Qualitative risk analysis, Quantitative risk analysis, Risk planning, Risk control, Evaluating the rewards & risks for sustainable opportunities. National Cost-Benefit Analysis, Financing Sustainable Opportunities.	4
3	Business Plan: What is business plan, Entrepreneurial opportunities and Business Plan? Preparing business plan. (Practical Exercises) Components of Business Plan, Executive summary, other components. Project report contents.	4
4	Commercial Appraisal: Economic feasibility and commercial viability, market analysis, Market Research, Industry Analysis, Competitor analysis, defining the target market, market segmentation, market positioning, building a marketing plan, market strategy.	4



5	Technical Appraisal: Operation and Production Plan: Types of production systems, Product design and analysis, New product development, location and layout decisions, project layout, plant and technology choices, product specification and customer needs, production planning and control, Commercializing Technologies	4
6	Financial Appraisal: pro forma income statements, financial projections, working capital requirement, funds flow and Cash flow statements; Ratio Analysis. Project Management Techniques: Identifying organizational structures Estimating costs and budgeting Using critical path project management tools (WBS, Gantt chart, Project Network Diagram) Establishing the critical path Tracking project milestones Using the program evaluation and review technique (PERT tool) Using process improvement tools (Fishbone, SIPOC) Managing time Controlling quality	4

References -

Text Books:

- Dwivedi, A.K.: Industrial Project and Entrepreneurship Development, Vikas Publishing House

Reference Books:

- Bangs Jr., D.H., The Business Planning Guide, Dearborn Publishing Co.
- Katz, J.A. and Green, R.P., Entrepreneurial Small Business, McGraw Hill
- Mullins, J. and Komisar R., Getting to Plan B, Harvard Business Press
- O'Donnell, M., The Business Plan: Step by Step, UND Center for Innovation.
- Scarborough, N.M. and Zimmerer, T.W., Effective Small Business Management, Pearson
- Pickle, H.B. and Abrahamson, R.L., Small Business Management, Wiley
- Desai, V., Dynamics of Entrepreneurial Development & Management, Himalaya Publishing
- Kao, J., Creativity & Entrepreneurship, Prentice Hall [SEP]
- Singh, Narendra, Project Management & Control, Himalaya Publications.



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Class:- Second Year MCA	Semester- IV	L	T	P	Credits
Course Code: MCA2041	Course Name : Principles of Management & Economics(Online Course)	2	-	-	2

Course Description:

This course introduces the fundamental principles of management and economics required for effective planning, decision-making, and resource management in technology-driven organizations. The management module covers management theories, managerial functions, organizational structures, communication, motivation, and project planning tools such as CPM, PERT, Gantt charts, and milestone charts. The economics module focuses on engineering economic analysis, comparison of alternatives, make-or-buy decisions, and depreciation methods to support managerial and financial decision-making. The course equips students with essential managerial and analytical skills applicable to software development, entrepreneurship, and IT project environments.

Course Learning Outcomes:

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

1. Analyze management principles, organizational structures, and managerial functions in technology-driven organizations.
2. Apply project planning and scheduling techniques using CPM, PERT, Gantt charts, and milestone charts.
3. Evaluate engineering economic alternatives using appropriate cost-benefit and financial analysis methods.
4. Calculate depreciation and apply economic decision-making techniques in business and project management scenarios.

Prerequisite:

Basics Knowledge of Business

Course Content

Unit No	Description	Hrs
1	Managerial skills: Theories of Management Principles of Management (by Henry Fayol), Functions of Management, Planning, Organizing, Staffing, Directing, Co-Ordination, Communication, Motivation and Controlling.	04
2	Organizational skills: Levels of management, Organizations-elements, types and characteristics of organization, Management by Objectives (MBO)	04
3	Planning Tools: Methods of scientific management- Critical Path Method (CPM), Programme Evaluation & Review Techniques (PERT), Network Crashing, Bar Chart, Mile-Stone chart, Gantt Chart.	04





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4	Methods of Economic Analysis: Economic equivalence, Methods of comparison of alternatives- Present Worth Method, Rate of Return method, Benefit-Cost ratio method.	04
5	Make or Buy Decision: Approaches of make or buy decision-Simple cost analysis, Economic analysis, break-even analysis, Payback analysis.	04
6	Depreciation: Methods of Depreciation- Straight line method, Declining balance depreciation, Sum of years digits method, sinking fund method, service output method	04

Note: - Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments as per schedule.

Weightage: 25% weightage for unit wise assignments + 75% weightage for final examination.

References -

Text Books:

- Daniel R. Gilbert, R. Edward Freeman, and James A. F. Stoner, Management, Pearson Education.
- Harold Kerzner, Project Management: A System Approach to Planning, Scheduling and Controlling, John Wiley & Sons.
- B. C. Punmia and K. K. Khandelwal, Project Planning, Scheduling and Controlling with PERT and CPM, Laxmi Publications.
- R. Panneerselvam, Engineering Economics, Prentice Hall India.

Reference Books:

- Mark V. Cannice, Harold Koontz, and Heinz Weihrich, Management, McGraw-Hill Education.
- Leland Blank and Anthony Tarquin, Basics of Engineering Economy, Tata McGraw-Hill.
- D. M. Mithani, Managerial Economics: Theory & Applications, Himalaya Publishing House.





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Class:- Second Year MCA	Semester- IV	L	T	P	Credits
Course Code: MCA2141	Course Name : Entrepreneurial Internship	-	-	--	16

Course Description:

This course provides students with hands-on experience in identifying entrepreneurial opportunities and developing a viable business venture. Students conduct market research, feasibility studies, and business analysis to prepare a comprehensive business plan covering commercial, technical, operational, financial, and legal aspects. The course emphasizes prototype validation, project appraisal, and professional presentation of the business plan, enabling students to apply entrepreneurial and project management concepts to real-world business challenges.

Course Learning Outcomes:

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

1. Analyze entrepreneurial opportunities through market research, feasibility study and stakeholder interactions.
2. Develop a comprehensive business plan incorporating knowledge of economical, technical operational, marketing, financial and legal aspects.
3. Evaluate the feasibility and viability of the proposed business venture through prototype validation, market analysis, and financial appraisal.
4. Present project outcomes through a comprehensive report and professional presentation.

Prerequisite:

Basics of Project Management

Course Content

Student will start working on collection of data required for business plan. During semester he may require to visit various support organizations, similar industries, suppliers of raw materials, machinery, special service providers. He has to conduct market survey. For this student can go out of campus with prior permission of mentor. Mentor should maintain this record. Students are required to work independently by taking guidance from mentor/Head CIIED/faculty on expert panel of CIIED.

Product prototype & execution of business operation is must & it should be validated by Departmental ED committee.

Continuous efforts taken by student should be observed by mentor for ISE evaluation. At the end of semester detailed project report will be presented before Expert committee for ISE evaluation of 100 marks.

Then student will appear for ESE. Project report evaluation & assessment will be done by a panel of experts appointed by COE.





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Component	Weightage	Assessment Criteria	Marks
ISE	10%	Preliminary Project Report	10
	20%	Market Survey and Feasibility Study	20
	20%	Completion of Legal and Regulatory Aspects	20
	50%	Final Project Report and Prototype Validation	50
Total ISE	100%		100
ESE	100%	Final Project Report, Presentation, Prototype Demonstration and Viva-Voce	100

