Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044

(An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune)

Curriculum Structure and Syllabus

Of

Second Year MCA

(Regulations 2024)

Effective from Academic Year 2025-26

Institute Vision

To be one of the top 100 Engineering Institutes of India in coming five years by offering exemplarily Ethical, Sustainable and Value Added Quality Education through a matching ecosystem for building successful careers.

Institute Mission

1. Serving the needs of the society at large through establishment of a state-of-art Engineering Institute.
2. Imparting right Attitude, Skills, Knowledge for self-sustenance through Quality Education.
3. Creating globally competent and Sensible engineers, researchers and entrepreneurs with an ability to think and act independently in demanding situations.

EOMS Policy

"We at PCCOE are committed to offer exemplarily Ethical, Sustainable and Value-Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders.

We shall strive for technical development of students by creating globally competent and sensible engineers, researchers, and entrepreneurs through Quality Education.

We are committed for Institute's social responsibilities and managing Intellectual property.

We shall achieve this by establishing and strengthening state-of-the-art Engineering Institute through continual improvement in effective implementation of Educational Organizations Management Systems (EOMS)."

Course Approval Summary

Board of Studies - Department of MCA

Sr. No.	Name of Course	Course Code	Page Number	Signature and Stamp of BoS Chairman
1	Advanced Database Management	MCA33PC09	16	
2	Advanced Web Technologies	MCA33PC10	18	
3	Advanced Web Technologies Lab	MCA33PC11	20	
4	Mobile Application Development Lab	MCA33PC12	22	
5	Advanced Data Science	MCA33PE17	25	
6	Network Security	MCA33PE18	27	
7	Dynamic Application Development and Frameworks	MCA33PE19	29	
8	Startup Management Essentials	MCA33PE20	31	
9	Advanced Data Science Lab	MCA33PE21	33	
10	Network Security Lab	MCA33PE22	35	
11	Dynamic Application Development and Frameworks Lab	MCA33PE23	37	
12	Startup Management Essentials Lab	MCA33PE24	39	
13	Seminar	MCA33AE01	41	
14	Professional Development Training	MCA33AE02	42	
15	Skill Enhancement - Advanced Excel	MCA33VS01	43	
16	Skill Enhancement - Digital Marketing	MCA33VS02	45	

Sr. No.	Name of Course	Course Code	Page Number	Signature and Stamp of BoS Chairman
17	Mini Project	MCA33EL03	47	
18	Emerging Trends in IT	MCA34EM02	49	
19	Open Elective - MOOC	MCA34OE01	51	
20	Internship	MCA34EL04	52	
21	Internet of Things	MCA34PE25	53	
22	Decision Science	MCA34PE26	55	
23	Advanced Network Security and Cryptography	MCA34PE27	57	
24	Entrepreneurial Marketing	MCA34PE28	59	

Approved by Academic Council:

Chairman, Academic Council

Pimpri Chinchwad College of Engineering, Pune

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"Knowledge Brings Freedom"

CURRICULUM FRAMEWORK

(Regulations 2024)

LIST OF ABBREVIATIONS

Sr. No.	Abbreviation	Type of Course
1	BSC	Basic Science Course
2	PCC	Programme Core Course
3	PEC	Programme Elective Course
4	OEC	Open Elective
5	VSEC	Vocational and Skill Enhancement Course
6	AEC	Ability Enhancement Course
7	EEM	Entrepreneurship/Economics/Management Course
8	ELC	Experiential Learning Courses

COURSE WISE CREDIT DISTRIBUTION

Sr. No.	Type of Course	No. of Courses	Credits	
			No.	%
1	Basic Science Course	2	8	10
2	Programme Core Course	12	24	30
3	Programme Elective Course	7	16	20
4	Open Elective	1	2	2.5
5	Vocational and Skill Enhancement Course	1	2	2.5
6	Ability Enhancement Course	2	4	5
7	Entrepreneurship/Economics/Management Course	2	4	5
8	Experiential Learning Courses	4	20	25
	TOTAL	**31**	**80**	**100**

SEMESTER-WISE COURSE DISTRIBUTION

Course Distribution : Semester Wise						
Sr. No.	**Type of Course**	**No. of Courses / Semester**				**Total**
		1	**2**	**3**	**4**	
1	Basic Science Course	1	1	0	0	2
2	Programme Core Course	6	2	4	0	12
3	Programme Elective Course	0	4	2	1	7
4	Open Elective	0	0	0	1	1
5	Vocational and Skill Enhancement Course	0	0	1	0	1
6	Ability Enhancement Course	0	0	2	0	2
7	Entrepreneurship/Economics/Management Course	0	1	0	1	2
8	Experiential Learning Courses	1	1	1	1	4
	Total	**8**	**9**	**10**	**4**	**31**

SEMESTER-WISE CREDIT DISTRIBUTION

Credit Distribution : Semester Wise						
Sr. No.	**Type of Course**	**No. of Credits / Semester**				**Total**
		1	**2**	**3**	**4**	
1	Basic Science Course	4	4	0	0	8
2	Programme Core Course	12	4	8	0	24
3	Programme Elective Course	0	8	4	4	16
4	Open Elective	0	0	0	2	2
5	Vocational and Skill Enhancement Course	0	0	2	0	2
6	Ability Enhancement Course	0	0	4	0	4
7	Entrepreneurship/Economics/Management Course	0	2	0	2	4
8	Experiential Learning Courses	4	2	2	12	20
	Total	**20**	**20**	**20**	**20**	**80**

Curriculum Structure

First Year

MCA

CURRICULUM STRUCTURE

First Year MCA Semester – I

First Year MCA (Regulations 2024) (With effect from Academic Year 2025-2026)																	
Semester-I																	
Course Code	**Course Name**	**Credit Scheme**				**Teaching Scheme (Hours/Week)**					**Evaluation Scheme and Marks**						**Total**
											FA		**SA**	**TW**	**PR**	**OR**	
		L	**P**	**T/A**	**Total**	**L**	**P**	**T/A**	**O***	**Total**	**FA-1**	**FA-2**					
MCA31PC01	Software Engineering	2	0	0	2	2	0	0	4	2	10	10	30	0	0	0	50
MCA31PC02	Data Structures	2	0	0	2	2	0	0	4	2	10	10	30	0	0	0	50
MCA31PC03	Data Communication and Networking	2	0	0	2	2	0	0	4	2	10	10	30	0	0	0	50
MCA31PC04	SQL Programming Lab	0	2	0	2	0	4	0	0	4	0	0	0	0	30	20	50
MCA31PC05	Java Programming Lab	0	2	0	2	0	4	0	0	4	0	0	0	0	30	20	50
MCA31PC06	Python Programming Lab	0	2	0	2	0	4	0	0	4	0	0	0	0	30	20	50
MCA31EL01	Research Methodologies and IPR	3	0	1	4	3	0	1	6	4	20	20	60	0	0	0	100
MCA31BS01	Mathematical Foundation for Computer Application-1	3	0	1	4	3	0	1	6	4	20	20	60	0	0	0	100
Total		**12**	**6**	**2**	**20**	**12**	**12**	**2**	**24**	**26**	**70**	**70**	**210**	**0**	**90**	**60**	**500**

L-Lecture, P-Practical, T/A-Tutorial/Activity, FA–Formative Assessment, SA-Summative Assessment, TW-Term Work, OR-Oral, PR-Practical

O* : Over and Above, Self Study, Experiential Learning

First Year MCA Semester – II

First Year MCA (Regulations 2024) (With effect from Academic Year 2025-2026)																	
Semester-II																	
Course Code	**Course Name**	**Credit Scheme**				**Teaching Scheme (Hours/Week)**					**Evaluation Scheme and Marks**						**Total**
											FA		**SA**	**TW**	**PR**	**OR**	
		L	**P**	**T/A**	**Total**	**L**	**P**	**T/A**	**O***	**Total**	**FA-1**	**FA-2**					
MCA32PC07	Operating System Concepts	2	0	0	2	2	0	0	4	2	10	10	30	0	0	0	50
MCA32PC08	Web Technologies Lab	0	2	0	2	0	4	0	-	4	0	0	0	0	30	20	50
MCA32PE01 to MCA32PE04	Elective-1	2	0	0	2	2	0	0	-	2	10	10	30	0	0	0	50
MCA32PE09 to MCA32PE12	Elective-2	2	0	0	2	2	0	0	-	2	10	10	30	0	0	0	50
MCA32PE05 to MCA32PE08	Elective-1 Lab	0	2	0	2	0	4	0	-	4	0	0	0	0	30	20	50
MCA32PE13 to MCA32PE16	Elective-2 Lab	0	2	0	2	0	4	0	-	4	0	0	0	0	30	20	50
MCA32EM01	Project Management	2	0	0	2	2	0	0	4	2	10	10	30	0	0	0	50
MCA32BS02	Mathematical Foundation for Computer Application-2	3	0	1	4	3	0	1	6	4	20	20	60	0	0	0	100
MCA32EL02	Research Project	0	2	0	2	0	4	0	-	4	0	0	0	50	0	0	50
Total		**11**	**8**	**1**	**20**	**11**	**16**	**1**	**14**	**28**	**60**	**60**	**180**	**50**	**90**	**60**	**500**

L-Lecture, P-Practical, T/A-Tutorial/Activity, FA–Formative Assessment, SA-Summative Assessment, TW-Term Work, OR-Oral, PR-Practical

O* : Over and Above, Self Study, Experiential Learning

Curriculum Structure
Second Year
MCA

Second Year MCA Semester – I

Second Year MCA (Regulations 2024) (With effect from Academic Year 2025-2026)																	
Semester-I																	
Course Code	**Course Name**	**Credit Scheme**				**Teaching Scheme (Hours/Week)**					**Evaluation Scheme and Marks**						**Total**
											FA		**SA**	**TW**	**PR**	**OR**	
		L	**P**	**T/A**	**Total**	**L**	**P**	**T/A**	**O***	**Total**	**FA-1**	**FA-2**					
MCA33PC09	Advanced Database Management	2	0	0	2	2	0	0	4	2	10	10	30	0	0	0	50
MCA33PC10	Advanced Web Technologies	2	0	0	2	2	0	0	4	2	10	10	30	0	0	0	50
MCA33PC11	Advanced Web Technologies Lab	0	2	0	2	0	4	0	0	4	0	0	0	0	30	20	50
MCA33PC12	Mobile Application Development Lab	0	2	0	2	0	4	0	0	4	0	0	0	0	30	20	50
MCA33PE17 to MCA33PE20	Elective-3	2	0	0	2	2	0	0	0	2	10	10	30	0	0	0	50
MCA33PE21 to MCA33PE24	Elective-3 Lab	0	2	0	2	0	4	0	0	4	0	0	0	0	30	20	50
MCA33AE01	Seminar	0	2	0	2	0	4	0	0	4	0	0	0	50	0	0	50
MCA33AE02	Professional Development Training	0	0	2	2	0	0	2	0	2	0	0	0	50	0	0	50
MCA33VS01 to MCA33VS02	Skill Enhancement	0	2	0	2	0	4	0	0	4	0	0	0	50	0	0	50
MCA33EL03	Mini Project	0	2	0	2	0	4	0	0	4	0	0	0	50	0	0	50
	Total	**6**	**12**	**2**	**20**	**6**	**24**	**2**	**8**	**32**	**30**	**30**	**90**	**200**	**90**	**60**	**500**

L-Lecture, P-Practical, T/A-Tutorial/Activity, FA–Formative Assessment, SA-Summative Assessment, TW-Term Work, OR-Oral, PR-Practical

O* : Over and Above, Self Study, Experiential Learning

Second Year MCA Semester – II

Second Year MCA (Regulations 2024) (With effect from Academic Year 2025-2026)																	
Semester-II																	
Course Code	**Course Name**	**Credit Scheme**				**Teaching Scheme (Hours/Week)**					**Evaluation Scheme and Marks**						**Total**
											FA		**SA**	**TW**	**PR**	**OR**	
		L	**P**	**T/A**	**Total**	**L**	**P**	**T/A**	**O***	**Total**	**FA-1**	**FA-2**					
MCA34EM02	Emerging Trends in IT	0	0	2	2	0	0	2	0	2	0	0	0	50	0	0	50
MCA34OE01	Open Elective - MOOC	0	0	2	2	0	0	2	0	2	0	0	0	50	0	0	50
MCA34EL04	Internship	0	12	0	12	0	24	0	0	24	0	0	0	150	0	150	300
MCA34PE25 to MCA34PE28	Elective-4	3	0	1	4	3	0	1	0	4	20	20	60	0	0	0	100
	Total	**3**	**12**	**5**	**20**	**3**	**24**	**5**	**0**	**32**	**20**	**20**	**60**	**250**	**0**	**150**	**500**

L-Lecture, P-Practical, T/A-Tutorial/Activity, FA–Formative Assessment, SA-Summative Assessment, TW-Term Work, OR-Oral, PR-Practical

O* : Over and Above, Self Study, Experiential Learning

PCCOE "Knowledge Brings Freedom"

List of Courses – Programme Elective Courses (First Year MCA)

FYMCA (Sem II)			
Course Code	**Elective 1**	**Course Code**	**Elective 2**
MCA32PE01	Data Warehouse and Data Mining	MCA32PE09	Data Science
MCA32PE02	Web Development using Django	MCA32PE10	Cloud Computing
MCA32PE03	UI/UX Design	MCA32PE11	Blockchain Technology
MCA32PE04	Start-Up and New Venture Development	MCA32PE12	Business Opportunity Identification
MCA32PE05	Data Warehouse and Data Mining Lab	MCA32PE13	Data Science Lab
MCA32PE06	Web Development using Django Lab	MCA32PE14	Cloud Computing Lab
MCA32PE07	UI/UX Design Lab	MCA32PE15	Blockchain Technology Lab
MCA32PE08	Start-Up and New Venture Development Lab	MCA32PE16	Business Opportunity Identification Lab

List of Courses – Programme Elective Courses (Second Year MCA)

SYMCA (Sem I)		SYMCA (Sem II)	
Course Code	**Elective 3**	**Course Code**	**Elective 4**
MCA33PE17	Advanced Data Science	MCA34PE25	Internet of Things
MCA33PE18	Network Security	MCA34PE26	Decision Science
MCA33PE19	Dynamic Application Development and Frameworks	MCA34PE27	Advanced Network Security and Cryptography
MCA33PE20	Startup Management Essentials	MCA34PE28	Entrepreneurial Marketing
MCA33PE21	Advanced Data Science Lab		
MCA33PE22	Network Security Lab		
MCA33PE23	Dynamic Application Development and Frameworks Lab		
MCA33PE24	Startup Management Essentials Lab		

List of Courses – Skill Enhancement Courses (Second Year MCA)

SYMCA (Sem I)			
Course Code	**Course Title**	**Course Code**	**Course Title**
MCA33VS01	Advanced Excel	MCA33VS02	Digital Marketing

Syllabus of Courses
Semester I
Second Year MCA

Course Syllabus of SYMCA Semester – I Courses (w.e.f. 2025-2026)

<table>
<tr><td>Program:</td><td colspan="8">MCA</td><td colspan="2">Semester : III</td></tr>
<tr><td>Course:</td><td colspan="8">Advanced Database Management</td><td colspan="2">Code : MCA33PC09</td></tr>
<tr><td rowspan="3">Credits</td><td colspan="4">Teaching Scheme (Hrs. / Week)</td><td colspan="5">Evaluation Scheme and Marks</td></tr>
<tr><td rowspan="2">Lecture</td><td rowspan="2">Practical</td><td rowspan="2">Tutorial / Activity</td><td rowspan="2">O*</td><td colspan="2">FA</td><td rowspan="2">TW</td><td rowspan="2">SA</td><td rowspan="2">Total</td></tr>
<tr><td>FA-1</td><td>FA-2</td></tr>
<tr><td>2</td><td>2</td><td>-</td><td>-</td><td>4</td><td>10</td><td>10</td><td>-</td><td>30</td><td>50</td></tr>
<tr><td colspan="10">Prior knowledge of :
1. Basic Database Management System
2. SQL Programming
3. Data Structure
is essential.</td></tr>
<tr><td colspan="10">Course Objectives
This course aims at enabling students:
1. To analyse transaction management, concurrency control, and recovery techniques for database integrity.
2. To introduce parallel and distributed database architectures for efficient data processing.</td></tr>
<tr><td colspan="10">Course Outcomes
After learning the course, the students should be able to:
1. Analyze transactions and concurrent operations in databases and solve case study-based problems to address and resolve concurrency issues.
2. Apply database recovery techniques to handle failures using log-based recovery operations
3. Apply I/O parallelism and data fragmentation techniques to improve query processing efficiency.
4. Apply principles of Spatial Indexing methods to manage geographical database</td></tr>
<tr><td colspan="10">Detailed Syllabus</td></tr>
<tr><td>Unit No.</td><td colspan="8">Description</td><td>Duration (Hrs.)</td></tr>
<tr><td>1</td><td colspan="8">Transaction and Concurrency Control :Concepts of transactions, ACID properties and different transaction states. Concurrency Control: Techniques for managing concurrent transactions and resolving conflicts. Scheduling and Serializability: Transaction scheduling, Serializability and methods for testing Serializability. Lock-Based Concurrency Control and Deadlock Handling Methods. Case Study based Problem-Solving in Database Transactions, Serializability and Concurrency Control</td><td>10</td></tr>
</table>

2	**Database Recovery** Database Recovery Concept, Types of failures, Log based recovery, Types of database recovery methods: REDO & UNDO, Deferred Update and Immediate Update, Problem-Solving on Deferred and Immediate Update methods	6
3	**Parallel Databases:** Introduction to parallel databases, parallel database architectures, and I/O parallelism. **Query Parallelism:** Concepts of inter-query and intra-query parallelism for efficient query processing. Key elements of parallel database processing **Distributed Database Systems:** Overview of distributed databases and their architectural models. **Data Fragmentation:** Techniques of data fragmentation- horizontal, vertical, and mixed fragmentation. **Case study-based problem-solving** on I/O parallelism and Data fragmentation	8
4	**Specialty Databases & Applications** Introduction to Spatial database system, Spatial Data indexing methods like Quad Tree, R-Tree, K-D Tree etc. and applications of Geographic database	6
Other*	Introduction to NOSQL Database, Key Differences between SQL and NoSQL Databases, NoSQL Data Models	4
	Total	**30+4=34**

Text Books:

1. Silberschatz, A., Korth, H. F., &Sudarshan, S. Database System Concepts. McGraw-Hill, 7th Edition (2019).
2. Singh, S. K. Database Systems: Concepts, Design and Applications. Pearson Education.

Reference Books:

1. Principles of Distributed Database Systems. Springer, 4th Edition (2019).
2. Bali Shankar Khurana, Advanced DBMS, Vision Publication (2021)

E-Resources:

1. DBMS Tutorial: https://www.tutorialspoint.com/dbms/dbms_data_recovery.htm
2. Distributed DBMS Tutorial: https://www.tutorialspoint.com/distributed_dbms/index.htm
3. Introduction To Distributed Database: https://www.youtube.com/watch?v=N32P6twSy_0&list=PLK32cwTOY7L8D9GxdYR2JkEIAA1J1sKYO
4. https://www.javatpoint.com/spatial-database-in-dbms
5. Introduction to NoSQL: https://www.geeksforgeeks.org/introduction-to-nosql/

Program:	MCA							Semester : III
Course:	Advanced Web Technologies							Code : MCA33PC10
Credits	Teaching Scheme (Hrs. / Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial / Activity	O*	FA		TW	SA	Total
					FA-1	FA-2			
2	2	-	-	4	10	10	-	30	50

Prior knowledge of :

1. HTML
2. CSS
3. Javascript

is essential.

Course Objectives

This course aims at enabling students:

1. To develop the foundation for building user interfaces in full-stack web development
2. To cultivate a deep understanding of advanced JavaScript and React.js concepts

Course Outcomes

After learning the course, the students should be able to:

1. Discuss the fundamentals of React.js and various concepts related to Advanced JavaScript
2. Demonstrate proficiency in various concepts related to Javascript, React.js
3. Compare different components, state management techniques in React

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Advanced Javascript** Working with Arrays & Objects, ES6+ Concepts, DOM Manipulation, Asynchronous JavaScript, JavaScript Functions & Closures	8
2	**Introduction to React.js** What is React?, Why React?, React version history, React 16 vs React 15, Just React - Hello World, Using create-react-app, Anatomy of react project, Running the app, Debugging first react app, Significance of component architecture, Types of components - Functional, Class-based, Pure Component Composition	7
3	**React Essentials** Templating with JSX, State and Lifecycle, React Hooks, Handling Events, Working with Forms, Conditional Rendering, Lists and Keys, Styling in React	7
4	**Advanced React** React Router (Introduction to React Router, Setting up React Router, Creating	8

	routes, Navigating with React Router, Using Link and NavLink, Nested Routes and Dynamic Routing, Nested routes, Passing parameters to routes), State Management with Redux (Introduction to Redux, Understanding the need for state management, Basic concepts: actions, reducers, store, Setting Up Redux), Handling errors	
Other*	Implementation of JWT token, Captcha Validation, Human Verification	4
	Total	**30 + 4 = 34**

Text Books:

1. Chris Minnick, ReactJSFoundationsBuilding User Interfaces with ReactJSAn Approachable Guide, Wiley Publication

Reference Books:

1. Keith Dvorjak, Advanced Javascript Coding from the Ground Up, Packt
2. Mark Thomas, React in Action, Oreilley Publication

E-Resources:

1. Advanced Concepts of Javascript : javascript.info
2. React JS Tutorial : https://react-tutorial.app

Program:	MCA					Semester : III
Course:	Advanced Web Technologies Lab					Code : MCA33PC11

Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial / Activity	TW	OR	PR	Total
2	-	4	-	-	20	30	50

Prior knowledge of :

1. HTML
2. CSS
3. Javascript

is essential.

Course Objectives

This course aims at enabling students:

1. To provide a platform for students to practice, demonstrate various concepts of advanced JavaScript and React.js, and, to encourage continuous learning and adaptation to emerging web technologies for building interactive applications

Course Outcomes

After learning the course, the students should be able to:

1. Develop interactive web applications using React.js by understanding its architecture, components, and project structure
2. Utilize React features such as JSX, state, lifecycle methods, and hooks to build dynamic UI components.
3. Implement Routing, State Management, and Error Handling using various features of React

Guidelines:

1. Students will be assessed based on practical work done by them throughout the semester, practical exam, and viva
2. Practical work and practical exam collectively have a weightage of 30 marks, and viva has the weightage of 20 marks.
3. Students are advised to use: VS Code, the Latest Version of Chrome

Detailed Syllabus

Assignment No.	Suggested List of Assignments
1	Working with Arrays & Objects : Assignment: Implement a Student Management System Create an array of student objects with properties: id, name, marks, and subjects. Implement functions to: Add a new student, Find the student with the highest marks, Get an array of students who have passed (marks > 40), Sort students based on marks
2	ES6+ Concepts : Assignment: Employee Records using ES6 Features Create a class Employee with name, designation, and salary. Implement getter and setter for salary. Use map, filter, and reduce to: Increase salary by 10% for employees earning less than 50,000, Get a list of employees earning more than 60,000

3	DOM Manipulation : Assignment: To-Do List Application Create an HTML form with an input field and an "Add Task" button. Display the tasks in a list below the form. Implement functionality to: Mark tasks as completed, Remove a task from the list, Edit a task, Store tasks in localStorage.
4	Asynchronous JavaScript (Callbacks, Promises, Async/Await) : Assignment: Fetch API & Weather App Use the OpenWeather API to fetch weather data. Display the temperature and weather conditions for a user-provided city. Implement error handling for invalid city names. Use async/await to make API requests.
5	JavaScript Functions & Closures : Assignment: Shopping Cart using Closures Implement a function createCart() that returns an object with methods to: Add an item (name, price), Remove an item, and Get the total price, The cart should maintain its state using closures.
6	Templating with JSX Create a simple React component using JSX that renders a div with a h1 title and a p description. Implement a React component that renders a list of items dynamically using JSX and map(). Use JSX expressions to conditionally render "Good Morning" or "Good Evening" based on the current time.
7	State and Lifecycle Create a class component that initializes a counter state and increases the counter every second using componentDidMount(). Implement a Clock component that displays the current time and updates it every second. Build a component that tracks the number of times a button has been clicked using state.
8	React Hooks Convert a class-based counter component to a functional component using the useState hook. Create a component that fetches and displays user data from an API using the useEffect hook. Implement a custom hook useLocalStorage that saves and retrieves values from localStorage. Use the useReducer hook to manage a counter with increment, decrement, and reset functionalities.
9	Working with Forms Create a controlled form component with name, email, and password fields. Display submitted values below the form. Implement a form validation system where the submit button is disabled if fields are empty. Build a dropdown form component where selecting an option updates a displayed message dynamically.

References:

1. Chris Minnick, ReactJSFoundationsBuilding User Interfaces with ReactJSAn Approachable Guide, Wiley Publication
2. Keith Dvorjak, Advanced Javascript Coding from the Ground Up, Packt
3. Mark Thomas, React in Action, O'reilly Publication
4. Advanced Concepts of Javascript : javascript.info
5. React JS Tutorial : https://react-tutorial.app

Program:	MCA						Semester : III
Course:	Mobile Application Development Lab						Code : MCA33PC12
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial / Activity	TW	OR	PR	Total
2	-	4	-	-	20	30	50

Prior knowledge of :

1. Object Oriented Programming
2. Logical Thinking
3. Database Operations

is essential.

Course Objectives

This course aims at enabling students:

1. To Demonstrate Basic Android Development.
2. To demonstrate how to create applications using SQLite database.
3. To implement concepts of Android Development.
4. To help the students understand the Android platform's organization patterns and programming mechanisms so that they can develop their Android applications effectively.

Course Outcomes

After learning the course, the students should be able to:

1. Create a basic Android application and deploy it on an emulator or physical device.
2. Implement event handling to respond to user interactions with UI widgets.
3. Apply principles of user interface design to create visually appealing and intuitive Android app layouts.
4. Implement different types of notifications, including status bar notifications and push notifications.
5. Implement different advanced widgets APIs.
6. Implement data storage solutions such as SharedPreferences, SQLite databases, and file storage to persist application data.

Guidelines:

A) Term work shall be based on the following topics:
   - Understanding of Android Studio and the basics of Android
   - User Interface Widgets
   - User Interface Designing
   - Notifications
   - Advanced Widgets
   - Data Storage, retrieval and Sharing

B) Students are advised to use:
   - Android Studio
   - Java Programming

Detailed Syllabus

Expt. No.	Suggested List of Assignments
1	**Introduction to Android Studio** 1. Write an android application which will print “Hello World” on the AVD 2. Write an android application that will accept two numbers from the users and will print the addition as output in TextView and Toast. 3. Write an android application that will demonstrate an Android Activity Life Cycle and print output in the logcat. 4. Write an android application that will display components in GridLayout. 5. Write an android application that will display components in TableLayout.
2	**User Interface Widgets** 1. Write an android application which will change the background color of an activity on switching the state of the ToggleButton. 2. Write an android application which will display the menu with the price of the menu item. Once the final order is completed display the total bill amount to the user in Toast. Use CheckBox for creating the menu items. 3. Write an android application for rating a movie on the scale of 1 to 5. Display the result in TextView. 4. Write an android application using Spinner for selecting the Cricket Team Players from the given list. Display the name of the Cricketer in Toast. 5. Write an android application which will demonstrate the use of ImageButton.
3	**User Interface Designing** 1. Write an android application which will allow users to navigate from one activity to another activity. The first Activity will ask the user to enter the name user and the Second activity will display the name in TextView which was entered in the first activity. 2. Write an android application that asks the user to enter the URL, and after clicking the button, the URL link should be opened in the web browser in an emulator. 3. Write an android application that will demonstrate the use of BaseAdapter and ArrayAdapter. 4. Write an android application for Gallery using adapters. 5. Write an application demonstrating the use of Android Session Management.
4	**Notifications** 1. Create an Android application that triggers a simple notification when a button is clicked. The notification should display a title, message, and a small icon. When clicked, it should open the main activity of the app. 2. Develop an Android app that sends a notification with two action buttons: a. One button should open a new activity. b. The other button should dismiss the notification. Use NotificationCompat.Builder to implement this feature. 3. Build an Android application where the user can set a reminder using a TimePicker. At the selected time, a notification should be triggered. Use AlarmManager and BroadcastReceiver to handle scheduled notifications. 4. Create an Android app that sends a notification with a custom sound, vibration pattern, and large icon. The notification should appear when the app is launched

	and should be dismissed when clicked. 5. Develop an Android application that saves notifications in an SQLite database. Each time a notification is triggered, it should be stored in the database with details like title, message, and timestamp. Create an activity with a RecyclerView to display the list of stored notifications.
5	**Advanced Widgets** 1. Write an android application which will create three fragments in a single activity. 2. Write an android application for Fragment Activity Life Cycle. 3. Write an android application that will look like WhatsApp Application using Fragment. 4. Write an android application that will parse XML data 5. Write an android application that will parse JSON data
6	**Data Storage, retrieval and Sharing** 1. Write an android application for reading a text file and displaying the data in an activity. 2. Write an android application for accepting a file from the user and storing it in internal memory. 3. Write an android application which takes different inputs from the user for a resume and will store it in a text file. 4. Write an application for saving and loading files. 5. Write an android application which will display the list of files available in a particular location using ListView

References:

1. Hello Android, Introducing Google's Mobile Development Platform, Ed Burnette, Pragmatic Programmers, ISBN: 978-1-93435-617-3
2. Professional AndroidTM Application Development Wrox Publications, Reto Meier
3. Sams teach yourself Android application development, Lauren Dercy and ShandeConder, Sams Publishing
4. https://developer.android.com/guide
5. https://www.vogella.com/tutorials/android.html
6. https://www.geeksforgeeks.org/android-tutorial/

Program:	MCA						Semester : III	
Course:	Advanced Data Science						Code : MCA33PE17	
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks				
	Lecture	Practical	Tutorial / Activity	FA		TW	SA	Total
				FA-1	FA-2			
2	2	-	-	10	10	-	30	50

Prior knowledge of :

1. Python Programming
2. Business Statistics
3. Data Science

is essential.

Course Objectives

This course aims at enabling students:

1. To understand the fundamental concepts and techniques of data science and machine learning.
2. To develop skills in data preprocessing and exploration for meaningful analysis.
3. To apply machine learning algorithms to solve practical problems.
4. To evaluate machine learning models and learn deployment techniques using modern tools.

Course Outcomes

After learning the course, the students should be able to:

1. Apply basic concepts of data science and machine learning to perform data analysis.
2. Analyze data using preprocessing and exploration techniques to extract meaningful insights.
3. Implement machine learning models to solve diverse data problems.
4. Evaluate and deploy machine learning models using advanced techniques and tools

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Data Science and Python Packages** Introduction to Data Science, Machine Learning and its Types, Python Data Analysis Packages: NumPy, Pandas, Matplotlib, Seaborn, Scikit-learn, Model Serialization Tools: Pickle and Joblib, Introduction to Streamlit.	7
2	**Data Preprocessing and Exploration** Feature Engineering, Handling Missing Data, Exploratory Data Analysis (EDA), Univariate Analysis, Bivariate Analysis, Multivariate Analysis.	8
3	**Supervised and Unsupervised Machine Learning** Supervised Learning: Regression, Classification; Algorithms: Decision Trees, SVM, k-Nearest Neighbors (kNN); Time-Series Forecasting; Unsupervised Learning: Clustering (K-means, Hierarchical), Dimensionality Reduction using Principal Component Analysis (PCA).	7
4	**Advanced Techniques and Deployment in Data Science** AI in Data Science, Model Evaluation and Tuning, Basics of Embeddings for Text Data, Vector Databases and RAG (Retrieval-Augmented	8

	Generation), ChatGPT for Data Science Applications, Model Deployment using Pickle/Joblib and Streamlit for Web Apps.	
	Total	**30**

Text Books:

1. Mastering Machine Learning with Python in Six Steps - A Practical Implementation Guide to Predictive Data Analytics Using Python, ManoharSwamynathan , Apress (2017)

Reference Books:

1. Introduction to Machine Learning with Python - A Guide for Data Scientists, Andreas C. Müller, Sarah Guido, O'Reilly Media (2016)
2. Python for Data Analytics with Pandas, Numpy, and MatPlotLib, Fabio Nelli, Apress Publication
3. Python for Data Analysis, Wes McKinney, O'Reilly Publication
4. Business Statistics, Naval Bajpai, Pearson Publication

E-Resources:

1. NOC: Python for Data Science - https://archive.nptel.ac.in/courses/106/106/106106212/
2. NOC: Introduction to Data Analytics - https://archive.nptel.ac.in/courses/110/106/110106072/
3. NOC: Introduction to Machine Learning - https://archive.nptel.ac.in/courses/106/105/106105152/
4. NOC: Machine Learning and Deep Learning - Fundamentals And Applications - https://onlinecourses.nptel.ac.in/noc23_ee87/preview

PCCOE
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Program:	MCA						Semester : III	
Course:	Network Security						Code : MCA33PE18	
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks				
	Lecture	Practical	Tutorial / Activity	FA		TW	SA	Total
				FA-1	FA-2			
2	2	-	-	10	10	-	30	50

Prior knowledge of :

1. Fundamentals of Computer Network
2. Basics of Programming Languages
3. Cyber Security Awareness

is essential.

Course Objectives

This course aims at enabling students:

1. To understand the fundamental concepts of network security and threats.
2. To learn various security mechanisms like cryptography, authentication, and access control.
3. To explore network security tools, firewalls, IDS/IPS, and secure communication protocols.
4. To gain insights into cyber Security frameworks and risk management.

Course Outcomes

After learning the course, the students should be able to:

1. Identify various network security threats and vulnerabilities.
2. Implement security mechanisms like encryption, authentication, and firewalls.
3. Utilize tools for network monitoring and intrusion detection.
4. Understand cybersecurity best practices and compliance frameworks.

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Fundamentals of Network Security** Introduction to Network Security and Cybersecurity, Security Goals: Confidentiality, Integrity, Availability (CIA Triad), Types of Security Attacks: Passive & Active Attacks, Network Security Models & Policies, Risk Assessment and Security Planning	7
2	**Cryptographic Techniques & Authentication** Symmetric & Asymmetric Cryptography, Encryption Algorithms: AES, DES, RSA, Hash Functions: SHA, MD5, Digital Signatures & Certificates, Authentication Mechanisms: Passwords, Multi-factor Authentication (MFA), Biometrics	7
3	**Network Security Mechanisms** Firewalls: Types of Firewalls, Intrusion Detection & Prevention Systems (IDS/IPS), Virtual Private Networks (VPNs) and Secure Sockets Layer (SSL), Secure Communication: HTTPS, TLS, SSH, Wireless Network Security & Secure Wi-Fi Protocols	8

4	Cybersecurity Threats & Legal Compliance Cyber Threats: Malware, Ransomware, Phishing, Social Engineering, Security in Cloud Computing & IoT Security Challenges, Incident Response & Security Policies, Cyber Laws & Compliance	8
	Total	**30**

Text Books:

1. William Stallings, "Network Security Essentials: Applications and Standards," 6th Edition, Pearson.
2. Behrouz A. Forouzan, "Cryptography and Network Security," 3rd Edition, McGraw Hill.
3. Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security: Private Communication in a Public World," 2nd Edition, Pearson.

Reference Books:

1. Douglas R. Stinson, "Cryptography: Theory and Practice," 3rd Edition, CRC Press.
2. Eric Maiwald, "Network Security: A Beginner's Guide," 3rd Edition, McGraw Hill.
3. Nina Godbole, SunitBelapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics, and Legal Perspectives," Wiley.

E-Resources:

1. NPTEL Course: Cryptography and Network Security by IIT Kharagpur https://nptel.ac.in/courses/106105031
2. Coursera: Introduction to Cybersecurity Tools &Cyberattacks By IBM https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks
3. Cisco Networking Academy: Introduction to Cybersecurity https://www.netacad.com/courses/introduction-to-cybersecurity?courseLang=en-US
4. YouTube Channel: Computerphile (Cybersecurity & Network Security) https://www.youtube.com/user/Computerphile

PCCOE "Knowledge Brings Freedom"

Program:	MCA						Semester : III	
Course:	Dynamic Application Development and Frameworks						Code : MCA33PE19	
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks				
	Lecture	Practical	Tutorial / Activity	FA		TW	SA	Total
				FA-1	FA-2			
2	2	-	-	10	10	-	30	50

Prior knowledge of :

1. HTML
2. CSS
3. JavaScript
4. React / Angular

is essential.

Course Objectives

This course aims at enabling students:

1. To learn the basics of Node.js, including its asynchronous nature and event-driven architecture
2. To learn how to set up routes, handle requests and responses, and manage middleware
3. To gain proficiency in MongoDB, a NoSQL database, and its document-oriented data model

Course Outcomes

After learning the course, the students should be able to:

1. Articulate the core concepts of Node.js, Express JS and MongoDB
2. Apply MongoDB operators, functions, commands for data retrieval, storage, management
3. Utilize Node.js modules and packages to enhance the functionality and modularity of applications.
4. Demonstrate advanced concepts of Node.js and Express JS

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**MongoDb** No SQL Database, Advantage over RDBMS, MongoDB Data Types, Install MongoDB, MongoDB Data Modeling, MongoDB Operators (Query & Projection Operator, MongoDB Update Operator, Aggregation Pipeline Stages, MongoDB limit(), MongoDB sort(), Query Modifiers), Database Commands, Database : Create Database, Drop Database, Collection : Create Collection, Drop Collection, CRUD : Documents, Inset Documents, Update Documents, Delete Documents, Query Documents, SQL to MongoDB Mapping, MongoDB text search, Partial Updates & Document Limits, Removing Documents, Multi Update, Upsert, Wire Protocol, Bulk() Operations and Methods, Common Commands, db.runCommand(), db.isMaster(), db.serverStatus(), db.currentOp() &db.killOp(), collection.stats() &collection.drop()	10
2	**Node.js** Introduction to Node JS, What is Node JS, Node.js Process Model,	6

	Advantages of Node JS, Traditional Web Server Model, Install Node.js on Windows, Working in REPL, Node JS Console, Functions, Buffer, Module, Modules Types, Modules Exports, Module Wrapper, What is NPM, Installing Packages Locally, Installing package globally, Adding dependency in package json, Updating packages, File System, Creating Server, Different Core Modules, Events and Event Emitter	
3	**Express JS** Overview of Express.js and its role in web application development, Understanding the basic concepts of routes, middleware, and handlers, Defining routes for handling different HTTP methods and URLs, Route parameters and query parameters, Creating and using middleware functions for various purposes (logging, authentication, etc.), Chaining multiple middleware functions, Integrating and using templating engines (e.g., EJS, Pug) to dynamically render HTML pages, Serving static files (CSS, JavaScript, images) with Express.js, Implementing error handling mechanisms to handle exceptions and errors	7
4	**Data Handling and Advanced Concepts** Handling request and response formats (JSON, XML, etc.), Implementing user authentication and authorization using middleware and libraries, Connecting String, Configuration, Building RESTful APIs using Express.js to handle CRUD operations, Sending Emails, Sending SMSs, What is a web socket? Communication using sockets!	7
	Total	**30**

Text Books:

1. MongoDB Fundamentals, Packt
2. Practical Node.js, Apress

Reference Books:

1. The Definative Guide to MongoDB, Apress
2. Beginning Node.js, Apress

E-Resources:

1. Node.js Tutorial : https://www.tutorialsteacher.com/nodejs
2. MongoDb Tutorial : https://www.mongodbtutorial.org/

Program:	MCA						Semester : III	
Course:	Startup Management Essentials						Code : MCA33PE20	
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks				
	Lecture	Practical	Tutorial / Activity	FA		TW	SA	Total
				FA-1	FA-2			
2	2	-	-	10	10	-	30	50

Prior knowledge of :

1. Start Up and New Venture Development

is essential.

Course Objectives

This course aims at enabling students:

1. To inculcate entrepreneurial mind-set into the minds of young professionals
2. To identify entrepreneurial opportunities
3. To leverage skills for founding, leading & managing Startups
4. To provide students with the knowledge and skills necessary to develop comprehensive business plans and deliver effective business pitches

Course Outcomes

After learning the course, the students should be able to:

1. Apply financial management techniques for new business
2. Develop a business plan for a Startup idea
3. Analyze the impact and effectiveness of a business pitch
4. Discover the different Government initiatives for Startup

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	The Financial Road Map Things to be considered before starting business, Business Planning Process,How to budget for Startup, Different Sources of funding-Bootstrapping, Angel Investment, Venture Capital, Crowd Funding etc	7
2	Business Plan Concept of Business Plan, Key Elements of Business Plan, importance of a business plan, Unique selling proposition (USP),Real-life examples of successful business plans	8
3	Business Pitch The Pitch, Preparing for your investor presentation, Elements of the Perfect Investment Pitch, Effective Business pitch presentations	8
4	Business Model Canvas Introduction to Business Model Canvas, Components of Business Model Canvas, Application of Business model Canvas, Business Model Canvas framework	7

	Total	**30**

Text Books:

1. Ries, E. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business, 2011.
2. Swanson, L. A. Business Plan Development Guide. Open Textbook Library, 2017.
3. Klaff, O. Pitch Anything: An Innovative Method for Presenting, Persuading, and Winning the Deal. McGraw-Hill Education, 2011.
4. Osterwalder, A., &Pigneur, Y. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. Wiley, 2010.

Reference Books:

1. Dynamics of Entrepreneurship Development – Vasant Desai.
2. Entrepreneurship: New Venture Creation – David H. Holt
3. Entrepreneurship Development New Venture Creation – SatishTaneja, S.L.Gupta
4. Entrepreneurship Development and small business management – Poornima M. Charantimath

E-Resources:

1. Startup India - https://www.startupindia.gov.in/ (Different Sources of Funding, Business Planning Process, Business Model Development)
2. Atal Innovation Mission (AIM) - https://www.aim.gov.in/ (Business Pitch, Investor Presentation, Startup Mentorship)
3. Invest India - https://www.investindia.gov.in/ (Business Plan Development, Business Model Canvas, Investment Readiness)
4. MSME Ministry - https://msme.gov.in/ (Government Support for Startups, Funding, and Business Growth)
5. SIDBI (Small Industries Development Bank of India) - https://www.sidbi.in/ (Financial Assistance, Startup Loans, Venture Capital)

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Program:	MCA						Semester : III
Course:	Advanced Data Science Lab						Code : MCA33PE21
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial / Activity	TW	OR	PR	Total
2	-	4	-	-	20	30	50

Prior knowledge of :

1. Python Programming
2. Business Statistics
3. Data Science

is essential.

Course Objectives

This course aims at enabling students:

1. To develop an in-depth understanding of the key technologies in data science.
2. To impart design thinking capability to build and analyze data-based models.
3. To gain practical experience in Python programming tools for data sciences.
4. To empower students with tools and techniques used in data science.

Course Outcomes

After learning the course, the students should be able to:

1. Apply data pre-processing techniques to process, transform, summarize, and visualize data.
2. Apply machine learning algorithms using Python programming for advanced data analysis.
3. Analyse advanced data analysis techniques and methods for problem-solving.
4. Evaluate a variety of datasets using principles of data science and artificial intelligence.

Guidelines:

1. Students will be assessed based on:
   A. The practical work done by them throughout the semester
   B. The Practical Exam and
   C. The Oral Exam.

   Practical work and practical exams collectively have a weightage of 30 marks and oral exam has a weightage of 20 marks.

2. Students are advised to use:
   a) Version control system such as Git
   b) Google Colab. Cloud-based and browser-based Python Interpreter
   c) Use of VS Code editor is recommended. Students may also use alternatives such as Python IDLE, PyCharm, etc.

Detailed Syllabus	
Expt. No.	**Suggested List of Assignments**
1	Demonstration of Python programming and Python Interpreter, Installation and configuration of Essentials Python Libraries and Tools
2	Demonstration of Python Data Structures: List, Tuple, Set, Dictionary, Assignments based on Python Programming and Statistical Concepts
3	Data Analysis with Python NumPy and Pandas Libraries – Creation, Manipulation, Analysis, Export and Import
4	Assignments based on Python Data Analysis Visualization Libraries: Matplotlib, Seaborn, Scikit-learn
5	Assignment based on Logistic and Linear Regression model using Scikit-learn Library
6	Assignment based on data exploration techniques, handling missing values, encoding categorical variables and data visualizations
7	Assignments based on Feature Engineering and Exploratory Data Analysis (EDA)
8	Assignments based on Supervised Machine Learning Algorithms: Regression, Classification, Decision Trees and Time Series Analysis
9	Assignments based on Unsupervised Machine Learning Algorithms - Clustering and Principal Component Analysis (PCA) algorithms
10	Assignments based on Real-life Data Analysis Case studies using a variety of business datasets.

References:

1. Introduction to Machine Learning with Python - A Guide for Data Scientists, Andreas C. Müller, Sarah Guido, O'Reilly Media (2016)
2. Python for Data Analytics with Pandas, Numpy, and MatPlotLib, Fabio Nelli, Apress Publication
3. Python for Data Analysis, Wes McKinney, O'Reilly Publication
4. Business Statistics, Naval Bajpai, Pearson Publication

Program:	MCA						Semester : III
Course:	Network Security Lab						Code : MCA33PE22
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial / Activity	TW	OR	PR	Total
2	-	4	-	-	20	30	50

Prior knowledge of :

1. Fundamentals of Computer Network
2. Basics of Programming Languages
3. Cybersecurity Awareness

is essential.

Course Objectives

This course aims at enabling students:

1. To develop hands-on skills in implementing network security mechanisms.
2. To familiarize students with security tools for encryption and network monitoring.
3. To facilitate hands-on experience secure communication and intrusion detection.

Course Outcomes

After learning the course, the students should be able to:

1. Analyse network security components such as firewalls and VPNs.
2. Apply cryptographic techniques for data protection.
3. Analyse security threats using intrusion detection systems.
4. Apply cybersecurity principles to protect networks from attacks.

Guidelines:

1. Students will be assessed based on
    a. The practical work done by them throughout the semester,
    b. The Practical Exam, and the Oral Exam. Practical work and practical exam collectively have a weightage of 30 marks and oral exam has a weightage of 20 marks.
2. Students are advised to:
    a. Use open-source security tools such as Wireshark, Snort, OpenSSL, Metasploit, Nmap, and Kali Linux.

Detailed Syllabus

Expt. No.	Suggested List of Assignments
1	Implement Basic Network Commands: Use commands like ping, tracert, netstat, ipconfig, and nslookup to analyze network connectivity and configurations.
2	Packet Capturing using Wireshark: Capture and analyze network traffic to observe protocols like HTTP, TCP, and DNS.

3	Scanning Networks with Nmap: Perform network scanning and enumeration using Nmap to identify active hosts and open ports.
4	Implement Symmetric Encryption: Write a Python program to encrypt and decrypt a message using AES/DES encryption.
5	Implement Asymmetric Encryption: Demonstrate RSA encryption and decryption using OpenSSL or Python.
6	Hashing Techniques: Generate and verify hashes using SHA-256 and MD5 for file integrity checks.
7	Configuring a Firewall: Set up and configure a basic firewall using Windows Defender or Linux iptables to allow/block specific traffic.
8	Setting Up a Virtual Private Network (VPN): Demonstrate a simple VPN setup using OpenVPN or WireGuard.
9	Implement Secure File Transfer: Use SFTP (Secure File Transfer Protocol) to transfer files securely.
10	Detect Phishing Websites: Use online tools like PhishTank to identify phishing websites and analyze their structure
11	Configure Secure Email Communication: Implement PGP/GPG encryption for sending and receiving encrypted emails.
12	Simulate a Man-in-the-Middle (MITM) Attack: Use tools like Ettercap to understand how MITM attacks work in a controlled environment.
13	Set Up an Intrusion Detection System (IDS): Install and configure Snort or Suricata for detecting suspicious network activity.
14	Analyze Log Files for Security Breaches: Inspect system logs (/var/log/syslog in Linux or Event View er in Windows) for unauthorized access attempts.
15	Perform a Basic SQL Injection Test: Use SQLMap or manual techniques to test for SQL injection vulnerabilities on a sample web form.

References:

1. Michael E. Whitman & Herbert J. Mattord, "Principles of Information Security," 6th Edition, Cengage Learning.
2. Kevin Mitnick& William L. Simon, "The Art of Deception: Controlling the Human Element of Security," Wiley.
3. Chris Sanders, "Practical Packet Analysis: Using Wireshark to Solve Real-World Network Problems," No Starch Press.
4. Joshua Picolet, "Hands-On Ethical Hacking and Network Defense," Cengage Learning.
5. NiteshDhanjani, Billy Rios, Brett Hardin, "Hacking: The Next Generation," O'Reilly Media.
6. NPTEL Course: Ethical Hacking by IIT Kharagpur https://onlinecourses.nptel.ac.in/noc19_cs68/preview
7. Cybrary: Network Security Fundamentals : https://www.cybrary.it/career-path/foundations
8. Cisco Packet Tracer Labs: Cisco Networking Academy https://www.netacad.com/cisco-packet-tracer
9. TryHackMe: Intro to Network Security : https://tryhackme.com/

Program:	MCA						Semester : III
Course:	Dynamic Application Development and Frameworks Lab						Code : MCA33PE23
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial / Activity	TW	OR	PR	Total
2	-	4	-	-	20	30	50

Prior knowledge of :

1. Basic Web Technologies

is essential.

Course Objectives

- This course aims at enabling students to build dynamic feature-rich applications using Node.js, Express JS and MongoD

Course Outcomes

After learning the course, the students should be able to:

1. Utilize Node.js modules and packages to enhance the functionality and modularity of applications.
2. Apply MongoDB operators, functions, commands for data retrieval, storage, management
3. Synthesize MongoDB schema design principles with application requirements to architect database schemas
4. Integrate MongoDB with other technologies such as Node.js, Express.js, and front-end frameworks to develop end-to-end solutions with seamless data flow and communication
5. Use middleware functions, template engines, routing, RESTful APIs of Express JS for building dynamic applications
6. Develop the dynamic applications with the capabilities of sending emails and SMS, data handling, socket communication, authentication and authorization

Guidelines:

1. Students will be assessed based on practical work done by them throughout the semester, practical exam, and viva
2. Practical work and practical exam collectively have a weightage of 30 marks, and viva has the weightage of 20 marks.
3. Students are advised to use: VS Code, the Latest Version of Chrome

Detailed Syllabus

Assignment No.	Suggested List of Assignments
1	Assignments based on Node.js Modules and Packages ● You are working for a digital library company that tracks user access logs and system events. To reduce dependency on external packages, the company wants to implement a lightweight logging microservice using only built-in Node.js modules. Develop a Node.js microservice that logs user activities to a file, rotates logs daily, and serves past logs through an HTTP interface.

	● A startup is building a global e-commerce platform and needs a Node.js package to handle currency conversion using real-time exchange rates. They want to keep the package lightweight and reusable across multiple apps. Create a reusable Node.js package (using third-party modules) that fetches live exchange rates and provides conversion functions.
2	Assignments based on data management using MongoDb operators, functions and commands ● SmartMart is a retail chain with thousands of customer transactions daily. They store purchase data in MongoDB and want to gain insights to improve their loyalty program. The data includes information on customers, transactions, and products. Use MongoDB aggregation operators, query operators, and functions to analyze customer behavior and generate insights. ● A growing tech company uses MongoDB to manage employee data. They need regular updates to handle promotions, department changes, and performance reviews while maintaining data integrity and efficiency. Design and execute MongoDB operations using update, array, and query operators to simulate HR tasks.
3	Assignments based on Express JS routing, template engines, request and response ● A local community center wants to build a web application where users can view, book, and manage upcoming events such as workshops, concerts, and meetups. They require a fast and responsive backend to serve dynamic content based on user requests. Develop a web application using Express.js routing, EJS (or any template engine), and proper request/response handling to manage events. ● A freelancer needs a basic personal CRM (contact relationship manager) where they can store and access their contacts via a clean interface. They want to manage this via a browser and avoid using complex CRMs. Build a web-based contact manager using Express.js, a template engine, and RESTful routing with detailed request/response management.
4	Development of a dynamic web application that implements the functionalities such as data management, sending emails and SMS, authentication and authorization ● A private clinic wants to streamline its appointment scheduling system. Patients should be able to register and book appointments online. Doctors and patients should receive email and SMS notifications for confirmations, and only authorized users should access patient or appointment records. Build a Node.js application that enables patient registration, secure login, appointment booking, and sends notifications using email and SMS. ● A startup wants to offer a platform where users can register for public or private events. Event organizers need to verify users via email, limit access to private events, and send QR codes/tickets via email and SMS. Create a Node.js backend system to handle event registration, secure access, and ticket notifications via email and SMS.

References:

1. MongoDB Fundamentals, Packt
2. Practical Node.js, Apress
3. The Definitive Guide to MongoDB, Apress
4. Node.js Tutorial : https://www.tutorialsteacher.com/nodejs
5. MongoDb Tutorial : https://www.mongodbtutorial.org/

Program:	MCA						Semester : III
Course:	Startup Management Essentials Lab						Code : MCA33PE24
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial / Activity	TW	OR	PR	Total
2	-	4	-	-	20	30	50

Prior knowledge of :

1. Start Up and New Venture Development

is essential.

Course Objectives

This course aims at enabling students:

1. To inculcate entrepreneurial mind-set into the minds of young professionals
2. To identify entrepreneurial opportunities
3. To leverage skills for founding, leading & managing Startups
4. To provide students with the knowledge and skills necessary to develop comprehensive business plans and deliver effective business pitches

Course Outcomes

After learning the course, the students should be able to:

1. Apply financial management techniques for new business
2. Develop a business plan for a Startup idea
3. Analyse the impact and effectiveness of a business pitch
4. Discover the different Government initiatives for Startup

Guidelines:

1. Students will be assessed based on practical work done by them throughout the semester, practical exam, and viva
2. Practical work and practical exams collectively have a weightage of 30 marks, and viva has the weightage of 20 marks.

Detailed Syllabus

Assignment No.	Suggested List of Assignments
1	Financial Modeling Exercises: ● Develop a financial budget for a startup considering different funding sources. ● Compare two real-world startup funding models and present insights.
2	Business Plan Development: ● Draft a structured business plan including key elements like USP, market analysis, and financial planning. ● Conduct a case study analysis of a successful startup's business plan.
3	Pitch Deck Creation: ● Analyze and improve an existing pitch deck based on investor expectations.

	● Design a 10-slide investor pitch deck for a startup idea
4	Mock Business Pitch: ● Present a startup pitch to a panel of faculty or peers acting as investors. ● Record and evaluate the effectiveness of the pitch based on feedback.
5	Product Launch Activity: ● Develop a Business Model Canvas for a new product idea. ● Create a marketing plan and promotional materials for a product launch.

References:

1. Ries, E. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business, 2011.
2. Swanson, L. A. Business Plan Development Guide. Open Textbook Library, 2017.
3. Klaff, O. Pitch Anything: An Innovative Method for Presenting, Persuading, and Winning the Deal. McGraw-Hill Education, 2011.
4. Osterwalder, A., &Pigneur, Y. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. Wiley, 2010.
5. Desai, V. Dynamics of Entrepreneurship Development. Himalaya Publishing House.2022.
6. Holt, D. H. Entrepreneurship: New Venture Creation. Prentice Hall.1992
7. Taneja, S., & Gupta, S. L. Entrepreneurship Development: New Venture Creation. Tata McGraw Hill.2001
8. Charantimath, P. M. Entrepreneurship Development and Small Business Management. Pearson Education.2019
9. Startup India - https://www.startupindia.gov.in/ (Different Sources of Funding, Business Planning Process, Business Model Development)
10. Atal Innovation Mission (AIM) - https://www.aim.gov.in/ (Business Pitch, Investor Presentation, Startup Mentorship)
11. Invest India - https://www.investindia.gov.in/ (Business Plan Development, Business Model Canvas, Investment Readiness)
12. MSME Ministry - https://msme.gov.in/ (Government Support for Startups, Funding, and Business Growth)
13. SIDBI (Small Industries Development Bank of India) - https://www.sidbi.in/ (Financial Assistance, Startup Loans, Venture Capital)

"Knowledge Brings Freedom"

Program:	MCA						Semester : III
Course:	Seminar						Code : MCA33AE01
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial / Activity	TW	OR	PR	Total
2	-	4	-	50	-	-	50

Prior knowledge of :

1. Research Methodologies

is essential.

Course Objectives

This course aims at enabling students:

1. To conduct a focused study on a specific domain of study.
2. To enhance the use of various presentation tools and techniques, preparing students for effective communication

Course Outcomes

After learning the course, the students should be able to:

1. Develop advanced skills to read, grasp, and effectively present topics related to technology.
2. Enhance their communication and writing abilities, ensuring effective articulation of ideas.
3. Produce a technical report that summarizes the state-of-the-art knowledge on an identified topic, demonstrating comprehensive knowledge.

Guidelines:

The Seminar course provides students with an opportunity to engage in discussions and in-depth analysis of new technology and management concepts. It fosters intensive study related to enhancing the technical and management knowledge of students, preparing them for practical applications in the real life.

1. Each student will choose a topic based on current trends and technologies.
2. The topic selection should be done in consultation with the guide to ensure relevance and depth.
3. Students are required to conduct a thorough review of literature from various sources, including reference books, journal articles, conference papers, white papers, magazines, web resources, and more, in the chosen area of the seminar topic.
4. Each student will prepare a seminar report consisting of finding, observations, conclusion of the study and deliver a seminar presentation, utilizing audio-visual aids.
5. Students are encouraged to use technical writing tools such as plagiarism checker, grammarly etc. To follow profession ethics

Program:	MCA							Semester : III
Course:	Professional Development Training							Code : MCA33AE02
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks				
	Lecture	Practical	Tutorial / Activity	FA		TW	SA	Total
				FA-1	FA-2			
2	-	-	2	-	-	50	-	50

Prior knowledge of :

1. Basic Mathematics & English

is essential.

Course Objectives

This course aims at enabling students:

1. To enhance the logical reasoning skills of the students and improve the problem-solving abilities
2. To improve the overall professional development of students.

Course Outcomes

After learning the course, the students should be able to:

1. Apply mathematical concepts to solve diverse numerical problems encountered in engineering, spanning arithmetic, algebra, geometry, and statistics.
2. Employ deductive reasoning, interpret data, and discern patterns to navigate complex logical puzzles and analytical challenges typical of engineering aptitude tests and professional scenarios.
3. Identify grammatical nuances, enhancing their verbal and written communication prowess essential for effective engineering discourse

Course Contents:

1. Numerical Ability-I : HCF & LCM and Number System, Geometry, Ages, Allegations and Mixtures, Averages, Clocks and Calendars, Equations, Percentages, Profit and Loss, Ratios and Proportion, Series and Progressions, Time, Speed and Distance, Time and Work. (24 Hrs.)
2. Numerical Ability-II : Permutations and Combinations, Probability, Mean, Median, Mode, Standard Deviation, and Variance, Data Interpretation, Graphical Data Interpretation, Pie Charts, Tabular Data Interpretation, Simple Arithmetic Operations, Interest and Compound Interest, Linear equations, Quadratic equations, Triplets, Trigonometry (12 Hrs.)
3. Logical Reasoning : Clocks and Calendar, Direction sense, Family tree, Syllogism, Seating arrangement, Team formation, Coding and Decoding, Number Series and Letter Series, Ranking and Arrangements, Game-Based Aptitude. (12 Hrs.)
4. Verbal Ability & Reading Comprehension : Subject-Verb Agreement, Articles and Other Determiners, Prepositions, Tenses, Parts of Speech, Active and Passive Voice, Direct and Indirect Speech, Conjunctions, Sentence Selection, Contextual Vocabulary, Error Spotting and Sentence Correction, Sentence Completion, Synonyms and Antonyms, Reading Comprehension, Jumble words & sentences. (12 Hrs.)

References:

1. Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.
2. ETHNUS, Aptimithra, 2013, 1stEdition, McGraw-Hill Education Pvt.Ltd.
3. S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.
4. M. Tyra, Quicker Maths, 2018, 5th edition, 2018, BSC publishing company Pvt. Ltd.

Program:	MCA						Semester : III
Course:	Advanced Excel						Code : MCA33VS01
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial / Activity	TW	OR	PR	Total
2	-	4	-	50	-	-	50

Prior knowledge of :

1. Computer Fundamentals
2. Basics of Programming

is essential.

Course Objectives

This course aims at enabling students:

1. To equip students with foundational and advanced Excel skills for efficient data management.
2. To enable students to apply Excel functions and tools for problem-solving.

Course Outcomes

After learning the course, the students should be able to:

1. Apply fundamental and advanced Excel functions to perform data entry, formatting, validation, and analysis.
2. Develop interactive reports and dashboards using Pivot Tables, Charts, and advanced data visualization techniques for decision-making.

Guidelines:

Term work shall be based on the following topics:

- **Introduction & Excel Essentials** : Applying conditional formatting rules using formulas, Advanced data validation techniques including creating dropdown lists and dependency lists, Techniques for sorting, filtering, and managing large datasets, Evolution of Excel with AI features
- **Advanced Functions & Data Analysis** : Logical Functions – IF, AND, OR, Nested IF, Lookup & Reference Functions – VLOOKUP, HLOOKUP, XLOOKUP, INDEX-MATCH, Text Functions – CONCATENATE, TEXT, LEFT, RIGHT, MID, LEN, SUBSTITUTE, Date & Time Functions – TODAY, NOW, DATE, DATEDIF, EOMONTH, Error Handling Functions – IFERROR, ISERROR, IFNA, Advanced Conditional Formatting – Formula-based formatting, Statistical Functions.
- **Pivot Tables &Charts** : Creating & Customizing Pivot Tables, Grouping & Filtering Data in Pivot Tables, Pivot Charts & Slicers, Macros.
- **Case Studies & Project Work :** Financial Data Analysis in Excel – Case Study, Employee Performance Report, Sales Data Analysis, Inventory Tracker, Budget Planner.Using Excel's AI-powered Data Types

Detailed Syllabus

Assignment No.	Suggested List of Assignments
1	Apply conditional formatting using formulas to highlight all sales figures that exceed

	the average sales of the dataset.
2	Use a formula to highlight rows where the "Order Status" is "Pending" and the "Due Date" has passed.
3	Create a dependent dropdown list where selecting a "Category" automatically filters the available "Sub-category" options.
4	Implement data validation to ensure that dates entered fall within a specific range and numbers are within a specified limit.
5	Write a formula using IF, AND, and OR to categorize employees based on their performance score and attendance rate.
6	Create a nested IF formula to determine grade categories based on students' marks.
7	Extract the domain name from a list of email addresses using RIGHT, LEN, and SEARCH functions. Format names in "LASTNAME, Firstname" format using text functions
8	Modify an existing lookup formula to handle missing values using IFERROR and IFNA.
9	Use AVERAGEIF and COUNTIF to analyze a dataset containing employee salaries and departments.
10	Create a pivot table to analyze total sales by region and filter data for the top 3 performing regions

References:

1. Alexander, M., &Kusleika, R. (2022). Microsoft Excel 365 Bible. Wiley.
2. Bluttman, K. (2022). Excel formulas & functions for dummies (5th ed.). For Dummies.
3. Winston, W. L. (2021). Data analysis and business modeling with Excel (6th ed.). Microsoft Press.
4. Jelen, B., & Alexander, M. (2016). Pivot table data crunching (5th ed.). Que Publishing.
5. Microsoft Support – Excel Documentation: https://support.microsoft.com/excel

Program:	MCA					Semester : III
Course:	Digital Marketing					Code : MCA33VS02
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks		
	Lecture	Practical	Tutorial / Activity	TW	OR	PR	Total
2	-	4	-	50	-	-	50

Prior knowledge of :

1. Web Development

is essential.

Course Objectives

This course aims at enabling students:

1. To develop students' ability to analyze and optimize digital marketing strategies across SEO, SEM, PPC, and social media platforms to improve brand visibility, website traffic, and customer engagement.
2. To enable students to apply artificial intelligence tools and techniques in digital marketing to enhance personalization, content creation, audience targeting, and overall campaign performance.

Course Outcomes

After learning the course, the students should be able to:

1. Analyze an underperforming website's SEO configuration and propose effective optimization strategies to enhance organic traffic and search engine rankings.
2. Apply social media marketing frameworks to design and develop complete campaigns aimed at increasing brand awareness and customer engagement for local businesses.
3. Apply search engine marketing (SEM) techniques to create and implement a paid search campaign strategy that drives targeted traffic and boosts sales for e-commerce platforms.
4. Design and analyze PPC campaigns using Google Ads to maximize user acquisition and optimize budget efficiency for online platforms.
5. Analyze the role of artificial intelligence in digital marketing and propose AI-driven strategies to improve personalization, customer engagement, content creation, and ad targeting.

Guidelines:

Term work shall be based on following topics:

- Search Engine Optimization
- Search Engine Marketing (SEM)
- Pay Per Click (PPC)
- Social Media Marketing (SMM)
- Content Marketing and Blogging
- AI in Digital Marketing (Chatbots, AI tools)

Detailed Syllabus

Assignment No.	Suggested List of Assignments
1	Analyze an underperforming travel blog's SEO setup and propose a complete SEO improvement plan to enhance organic traffic and rankings.

2	Apply social media marketing strategies to design a complete campaign to increase brand awareness and customer engagement for a local cafe.
3	Apply SEM concepts to design a paid search campaign strategy to drive website traffic and increase online sales for an e-commerce fashion brand.
4	Design and analyze a PPC campaign to increase sign-ups for an online learning platform using Google Ads.
5	Analyze how artificial intelligence (AI) can be applied to improve digital marketing strategies such as personalization, customer engagement, ad targeting, and content creation.

References:

1. The Complete Digital Marketing Course - 12 Courses in 1 : https://www.udemy.com/course/learn-digital-marketing-course/?couponCode=ST7MT290425G3

2. Digital Marketing Certification Course: Get Certified in Digital Marketing : https://academy.hubspot.com/courses/digital-marketing

3. Digital Marketing Masterclass: AI & Social Media Marketing : https://www.udemy.com/course/digital-marketing-masterclass/?couponCode=ST7MT290425G3

PCCOE "Knowledge Brings Freedom"

Program:	MCA					Semester : III
Course:	Mini Project					Code : MCA33EL03
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks		
	Lecture	Practical	Tutorial / Activity	TW	OR	PR	Total
2	-	4	-	50	-	-	50

Prior knowledge of :

1. Software Engineering
2. SQL
3. Networking
4. Programming

is essential.

Course Objectives

This course aims at enabling students:

1. To understand the domain of study
2. To develop practical ability to solve problems

Course Outcomes

After learning the course, the students should be able to:

1. Implement the SDLC components.
2. Design the database/Dataset as required for the problem statement.
3. Present project, verbal and written format.

Guidelines:

This course focuses on practical activities that enhance problem-solving skills in computing. The Mini Project provides students with an opportunity to demonstrate their domain knowledge and technical abilities.

1. Students have the flexibility to choose software development as their project type. The Mini Project title should be approved by the respective guide. It should be fulfil all the SDLC components.
2. The Project Synopsis should contain an Introduction to Project, Objectives, and Problem statement, which should clearly explain the project scope in detail. Any other point may be included if required as per the project type/category/nature/scope.
3. The evaluation of the Mini Project will be based on minimum 2 (two) reviews and will carry a total of 50 marks.
4. Mini Project work can be carried out individually or in groups. In the case of group projects, each student must be given responsibility for a distinct module and care should be taken to ensure that the progress of individual modules is independent of others.
5. At the end of the semester, students must submit the mini project report as per the requirements of a template.

Syllabus of Courses
Semester II
Second Year MCA

Program:	MCA						Semester : IV	
Course:	Emerging Trends in IT						Code : MCA34EM02	
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks				
	Lecture	Practical	Tutorial / Activity	FA		TW	SA	Total
				FA-1	FA-2			
2	-	-	2	-	-	50	-	50

Prior knowledge of :

1. Basic Computing Knowledge
2. Fundamentals of AI
3. Networking concepts.

is essential.

Course Objectives

This course aims at enabling students:

1. To explore new and disruptive technologies in IT beyond traditional domains.
2. To understand the impact of modern computing paradigms on various industries.
3. To equip students with knowledge of future trends and their applications in IT.

Course Outcomes

After learning the course, the students should be able to:

1. Summarize emerging trends in IT, including Quantum Computing, Extended Reality, and Generative AI.
2. Develop fundamental concepts of Generative AI and Prompt Engineering in real-world applications.
3. Interpret the impact of modern computing paradigms on various industries.

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Quantum Computing and AI Synergies** Introduction to Quantum Computing, Role of Quantum AI, Quantum Algorithms: How AI algorithms can be re-imagined using quantum principles, Quantum Cryptography & Security Challenges: Use of AI in quantum error correction and improving quantum cryptography mechanisms	7
2	**AI in Extended Reality and Metaverse** Fundamentals of Augmented Reality (AR) & Virtual Reality (VR) Mixed Reality (MR) & Digital Twins: AI in object detection, gesture tracking, and environment adaptation in AR/VR systems, Use of AI for digital twin modeling, Metaverse: Concept, Infrastructure, and Applications, AI-driven avatars and agents, Challenges & Future of Extended Reality, Ethics in AI-powered Extended Reality	7

3	**Generative AI and Its Applications** Introduction to Generative AI & Key Models, AI in Content Creation & Automation (Text, Image, Video, and Code Generation), Bias, Ethics & Copyright Issues in AI-Generated Content, Future Trends: AI-Augmented Creativity & Human-AI Collaboration	8
4	**AI-Driven Prompt Engineering for Intelligent Systems** Introduction to Prompt Engineering, AI-powered tools for automating prompt refinement and optimization,Role of prompt engineering in AI, How prompt design influences Generative AI output quality and ethical use of AI models,AI-human interaction using natural language prompts in real-time applications.	8
	Total	**30**

Text Books:

1. Nielsen, M. A. & Chuang, I. L. Quantum Computation and Quantum Information. Cambridge University Press, 2010.
2. Jerald, J. The VR Book: Human-Centered Design for Virtual Reality. Association for Computing Machinery, 2015.
3. Goodfellow, I., Bengio, Y., &Courville, A. Deep Learning. MIT Press, 2016.
4. Brown, T. & Mann, B. Generative AI: Concepts, Applications, and Future Trends. O'Reilly Media, 2023.
5. Reynolds, J. The Art of Prompt Engineering: Creating Effective AI Prompts. Independently Published, 2023.

Reference Books:

1. Goje, A. C., Gornale, S. S., & Mali, R. S. (2014). Emerging Trends in Information Technology. Tech-Max Publications.
2. Bansal, S. K., Chauhan, T., & Joshi, S. (2023). An In-depth Exploration of Emerging Trends in Information Technology. CRC Press.
3. Wecel, K., Slowiński, A., &Kryszkiewicz, M. (2016). Emerging Trends in Information Systems. Springer.
4. Schmidhuber, J. (2020). Artificial Intelligence: Foundations of Generative AI and Emerging Technologies. MIT Press.

E-Resources:

1. University of San Diego – https://onlinedegrees.sandiego.edu/information-technology-trends/
2. Simplilearn – https://www.simplilearn.com/top-technology-trends-and-jobs-article
3. ISACA – https://www.isaca.org/resources/emerging-technology-resources
4. OER Information Systems – https://open.ocolearnok.org/informationsystems/chapter/chapter-11-emerging-trends-in-information-systems/
5. Springer – https://link.springer.com/book/10.1007/978-3-319-23929-3

Program:	MCA							Semester : IV
Course:	Open Elective - MOOC							Code : MCA34OE01
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks				
	Lecture	Practical	Tutorial / Activity	FA		TW	SA	Total
				FA-1	FA-2			
2	-	-	2	-	-	50	-	50

Prior knowledge of :

1. Computer Fundamental

is essential.

Course Objectives

This course aims at enabling students:

1. To encourage students to engage in self-learning.
2. To offer students opportunities to explore new areas of interest.
3. To offer diverse knowledge and skills within a single platform.

Course Outcomes

After learning the course, the students should be able to:

1. To apply domain experiences in solving real life problems.
2. To analyze the new state- of- art for life-long learning.
3. To gain knowledge in various technical domains.

Guidelines:

MOOC stands for Massive Open Online Course. Students can typically access course materials at their own pace. Many MOOCs include interactive elements such as quizzes, assignments, and discussion forums to facilitate engagement and learning. MOOCs are often provided by universities, colleges, or online learning platforms like NPTEL, Coursera, edX etc.

1. Students should consult with MOOC course guides for selecting their MOOC course.
2. Students should pay attention to the course duration. They need to ensure that the course they select runs for at least 8 weeks.
3. Students should register for MOOC courses where the course contains Learning material, Assignments and End Exam schemes such as NPTL'S SWAYAM, Coursera etc. Once a suitable course is identified, students can register on the MOOC platform offering the course. Some courses may have specific start dates, so students should plan accordingly.
4. Students are allowed to complete the MOOC course in either of the semester III/IV.
5. Minimum two (2) internal reviews for MOOC courses shall be conducted.
6. Students should keep records of their enrollment, such as the course name, platform, and start and end dates. This documentation will be essential for verification.
7. After completing the MOOC course, students should focus on their learning outcomes. They may be required to submit a report or evidence of course completion to the department.
8. MOOC platforms offer certificates of completion or achievement. Students should consider obtaining these certificates as proof of their learning.

Program:	MCA						Semester : IV
Course:	Internship						Code : MCA34EL04
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial / Activity	TW	OR	PR	Total
12	-	24	-	150	150	-	300

Course Objectives

1. This course aims at enabling students:
2. To encourage and provide opportunities for students to get professional/personal experience.
3. To learn and apply the technical knowledge from academic /classroom learning in real-life/industrial situations.
4. To get familiar with various tools and technologies used in industries and their applications.
5. To nurture professional and societal ethics along with team building.

Course Outcomes

After learning the course, the students should be able to:

1. Prepare requirements and design documents
2. Develop advanced technical skills relevant to the project
3. Demonstrate systems with results and interpretation

Guidelines:

The Internship work constitutes a major component in most professional programs. The internship work is not only a partial fulfillment of the MCA requirements but also provides a mechanism to prove their skills, abilities, and specialization.

1. The majority of the students are expected to work on a real-life project preferably in some Industry/ Research and Development Laboratories/Educational institutions. Approval of the problem statement is mandatory. Students can formulate a project problem with the help of her/his Guide and submit the project synopsis.
2. If the project is done in groups, each student must handle responsibility for a distinct module and care should be taken to see the progress of individual modules is independent of others.
3. The synopsis report should contain an Introduction to Project, Objectives, and Problem statement, which should clearly explain the project scope in detail. Any other point may be included if required as per the project type/category/nature/scope.
4. Students must present internship progress review time to time to the guide.
5. The internship report should be prepared in a format prescribed by the department.
6. Internal assessment of 150 marks will be done on the basis of minimum 3 reviews by the department.
7. Internship may be carried out in the department or outside with prior approval of the PAC committee.

Program:	MCA						Semester : IV	
Course:	Internet of Things						Code : MCA34PE25	
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks				
	Lecture	Practical	Tutorial / Activity	FA		TW	SA	Total
				FA-1	FA-2			
4	3	-	1	20	20	-	60	100

Prior knowledge of :
1. Logic Design

is essential.

Course Objectives

This course aims at enabling students:
1. To define the IoT architecture and design
2. To understand IoT enabling technologies
3. To explore different domain specific IoT structure

Course Outcomes

After learning the course, the students should be able to:
1. Discuss foundations of IoT logic design
2. Illustrate the IoT enabling technologies components
3. Apply IoT design to various domain
4. Analyze the application of data analytics for IoT
5. Analyze the architecture and develop programming using modern tools for the given use case
6. Compare the performances of IoT models

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Foundations of The Internet of Things (IOT)** Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M	6
2	**IoT enabling technologies** Sensors Networks : Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.	7
3	**Domain Specific IoT** Home automation, Smart Cities, Environment, Energy , Retail, Logistics, Agriculture, Industry , Health and Lifestyle, IoT and M2M- Difference between IoT and M2M, SDN & NFV for IoT , IoT Platforms Design Methodology- Introduction, IoT Design Methodology,	10

	IoT Systems - Logical Design using Python: Introduction, Installing Python, Python Data Types and Data structures, Control flow, Functions, Modules, Packages, File Handling, Operations, Classes, Python Packages of Interest for IoT. Case Study on IoT System for Weather Monitoring	
4	**Data Analytics for IoT** An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, Formal Risk Analysis Structures: OCTAVE and FAIR	7
5	**IoT Physical Devices and Endpoints** Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints – RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python	7
6	**Case studies/Industrial applications** IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipment, Industry 4.0 concepts.	8
	Total	**45**

List of Tutorial / Activities:

1. Develop a program to blink 5 LEDs back and forth.
2. Develop a program to interface a relay with Arduino board.
3. Develop a program to deploy an intrusion detection system using Ultrasonic and sound sensors
4. Develop a program to control a DC motor with Arduino board.
5. Develop a program to deploy smart street light system using LDR sensor.
6. Develop a program to classify dry and wet waste with the Moisture sensor (DHT22).
7. Develop a program to read the pH value of a various substances like milk, lime and water.
8. Develop a program to detect the gas leakage in the surrounding environment.
9. Develop a program to simulate interfacing with the keypad module to record the keystrokes

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the“Internet of Things”, 1stEdition, Pearso Education (Cisco Press Indian Reprint). (ISBN: 9789386873743)
2. Srinivasa K G, “Internet of Things”, CENGAGE Leaning India, 2017

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014. (ISBN: 978-8173719547)
2. Raj Kamal, “Internet of Things: Architecture and Design Principles”, 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

E-Resources:

1. NPTEL course on Introduction to IoT, https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/
2. Arduino Documentation, https://docs.arduino.cc/
3. Introduction to IoT Complete Master Course, https://www.udemy.com/topic/arduino/

Program:	MCA						Semester : IV	
Course:	Decision Science						Code : MCA34PE26	
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks				
	Lecture	Practical	Tutorial / Activity	FA		TW	SA	Total
				FA-1	FA-2			
4	3	-	1	20	20	-	60	100

Prior knowledge of :

1. Basic of Mathematics

is essential.

Course Objectives

This course aims at enabling students:

1. To introduce mathematical models and optimization techniques for decision-making.
2. To develop analytical skills for real-world applications in business, IT, and management.

Course Outcomes

After learning the course, the students should be able to:

1. Apply mathematical modeling techniques to optimize decision-making in business and IT-related problems.
2. Analyze various decision-making environments, including certainty, risk, and uncertainty, using quantitative methods.
3. Solve real-world optimization problems using linear programming, transportation models, and Assignments.
4. Utilize decision-making tools such as network analysis, Inventory model and queuing models to enhance business efficiency.

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Introduction to Decision Science** Overview of Decision Science, Characteristics, Scope, and Applications, Decision-Making Environments: Certainty, Risk, and Uncertainty, Decision Trees and Payoff Matrices	5
2	**Linear Programming & Optimization** Formulation of Linear Programming Problems (LPP),Graphical & Standard Simplex Method, Duality in Linear Programming	8
3	**Transportation & Assignment Problems** Transportation Problem: Formulation & Solutions (North-West Corner, Least Cost, Vogel's Approximation),MODI Method for Optimality, Assignment Problem: Hungarian Method, Variations in Assignment (Maximization, Unbalanced Problems)	8
4	**Queuing Theory & Simulation Techniques** Basics of Queuing Theory, Poisson Arrivals and Exponential Service Time	8

	Models, Queuing Models, Monte Carlo Simulation Techniques	
5	**Network Analysis & Decision Making** Project Scheduling Techniques: CPM & PERT, Time-Cost Trade-Off and Crashing, Game Theory: Two-Person Zero-Sum Games, Dominance Rule and Mixed Strategy Solutions	8
6	**Inventory & Forecasting Models** Inventory Models: EOQ, ABC Analysis, Deterministic and Probabilistic Inventory Models, Forecasting Methods: Moving Average, Exponential Smoothing, Applications in Business & IT	8
	Total	**45**

List of Tutorial / Activities:

1. Tutorial on Decision Science
2. Tutorial on Linear Programming & Optimization
3. Tutorial on Transportation & Assignment Problems
4. Tutorial on Queuing Theory & Simulation Techniques
5. Tutorial on Network Analysis & Decision Making
6. Tutorial on Inventory & Forecasting Models

Text Books:

1. Taha, H. A. (2017). Operations Research: An introduction (10th ed.). Pearson.
2. Hillier, F. S., & Lieberman, G. J. (2021). Introduction to operations research (11th ed.). McGraw-Hill.

Reference Books:

1. Winston, W. L. (2004). Operations research: Applications and algorithms (4th ed.). Cengage Learning.
2. Ravindran, A., Phillips, D. T., & Solberg, J. J. (2007). Operations research: Principles and practice (2nd ed.). Wiley.

E-Resources:

1. NPTEL Course: NPTEL : Management - NOC:Data Analysis and Decision Making - I

Program:	MCA						Semester : IV	
Course:	Advanced Network Security and Cryptography						Code : MCA34PE27	
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks				
	Lecture	Practical	Tutorial / Activity	FA		TW	SA	Total
				FA-1	FA-2			
4	3	-	1	20	20	-	60	100

Prior knowledge of :

1. Basics of Network Security
2. Cryptographic Fundamentals
3. Programming & Scripting

is essential.

Course Objectives

This course aims at enabling students:

1. To provide an in-depth understanding of advanced network security threats and defense mechanisms.
2. To introduce modern cryptographic techniques and their applications in securing network communications.
3. To explore advanced security architectures, intrusion detection, and prevention systems.
4. To analyze cyber security frameworks, risk management, and compliance standards.

Course Outcomes

After learning the course, the students should be able to:

1. Understand advanced network threats using security mechanisms.
2. Evaluate cryptographic techniques for data confidentiality and integrity.
3. Analyze and configure security solutions like IDS/IPS, firewalls, and VPNs.
4. Understand cyber risk management and compliance with security policies.
5. Apply emerging technologies like Blockchain and AI for network security enhancements

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Foundations of Advanced Network Security** Review of Network Security Fundamentals, Security Threat Landscape: APTs, Zero-Day Attacks, Advanced Persistent Threats (APT), Security Models and Policies (Bell-LaPadula, Biba, Clark-Wilson), Security Frameworks: NIST, ISO 27001, CIS Controls	7
2	**Advanced Cryptographic Techniques** Modern Symmetric & Asymmetric Cryptography (AES, ECC, RSA-4096), Quantum Cryptography and Post-Quantum Algorithms, Cryptographic Protocols: Diffie-Hellman, Zero Knowledge Proofs, Homomorphic Encryption, Digital Signatures and PKI Infrastructure	8

3	**Secure Network Protocols and Architectures** Secure Routing Protocols (BGP Security, OSPF Authentication), IPsec, TLS 1.3, and HTTPS Security, Zero-Trust Security Model & Software-Defined Perimeter, Transport Layer Security (TLS) and VPN Security	8
4	**Intrusion Detection, Prevention & Cyber Threat Intelligence** Intrusion Detection & Prevention Systems (Snort, Suricata), Threat Intelligence Frameworks (MITRE ATT&CK, STIX/TAXII), Honeypots and Deception Techniques, SIEM Solutions (Splunk, ELK Stack)	7
5	**Cybersecurity Risk Management & Compliance** Risk Assessment, Vulnerability Management, and Penetration Testing, Compliance Standards (GDPR, HIPAA, PCI-DSS), Cybersecurity Incident Response and Digital Forensics, Case Studies: Real-world Cybersecurity Breaches	7
6	**Emerging Technologies in Network Security** AI & ML in Cybersecurity: Threat Prediction & Anomaly Detection, Blockchain for Secure Transactions and Identity Management, Secure DevOps (DevSecOps) and Cloud Security Best Practices, 5G Security Challenges and Solutions	8
	Total	**45**

List of Tutorial / Activities:

1. OpenVAS Security Scanning – Perform a risk assessment using OpenVAS.
2. Case Study Analysis: APT Attacks (SolarWinds, Stuxnet).
3. AES & ECC Encryption Hands-on – Encrypt and decrypt data using AES and ECC in OpenSSL.
4. Digital Signatures & PKI – Implement digital signatures using RSA.
5. Quantum Cryptography Basics – Explore post-quantum cryptographic algorithms.
6. Honeypot Deployment – Set up a basic honeypot to capture malicious traffic.
7. SIEM Hands-on – Log analysis
8. AI-based Anomaly Detection – Train an ML model to detect network anomalies.

Text Books:

1. William Stallings, "Cryptography and Network Security: Principles and Practice," 8th Edition, Pearson.
2. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms, and Source Code in C," 2nd Edition, Wiley.
3. AtulKahate, "Cryptography and Network Security," McGraw Hill.

Reference Books:

1. Neal Koblitz, "A Course in Number Theory and Cryptography," Springer.
2. Joseph MiggaKizza, "Guide to Computer Network Security," Springer.
3. Niels Ferguson, Bruce Schneier, Tadayoshi Kohno, "Cryptography Engineering," Wiley.

E-Resources:

1. NPTEL Course: Advanced Cryptography : https://onlinecourses.nptel.ac.in/noc25_cs16/preview
2. Coursera: Cryptography I by Stanford University : https://www.coursera.org/learn/crypto
3. YouTube Channel: Cryptography Full Course | Cryptography And Network Security | Cryptography | Simplilearn : https://www.youtube.com/watch?v=C7vmouDOJYM

Program:	MCA						Semester : IV	
Course:	Entrepreneurial Marketing						Code : MCA34PE28	
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks				
	Lecture	Practical	Tutorial / Activity	FA		TW	SA	Total
				FA-1	FA-2			
4	3	-	1	20	20	-	60	100

Prior knowledge of :

1. Start Up and New venture Development

is essential.

Course Objectives

This course aims at enabling students:

1. To Develop an understanding of the entrepreneurial mind-set and its implications for marketing decision-making
2. To identify market opportunities for entrepreneurial ventures.
3. To Understand and apply various marketing tactics to effectively reach target markets and achieve business objectives.

Course Outcomes

After learning the course, the students should be able to:

1. Make use of key concepts of Entrepreneurship management
2. Apply the marketing management techniques for market opportunities
3. Develop and implement innovative marketing strategies based on Marketing Mix
4. Utilize a variety of digital marketing tactics to achieve business objectives.

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Introduction to Entrepreneurship Management:** Concept of Management, Managerial levels/Hierarchy: Top Level, Middle Level, Lower Level, Five Functions of Management: Planning, Organizing, Staffing, Directing, Controlling, Managerial Skills: Technical Skill, Human Skill, Conceptual Skill	7
2	**Marketing Management** Definition & Functions of Marketing, Core concepts of marketing:-Need, Want, Demand, Customer Value, Exchange, Customer Satisfaction, Customer Delight, Customer loyalty Segmentation, Target Marketing & Positioning, Unique value proposition development, Branding for startups	8
3	**Marketing Mix** Marketing Mix, 4P's - Product, Price, Place, Promotion, Additional 3P's- People, Process, Physical evidence.	8

	Product Life Cycle, Five steps consumer buyer decision process	
4	**Digital Marketing strategies for Entrepreneurial Ventures** Overview of digital marketing landscape, Social media marketing strategies, E-commerce platforms,Business profile on Google Linked in and Business	8
5	**Lean Startup Methodology** Lean Startup methodology,Core Principles of Lean Startup, Steps in Lean Startup Methodology,MVP (Minimum Viable Product),Example of Lean Startup Process	7
6	**Achieving Sustainable growth of Start-ups** Introduction to Sustainable Growth,Key Components of a Value Proposition,Crafting a Value Proposition, Market Research and Product-Market Fit,Strategies for scaling business operations	7
	Total	**45**

List of Tutorial / Activities:

1. Business Simulation Game
2. Elevator Pitch Competition
3. 7P's Marketing Strategy Case Study
4. Digital Presence & Social Media Plan
5. Lean Startup Experiment (For Lean Startup Methodology) Teams brainstorm a startup idea and develop an MVP (Minimum Viable Product)
6. Startup Simulation: From Idea to MVP

Text Books:

1. Barringer, B. R., & Ireland, R. D. Entrepreneurship: Successfully Launching New Ventures. Pearson, 2018.
2. Kotler, P., & Keller, K. L. Marketing Management. Pearson, 2019.
3. Kotler, P., & Armstrong, G. Principles of Marketing. Pearson, 2022.
4. Ries, E. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business, 2011.
5. Chaffey, D., & Ellis-Chadwick, F. Digital Marketing: Strategy, Implementation, and Practice. Pearson, 2022.
6. Ellis, S., & Brown, M. Startup Growth Engines: Case Studies of How Today's Most Successful Startups Unlock Extraordinary Growth. GrowthHackers, 2014.

Reference Books:

1. Desai, V. Dynamics of Entrepreneurship Development. Himalaya Publishing House, 2022.
2. Holt, D. H. Entrepreneurship: New Venture Creation. Prentice Hall, 1992.
3. Taneja, S., & Gupta, S. L. Entrepreneurship Development: New Venture Creation. Tata McGraw Hill, 2001.
4. Charantimath, P. M. Entrepreneurship Development and Small Business Management. Pearson Education, 2019.
5. Robbins, S. P. Organizational Behavior. Pearson Education, 2018.
6. Kotler, P., Keller, K., Koshy, A., &Jha, M. Marketing Management: A South Asian Perspective (15th ed.). Pearson Education, 2016.

E-Resources:

1. Startup India - https://www.startupindia.gov.in/ (Different Sources of Funding, Business Planning Process, Business Model Development)

2. Atal Innovation Mission (AIM) - https://www.aim.gov.in/ (Innovation and Entrepreneurship Support, Startup Incubation, Government Initiatives for Startups)
3. Invest India - https://www.investindia.gov.in/ (Investment Opportunities, Market Entry Strategies, Business Regulations for Startups)
4. Ministry of Micro, Small & Medium Enterprises (MSME), Government of India - https://msme.gov.in/ (MSME Policies, Financial Assistance for Startups, Sustainable Business Growth)

VISION AND MISSION OF MCA DEPARTMENT

VISION:

To be a renowned hub in Computer Application education dedicated to provide Ethical, Sustainable, and Value-Added Education, nurturing skilled professionals equipped for successful careers in the digital world.

MISSION:

- Cultivate a responsive community that addresses the evolving needs of society by providing essential learning environment and culture
- Empower students with the right Attitude, Skills, and Knowledge by providing a comprehensive curriculum in computer applications development and management
- Foster the growth of globally competent and thoughtful graduates, researchers, and entrepreneurs who excel in demanding scenarios