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

First Year Master of Computer Applications (MCA)

(Regulation 2024)

Effective from Academic Year 2024-25

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 Master of Computer Applications (MCA)

Sr. No.	Name of Course	Course Code	Page Number	Signature and Stamp of BoS Chairman
1	Software Engineering	MCA31PC01	16	
2	Data Structures	MCA31PC02	18	
3	Data Communication and Networking	MCA31PC03	19	
4	SQL Programming Lab	MCA31PC04	21	
5	Java Programming Lab	MCA31PC05	23	
6	Python Programming Lab	MCA31PC06	25	
7	Research Methodologies and IPR	MCA31EL01	26	
8	Mathematical Foundation for Computer Application-1	MCA31BS01	29	
9	Operating System Concepts	MCA32PC07	33	
10	Web Technologies Lab	MCA32PC08	34	
11	Data Warehouse and Data Mining	MCA32PE01	36	
12	Web Development using Django	MCA32PE02	38	
13	UI/UX Design	MCA32PE03	39	
14	Start-Up and New Venture Development	MCA32PE04	42	
15	Data Science	MCA32PE09	44	
16	Cloud Computing	MCA32PE10	45	
17	Blockchain Technology	MCA32PE11	47	
18	Business Opportunity Identification	MCA32PE12	49	
19	Data Warehouse and Data Mining Lab	MCA32PE05	50	
20	Web Development using Django Lab	MCA32PE06	52	
21	UI/UX Design Lab	MCA32PE07	54	
22	Start-Up and New Venture Development Lab	MCA32PE08	55	
23	Data Science Lab	MCA32PE13	57	

24	Cloud Computing Lab	MCA32PE14	58	
25	Blockchain Technology Lab	MCA32PE15	60	
26	Business Opportunity Identification Lab	MCA32PE16	61	
27	Project Management	MCA32EM01	63	
28	Mathematical Foundation for Computer Application-2	MCA32BS02	64	
29	Research Project	MCA32EL02	66	

Approved by Academic Council:

Chairman, Academic Council

Pimpri Chinchwad College of Engineering

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CURRICULUM FRAMEWORK

(Regulation 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 (Regulation 2024) (With effect from Academic Year 2024-2025)															
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**	**FA-1**	**FA-2**					
MCA31PC01	Software Engineering	2	0	0	2	2	0	0	10	10	30	0	0	0	50
MCA31PC02	Data Structures	2	0	0	2	2	0	0	10	10	30	0	0	0	50
MCA31PC03	Data Communication and Networking	2	0	0	2	2	0	0	10	10	30	0	0	0	50
MCA31PC04	SQL Programming Lab	0	2	0	2	0	4	0	0	0	0	0	30	20	50
MCA31PC05	Java Programming Lab	0	2	0	2	0	4	0	0	0	0	0	30	20	50
MCA31PC06	Python Programming Lab	0	2	0	2	0	4	0	0	0	0	0	30	20	50
MCA31EL01	Research Methodologies and IPR	3	0	1	4	3	0	1	20	20	60	0	0	0	100
MCA31BS01	Mathematical Foundation for Computer Application-1	3	0	1	4	3	0	1	20	20	60	0	0	0	100
Total		**12**	**6**	**2**	**20**	**12**	**12**	**2**	**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

First Year MCA Semester – II

First Year MCA (Regulation 2024) (With effect from Academic Year 2024-2025)																
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**	**FA-1**	**FA-2**						
MCA32PC07	Operating System Concepts	2	0	0	2	2	0	0	10	10	30	0	0		0	50
MCA32PC08	Web Technologies Lab	0	2	0	2	0	4	0	0	0	0	0	30		20	50
MCA32PE01 to MCA32PE04	Elective-1	2	0	0	2	2	0	0	10	10	30	0	0		0	50
MCA32PE09 to MCA32PE12	Elective-2	2	0	0	2	2	0	0	10	10	30	0	0		0	50
MCA32PE05 to MCA32PE08	Elective-1 Lab	0	2	0	2	0	4	0	0	0	0	0	30		20	50
MCA32PE13 to MCA32PE16	Elective-2 Lab	0	2	0	2	0	4	0	0	0	0	0	30		20	50
MCA32EM01	Project Management	2	0	0	2	2	0	0	10	10	30	0	0		0	50
MCA32BS02	Mathematical Foundation for Computer Application-2	3	0	1	4	3	0	1	20	20	60	0	0		0	100
MCA32EL02	Research Project	0	2	0	2	0	4	0	0	0	0	50	0		0	50
Total		**11**	**8**	**1**	**20**	**11**	**16**	**1**	**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

Curriculum Structure

Second Year

MCA

Second Year MCA Semester – I

Second Year MCA (Regulation 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**	**FA-1**	**FA-2**					
MCA33PC09	Advanced Database Management	2	0	0	2	2	0	0	10	10	30	0	0	0	50
MCA33PC10	Advanced Web Technologies	2	0	0	2	2	0	0	10	10	30	0	0	0	50
MCA33PC11	Advanced Web Technologies Lab	0	2	0	2	0	4	0	0	0	0	0	30	20	50
MCA33PC12	Mobile Application Development Lab	0	2	0	2	0	4	0	0	0	0	0	30	20	50
MCA33PE17 to MCA33PE20	Elective-3	2	0	0	2	2	0	0	10	10	30	0	0	0	50
MCA33PE21 to MCA33PE24	Elective-3 Lab	0	2	0	2	0	4	0	0	0	0	0	30	20	50
MCA33AE01	Seminar	0	2	0	2	0	4	0	0	0	0	50	0	0	50
MCA33AE02	Professional Development Training	0	0	2	2	0	0	2	0	0	0	50	0	0	50
MCA33VS01 to MCA33VS02	Skill Enhancement	0	2	0	2	0	4	0	0	0	0	50	0	0	50
MCA33EL03	Mini Project	0	2	0	2	0	4	0	0	0	0	50	0	0	50
Total		**6**	**12**	**2**	**20**	**6**	**24**	**2**	**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

Second Year MCA Semester – II

Second Year MCA (Regulation 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**	**FA-1**	**FA-2**					
MCA34EM02	Emerging Trends in IT	0	0	2	2	0	0	2	0	0	0	50	0	0	50
MCA34OE01	Open Elective - MOOC	0	0	2	2	0	0	2	0	0	0	50	0	0	50
MCA34EL04	Internship	0	12	0	12	0	24	0	0	0	0	150	0	150	300
MCA34PE25 to MCA34PE28	Elective-4	3	0	1	4	3	0	1	20	20	60	0	0	0	100
Total		**3**	**12**	**5**	**20**	**3**	**24**	**5**	**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

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		

Syllabus of Courses
Semester I
First Year MCA

Course Syllabus of Semester – I Courses (w.e.f. 2024-2025)

Program:	MCA						Semester : I	
Course:	Software Engineering						Code : MCA31PC01	
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. Problem-solving and Analytical Thinking
2. Understanding of Computer Science Fundamentals
3. Database Management Systems concepts

is essential.

Course Objectives

This course aims at enabling students:

1. To impart concepts of study on the processes and methods of software and agile software development methodology.
2. To learn & understand the Requirement analysis and system Design.
3. To Learn & apply the software design principles to develop software GUI and object-oriented models.
4. To understand the software quality management and testing methodology.

Course Outcomes

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

1. Know the fundamentals of the software development life cycle with current trends in the area of Software Engineering.
2. Apply object-oriented software design and development techniques.
3. Determine an appropriate and effective graphical user interface.
4. Examine the testing design techniques for preparing test cases.

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Introduction to Software Engineering** The Linear Sequential Model, Prototyping Model, RAD Model, Spiral Model,Agile Development: Agile manifesto, Agility principles, Extreme Programming, SCRUM, Crystal, Kanban, Feature Driven Development, Adaptive Software Development,Requirement Engineering: Types of Requirements –Functional and Nonfunctional, IEEE standard format Structure and contents of SRS	6

2	**System Design** Unified Modeling Language(UML):Class Diagram and Object, Deployment Diagram, Use case Diagram, Activity Diagram, Sequence diagram, State Transition Diagram,Graphical User Interface: Design patterns. Elements of good design, User Interface Design Case study on all above diagrams	10
3	**Software Quality Assurance and Testing:** Software Quality Assurance Fundamentals: Quality Assurance, QualityControl, Software Quality Assurance Challenges, Software Quality Metrics: Process Metrics &Product Metrics Software Testing Fundamentals: Introduction of testing, Testing Principles, SoftwareTesting Life cycle, Test plan,Levels of Testing, Test Types,Demo of any one Testing tools: Selenium -WebDriver and Test NG, Appium, JMeter, etc	6
4	**Current trends in Software Engineering** Global software development challenges, Agents and Mobile Software engineering, Artificial Intelligence and Machine Learning in Software Engineering, Low-Code/No-Code Development Platforms, Green software engineering practices.	8
	Total	**30**

Text Books:

1. Pressman, R. Software Engineering. McGraw-Hill, 2010.
2. Jacobson, I. Object-Oriented Software Engineering: A Use Case Driven Approach. Addison-Wesley, 1992.
3. Limaye, M.G. Software Testing Principles, Techniques and Tools. Tata McGraw-Hill, 2009

Reference Books

1. Jacobson, I. Object-Oriented Software Engineering: A Use Case Driven Approach. Addison-Wesley, 1992.
2. Bahrami, A. Object Oriented System Development. McGraw-Hill International Edition, 1999.
3. Rumbaugh, J., & Blaha, M. Object-Oriented Modeling and Design with UML. Pearson, 2004.
4. Larman, C. Agile and Iterative Development: A Manager's Guide. Addison-Wesley, 2003.
5. Beizer, B. Software Testing Techniques. DreamTech Press, 2nd Edition, 2003.
6. Patton, R. Software Testing. Sams Publishing, 2nd Edition, 2005.

E-Resources:

1. Agile: https://www.sealights.io/software-development-metrics/the-agile-process-scrum-kanban-and-xp/
2. UML Diagrams: Tutorials and Examples
3. https://www.geeksforgeeks.org/software-engineering-software-quality-assurance/
4. https://www.tutorialspoint.com/software_engineering/software_engineering_tutorial.pdf

Program:	MCA							Semester : I
Course:	Data Structures							Code : MCA31PC02
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. Basics of Computer

is essential.

Course Objectives

This course aims at enabling students:

1. To provide the knowledge of basic data structures and their implementations.
2. To understand importance of data structures in context of writing efficient programs.
3. To develop skills to apply appropriate data structures in problem solving

Course Outcomes

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

1. Comprehend fundamental data structures such as arrays, linked lists, stacks, queues, trees, and graphs
2. Perform basic operations on data structures, including insertion, deletion, traversal, searching, and sorting
3. Apply data structures to solve a variety of computational problems
4. Analyze the time and space complexity of algorithms involving various data structures

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Introduction to Data Structures** Concept, Need, Types, Array Revisited, Time Complexity, Space Complexity	6
2	**Searching and Sorting Techniques** Sorting Algorithms: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, etc, Searching Algorithms : Linear Search, Binary Search, Hashing, etc	8
3	**Linear Data Structures** Stack : Concept, Operations, Applications, Queue : Concept, Operations, Types, Applications, Linked List : Concept, Operations, Types, Applications	8

4	**Non-Linear Data Structures** Tree : Concept, Operations, Types, Applications, Graph : Concept, Representation, Operations, Types, Applications	8
	Total	**30**

Text Books:

1. Tremblay Jean-Paul, Sorenson Paul G., *An Introduction to Data Structures with Applications*, McGraw Hill Publication, 2007
2. Samanta D., *Classic Data Structures*, PHI Publication, 2009

Reference Books:

1. Srivastava S.K., *Data Structures through C in Depth*, BPB Publication, 2004
2. Lipschutz S., *Schaum's Outlines Data Structures with C*, Tata McGraw Hill, 2019

E-Resources:

1. Data Structures in C++ Course, https://www.scaler.com/topics/course/cpp-data-structures/

Program:	**MCA**						**Semester : I**	
Course:	**Data Communication and Networking**						**Code : MCA31PC03**	
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. Computer fundamentals and programming.
2. Operating systems and software applications

is essential.

Course Objectives

This course aims at enabling students:

1. To understand the basic concepts and evolution of data communication and networking.
2. To identify various networking devices and technologies.
3. To analyze error detection and correction methods.
4. To describe network topologies and network communication devices.

Course Outcomes

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

1. Analyse the functioning of data communication and computer network.
2. Evaluate the relevant transmission media and switching techniques.

3. Apply error detection and correction methods to ensure reliable data communication
4. Evaluate the network topologies and network communication devices

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Fundamentals of Data Communication and Networking** Process of data communication and its components: Transmitter, Receiver, Medium, Message, Protocol. Protocols, Standards, Standard organizations, Bandwidth, Data Transmission Rate, Baud Rate and Bits per second. Modes of Communication (Simplex, Half duplex, Full Duplex). Analog Signal and Digital Signal, Analog and Digital Transmission: Analog To Digital , Digital To Analog Conversion Network Architecture: Peer To Peer, Client Server Network	8
2	**Transmission Media and Switching** Communication Media: Guided Transmission Media: Twisted-Pair Cable, Coaxial Cable Fiber - Optic Cable Unguided Media: Radio Waves, Microwaves, Infrared, Satellite Line-of-Sight Transmission Point to Point, Broadcast Multiplexing:Frequency Division Multiplexing, Time Division Multiplexing Switching: Circuit Switched Network, Packet Switched Network	8
3	**Error Detection, Correction and Wireless Communication** Types of Errors: Single Bit Error and Burst Error, Redundancy Error Detection: Longitudinal Redundancy Check (LRC), Vertical Redundancy Check (VRC), Cyclic Redundancy Check(CRC) Forward Error Correction: Forward error Correction IEEE standards: 802.1, 802.2, 802.3, 802.4, 802.5 Wireless LANs: 802.1 1 Architecture, MAC Sublayer, Addressing Mechanism Bluetooth Architecture: Piconet, Scatternet, Mobile Generations: IG, 2G, 3G, 4G and 5G	8
4	**Network Topologies And Network Devices** Network Topologies: Introduction, Definition, Selection, Criteria, Types of Topology- i) Bus ii) Ring iii) Star iv)Mesh v)Tree vi)Hybrid Network Connecting Devices: Hub, Switch, Router, Repeater, Bridge, Gateway, Modem, Wireless infrastructure	6
	Total	**30**

Text Books:

1. F. Behrouz, Data communications and Networking, Tata McGraw Hill, New Delhi, 2006
2. T. Andrew S., Computer Networks, PHI Learning Pvt Ltd, Delhi, 2013
3. A. Godbole, Data Communication and Networks, Tata McGraw Hill, New Delhi 2006

Reference Books:

1. C. E. Douglas,Internetworking with TCP/IP Principles, Protocols and Architectures, PHI

Learning Pvt Ltd, Delhi,2013

E-Resources:

1. Data Communication & Computer Network: https://www.tutorialspoint.com/data_communication_computer_network/index.htm

Program:	**MCA**						**Semester : I**
Course:	**SQL Programming Lab**						**Code : MCA31PC04**
Credits	**Teaching Scheme (Hrs. / Week)**			**Evaluation Scheme and Marks**			
	Theory	**Practical**	**Tutorial / Activity**	**TW**	**OR**	**PR**	**Total**
2	**-**	**4**	**-**	**-**	**20**	**30**	**50**

Prior knowledge of :

1. Basics of Programming
2. Set Theory

is essential.

Course Objectives

This course aims at enabling students:

1. To develop database handling, data manipulation and data processing skills through SQL & PL/SQL, which will help students to develop data centric computer applications.

Course Outcomes

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

1. Analyze the problem of a real-life situation and draw the ER Diagram
2. Create relational database schemas using SQL.
3. Apply SQL queries to retrieve, manipulate and analyze data effectively in relational databases.
4. Implement advanced SQL techniques such as joins and subqueries
5. Create stored procedures and functions for data management tasks

Guidelines: 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 exam collectively have the weightage of 30 marks and oral exam has the weightage of 20 marks.

Students are advised to use:

open source/ freeware tool (Oracle Express Edition/ Oracle Live SQL)

Detailed Syllabus

Asgn. No.	Suggested List of Assignments
1	Case Study: Real-Life Scenario Analysis for Database Design - Identifying entities, relationships between entities, attributes, keys, cardinalities, generalization, specialization etc. Create an Entity-Relationship Diagram illustrating the entities and their relationships in the scenario using ERD Plus, ER Win etc. and create the database tables corresponding to the identified entities and relationships. Ensure that the SQL schema reflects the relationships and constraints identified in the ERD.
2	Write at least 20 SQL queries on the suitable database application using SQL DDL/ DML statements
3	Write at least 20 SQL queries to analyze the data by using Aggregate functions-MIN, MAX, AVERAGE, SUM, COUNT and Group By…Having Clause.
4	Write at least 10 SQL queries to retrieve data from multiple tables using Joins and Nested Subquery.
5	Consider Tables: 1 Borrower (Roll_no, Name, DateofIssue, NameofBook, Status) 2 Fine (Roll_no,Date,Amt) Accept roll_no & name of book from user. ● Check the number of days (from date of issue), ● If days are between 15 to 30 then the fine amount will be Rs 5 per day. ● If no. of days>30, per day fine will be Rs 50 per day & for days less than 30, Rs. 5 per day. ● After submitting the book, status will change from I to R. ● If the condition of fine is true, then details will be stored into a fine table. ● Also handle the exception by named exception handler or user defined exception handler
6	Write a Stored Procedure namely proc_Grade for the categorization of student. If marks scored by students in examination is <=1500 and marks>=990 then student will be placed in distinction category if marks scored are between 989 and900 category is first class, if marks 899 and 825 category is Higher Second Class Write a PL/SQL block to use procedure created with above requirement. ● Stud_Marks(name, total_marks) ● Result(Roll,Name, Class)
7	Write a PL/SQL function named calculate_bonus to calculate the bonus amount for employees based on their performance ratings. The function should accept the employee's salary and performance rating as input parameters. The bonus amount should be determined as follows: ● For performance rating 1, the bonus is 5% of the salary. ● For performance rating 2, the bonus is 7% of the salary. ● For performance rating 3, the bonus is 10% of the salary
8	Create a PL/SQL function named calculate_price to calculate the price of a product. The function should take the product ID and quantity as input parameters. It should retrieve the unit price of the product from the database and calculate the total price based on the quantity ordered. Additionally, apply any applicable discounts or promotions stored in the

	database. The function should return the final price of the product.

References:

1. Gruber, M..*Understanding SQL*. BPB,(1990)
2. Bayross, I.*SQL- PL/SQL*. BPB Publications.(2009)
3. Feuerstein, S. *Oracle PL/SQL Best Practices*. O'Reilly Media.(2001)
4. George Koch, Kevin Loney, *Oracle – The Complete Reference*. Oracle Press.(1997)
5. **SQL Tutorial**: https://www.w3schools.com/sql/
6. **SQL Tutorial:** https://www.tutorialspoint.com/sql/index.htm
7. **SQL Tutorial**: https://www.javatpoint.com/sql-tutorial

Program:	**MCA**						**Semester : I**
Course:	**Java Programming Lab**						**Code : MCA31PC05**
Credits	**Teaching Scheme (Hrs. / Week)**			**Evaluation Scheme and Marks**			
	Theory	**Practical**	**Tutorial / Activity**	**TW**	**OR**	**PR**	**Total**
2	**-**	**4**	**-**	**-**	**20**	**30**	**50**

Prior knowledge of :

1. Computer Fundamentals
2. Basics Concepts of Programming

is essential.

Course Objectives

This course aims at enabling students:

1. To learn why Java is useful for the design of desktop and web applications.
2. To learn how to implement object-oriented designs and identify Java language components and how they work together in applications.
3. To learn about the concepts and principles of Java programming.
4. To develop applications using object-oriented programming concepts of Java.

Course Outcomes

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

1. Describe different concepts such as Programming Constructs, Multithreading, OOPs, File Handling, Collections using Java Programming.
2. Implement different concepts of object-oriented programming.
3. Implement Annotations, Lambda Expression using Java Programming.
4. Perform different operations related to file handling, multithreading using Java Programming.
5. Use different classes and interfaces from Collection Framework.

Guidelines:

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 exam collectively have the weightage of 30 marks and oral exam has the weightage of 20 marks.

Students are advised to use:

1. Eclipse

Detailed Syllabus

Asgn. No.	Suggested List of Assignments
1	Assignments based on Control Structures.
2	Assignments based on Arrays.
3	Assignments based Strings and String Buffers.
4	Assignments based on Constructors.
5	Assignments based on Inheritance.
6	Assignments based on Polymorphism, Encapsulations and Abstraction.
7	Assignments Exception Handling.
8	Assignments based on Interface.
9	Assignments based on Packages.
10	Assignments based on Generics and Lambda Expressions.
11	Assignments based File Handling.
12	Assignments based on Multithreading 1.
13	Assignments based on Multithreading 2.
14	Assignments based on Collection Framework 1.
15	Assignments based on Collection Framework 2.

References:

1. Schildt, H. *Java: The Complete Reference*. Tata McGraw-Hill Education, (2019)
2. Balagurusamy, E. *Programming with Java: A Primer*. Tata McGraw-Hill Education, (2014)
3. Kogent Solution Inc. *Java 6 Programming Black Book*. Dreamtech Press, (2007)
4. **Java Official Documentation :** https://docs.oracle.com/javase/tutorial/
5. **Java Tutorial :** https://www.geeksforgeeks.org/java/
6. **Java Tutorial :** https://www.javatpoint.com/java-tutorial

Program:	MCA						Semester : I
Course:	Python Programming Lab						Code : MCA31PC06
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial / Activity	TW	OR	PR	Total
2	-	4	-	-	20	30	50

Prior knowledge of :

1. Computer Fundamentals
2. Basics Concepts of Programming

is essential.

Course Objectives

This course aims at enabling students:

1. To solve real-world problems by applying programming concepts.
2. To develop and use functions and modules in Python for better code organization and reusability.
3. Develop desktop and command-line applications with Python for various purposes.
4. Present and demonstrate proficiency in Python programming through projects that apply concepts learned in the course

Course Outcomes

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

1. Describe different concepts associated to Python programming.
2. Demonstrate the use of functions, modules
3. Apply the concepts of exception handling.
4. Perform different operations related to file handling using Python.
5. Implement different concepts of object oriented programming.
6. Perform CRUD Operations on MySQL database using Python.

Guidelines:

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 exam collectively have the weightage of 30 marks and oral exam has the weightage of 20 marks.

Students are advised to use:

A. Notebook
B. Python 3.X
C. MySQL WorkBench

Detailed Syllabus

Asgn. No.	Suggested List of Assignments
1	Assignments based on control structures (If Else, Elif, For, While)

2	Assignments based on input and outputs.
3	Assignments based on Data Structures in Python (List, Tuple, Set, Dictionary).
4	Assignments based on Functions in Python 1.
5	Assignments based on Functions in Python 2.
6	Assignments based on modules in Python 1.
7	Assignments based on modules in Python 2.
8	Assignments based on Exception Handling in Python 1.
9	Assignments based on Exception Handling in Python 2.
10	Assignments based on Input Output and File Handling using Python 1.
11	Assignments based on Input Output and File Handling using Python 2.
12	Assignments based on Object Oriented Programming 1.
13	Assignments based on Object Oriented Programming 2.
14	Assignments based on Database Handling 1.
15	Assignments based on Database Handling 2.

References:

1. Lutz, M. *Learning Python*. O'Reilly Media, (2013)
2. Dawson, M. *Programming with Python: A User's Book.* Cengage Learning, (2023)
3. Beazley, D. *Python Essential Reference.* Addison-Wesley Professional, (2009)
4. **Python For Beginners :** https://www.python.org/about/gettingstarted/
5. **Python Tutorial :** https://www.w3schools.com/python/default.asp
6. **Learn Python Programming:** https://www.geeksforgeeks.org/python-programming-language/

Program:	**MCA**						**Semester : I**	
Course:	**Research Methodologies and IPR**						**Code : MCA31EL01**	
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. Fundamentals of Computer
2. Basics of Business Statistics

is essential.

Course Objectives

This course aims at enabling students:

1. To develop an understanding of various research types and methodologies.
2. To identify various sources of information for literature review and data collection.
3. To learn the literature review concepts, technical reading, writing, and citations.
4. To develop an understanding of research and publication ethics.
5. To understand the concepts of intellectual property rights.
6. To learn the procedure of obtaining patents, copyrights, trademarks and industrial design

Course Outcomes

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

1. Understand the research methodology and explain the technique of defining a research problem.
2. Explain the details of sampling designs and different data collection methods.
3. Search, select, and critically analyze research articles and papers.
4. Apply the appropriate statistical methods required for research design and analysis.
5. Explain various forms of intellectual property, their relevance, rights, and business impact in the changing global business environment
6. Identify procedures to protect different forms of IPRs at national and international levels.

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Introduction to Research Methodology** Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India	6
2	**Research and Sampling Design** What is a Research Problem?, Selecting the Problem, Important Concepts Relating to Research Design, Census, and Sample Survey, Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs, Examples	6
3	**Literature Review, Technical Reading, Writing and Citations** New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Science Citation Index (SCI), Web of Science, Scopus, IEEE Xplore, and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet. Citations: Functions and Attributes, Knowledge Flow through Citation, Citing Datasets, Styles and Tools for Citations, Research Acknowledgments.	10

4	**Data Collection, Processing, and Analysis of Data:** Collection of Primary Data, Collection of Data through Questionnaires, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Processing Operations, Elements/Types of Analysis, Statistics in Research, Measures of Central Tendency, Measures of Dispersion, Measures of Asymmetry (Skewness), Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression Analysis, other Measures, and Examples	8
5	**Introduction to Intellectual Property Rights** Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Categories of Intellectual Property: Patents, Copyrights and Related Rights, Trademarks, Geographical Indications, Trade Secrets, Semiconductor Integrated Circuits and Layout Designs, Plant Varieties, Traditional Knowledge, Industrial Designs, Biodiversity Conservation, Major Amendments in IP Laws and Acts in India	8
6	**IP Ecosystem in India, and Introduction to WIPO** Department for Promotion of Industry and Internal Trade (DPIIT), National Research Development Corporation (NRDC), Technology Information Forecasting and Assessment Council (TIFAC), Patent Facilitation Centre, Indian Web Portals for Patents and Technologies, Origin of WIPO, Salient Features of WIPO, Main Activities of WIPO, India and WIPO**.**	7
	Total	**45**

List of Tutorial / Activities:

1. Finding and using primary and secondary sources for research papers and data collection.
2. Writing systematic literature reviews based on the existing research papers.
3. Recognizing statistics, facts, arguments, and opinions in the existing research literature.
4. Identifying and writing the research gaps in the existing research literature.
5. Developing a research question, choosing a research topic, and writing the aims and objectives of the research while working collaboratively with others.
6. Writing technical analysis and citing the research using various citation tools.
7. Recognizing ethical issues, understanding legal requirements, avoiding plagiarism, and improving the quality of research.
8. Research paper presentation/submission in quality national or international journals/conferences.
9. Develop an understanding of India's intellectual property rights and registration process.
10. Identify the role of WIPO (World Intellectual Property Organization) in developing IPR.
11. Identify the emerging trends in intellectual property law in India.
12. Presentation of technical ideas in posters, papers, copyrights, trademarks, patents, etc.

Text Books:

1. C.R. Kothari, Gaurav Garg, *Research Methodology: Methods and Techniques*,, New Age International, 2020
2. Prof. Rupinder Tewari Ms. Mamta Bhardwa, *Intellectual Property A Primer for Academia (https://dst.gov.in/sites/default/files/E-BOOK%20IPR.pdf)*

Reference Books:

1. Ranjit Kumar, *Research Methodology: A step-by-step guide for beginners*, Sage Publications, 2023.
2. Naval Bajpai, *Business Statistics*, Pearson Publication. 2010.
3. Deborah E. Bouchoux, *Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets*, 2012.

E-Resources:

1. NOC: Research Methodology, https://nptel.ac.in/courses/127106227
2. NOC: Research Methodology and IPR, https://onlinecourses.swayam2.ac.in/ntr24_ed08/preview
3. Official Website of Intellectual Property India, https://www.ipindia.gov.in/
4. Official Website of World Intellectual Property Organization (WIPO), https://www.wipo.int/portal/en/index.html

Program:	**MCA**						**Semester : I**	
Course:	**Mathematical Foundation for Computer Application-1**						**Code : MCA31BS01**	
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 Mathematics

is essential.

Course Objectives

This course aims at enabling students:

1. To recognize the mathematical underpinnings of probability.
2. To study decisions about likelihood of events, based on a pattern of collected data.
3. To recognize and understand probability distribution function

Course Outcomes

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

1. Use probability theory to solve permutation and combination problems.
2. Apply the Addition Rule and the Principle of Inclusion and Exclusion and Dearrangements.
3. Implement the concept of Conditional Probability and probability.
4. Analyze the discrete probability distribution and apply it appropriately.
5. Analyze the continuous and normal probability distribution and apply it appropriately

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Counting Principle:** Addition and Multiplication Principles,Permutations of n Objects, Circular Permutation, Permutation with repetitions.	7
2	**Principle of Inclusion and Exclusion:** Principle of Inclusion and Exclusion theorem and applications, Dearrangement theorem and its applications,Non negative integer value solution, Multinomial Theorem and application.	7
3	**Probability:** Trail,Events,Sample spaces, probability axioms, Independent and Dependent Events, Conditional probability and its applications,Bayes's Theorem and its applications.	6
4	**Random variables and Mathematical Expectation:** Random Variable (Discrete and continuous),Probability Distribution of a Random Variable, Probability Mass Function, Probability Density Function, Distribution Function., Mathematical Expectation of Probability Distribution, Theorems, Calculation of Mean and Variance using Mathematical Expectation, Concepts of Bivariate Random Variable, Discrete and Continuous Bivariate Random Variable	9
5	**Discrete Probability Distribution:** Binomial Distribution, Finding Mean and variance of Binomial Distribution , Poisson Distribution , Finding Mean and variance of Poisson Distribution, Numerical base on Binomial Distribution and Poisson Distribution	8
6	**Continuous Probability Distribution:** Uniform Distribution, Finding Mean and variance of uniform DistributionNormal Distribution ,Numerical base on Uniform Distribution and Normal Distribution	8
	Total	**45**

List of Tutorial / Activities

1. Activity on Counting Principle
2. Activity on Inclusion and Exclusion
3. Activity on Probability
4. Activity on Mathematical Expectation
5. Activity on Discrete Probability distribution
6. Activity on Continuous Probability Distribution

Text Books:

1. Apte, D. P. *Probability and Combinatorics*. Excel Books India.2007.
2. Gupta, S. C., & Kapoor, *V. K. Fundamentals of mathematical statistics*. Sultan Chand & Sons.2020.

Reference Books:

1. Williams, A. S. W. A. S. *Statistics for business and economics*. South-Western,A TRIZ. 2011.
2. Judge, G. G., Griffiths, W. E., Hill, R. C., Lütkepohl, H., & Lee, T. C. *The theory and practice of econometrics* . John Wiley & Sons.1991.
3. Gupta, S. P. *Statistical Methods By SP Gupta*. Sultan Chand and Sons, Delhi, India.2001.

E-Resources:

1. Statistical Concept:Statistical Methods calculators (atozmath.com)
2. Discrete Mathematics: https://www.tutorialspoint.com/discrete_mathematics/index.htm

Syllabus of Courses
Semester II
First Year MCA

Program:	MCA						Semester : II	
Course:	Operating System Concepts						Code : MCA32PC07	
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. Computer Fundamentals

is essential.

Course Objectives

This course aims at enabling students:

1. To introduce fundamental ideas and capabilities of contemporary operating systems.
2. To comprehend the idea of process and thread management.
3. To comprehend different memory management strategies.

Course Outcomes

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

1. Identify knowledge of the role of Operating Systems and their types.
2. Apply the concept of a process, thread and scheduling algorithms.
3. Use process synchronization and deadlock problems related to inconsistency and race conditions with shared variables.
4. Demonstrate various memory management techniques

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Operating System Overview:** Operating System Objectives and Functions, The Evolution of Operating Systems, Developments Leading to Modern Operating Systems, Virtual Machines, OS Design Considerations for Multiprocessor and Multicore architectures, Microsoft Windows Overview, Modern UNIX Systems, Linux, Android. Booting Process of all the above operating systems.	5
2	**Process:** Concept of a Process, Process States, Process Description, Process Control Execution of the Operating System. Threads: Processes and Threads, Concept of Multithreading, Types of Threads, Thread Management Scheduling: Types of Scheduling, Scheduling Algorithm	9

3	**Concurrency:** Mutual Exclusion and Synchronization Concurrency: Process/thread Synchronization and Mutual Exclusion Principles of Concurrency, Requirements for Mutual Exclusion, Mutual Exclusion: Hardware Support, Operating System Support ,Classical synchronization problems: Readers/Writers Problem, Producer and Consumer problem. Concurrency: Principles of Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock detection	9
4	**Memory Management:** Background ,Swapping ,Contiguous Memory Allocation ,Paging , Segmentation,Virtual Memory , Demand Paging , Page Replacement	7
	Total	**30**

Text Books:

1. William Stallings, *Operating System: Internals and Design Principles*, Prentice Hall, 2014.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, *Operating System Concepts*, John Wiley & Sons ,Inc.2012.

Reference Books:

1. Tom Adelstein and Bill Lubanovic, *Linux System Administration*, O'Reilly Media, Inc.2007.
2. Harvey M. Deitel, *Operating Systems,* Prentice Hall,2003,
3. Andrew S. Tanenbaum, *Modern Operating System*, Prentice Hall, 2007.

E-Resources:

1. To Understand Operating System Basics: https://nptel.ac.in/courses/106/105/106105214/
2. Unix:https://www.youtube.com/watch?v=1hf_0EeOYBY (NPTEL IIT Madras)

Program:	**MCA**						**Semester : II**
Course:	**Web Technologies Lab**						**Code : MCA32PC08**
	Teaching Scheme (Hrs. / Week)			**Evaluation Scheme and Marks**			
Credits	**Theory**	**Practical**	**Tutorial / Activity**	**TW**	**OR**	**PR**	**Total**
2	**-**	**4**	**-**	**-**	**20**	**30**	**50**

Prior knowledge of :

1. Computer Fundamentals
2. Object Oriented Programming

is essential.

Course Objectives

This course aims at enabling students:

1. To acquire the knowledge of HTML, CSS, Bootstrap and JavaScript.
2. To gain the skills needed for entry into web application and development careers.

Course Outcomes

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

1. Use HTML elements to create the web pages
2. Style and/or layout the web pages using CSS
3. Build responsive web pages using Bootstrap
4. Develop interactive web pages using basics of JavaScript
5. Use advanced JavaScript features to build dynamic web pages

Guidelines:

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 exam collectively have the weightage of 30 marks and oral exam has the weightage of 20 marks.

Practical work and practical exam collectively have the weightage of 30 marks and oral exam has the weightage of 20 marks**.**

Students are advised to use:

1. Version control system such as Git
2. Free Web Hosting such as Netlify, Heroku etc

Use of VS Code editor is recommended. Students may also use alternatives such as Atom, Sublime

Detailed Syllabus

Asgn. No.	Suggested List of Assignments
1	Creating Web Page Structures - 1
2	Creating Web Page Structures – 2
3	Styling the Web Pages - 1
4	Styling the Web Pages – 2
5	Styling the Web Pages – 3
6	Building Responsive Web Pages - 1
7	Building Responsive Web Pages - 2
8	Building Responsive Web Pages – 3
9	Event Handling, DOM Manipulation - 1
10	Event Handling, DOM Manipulation – 2
11	Regular Expression, Form Validation - 1

12	Regular Expression, Form Validation - 2
13	Implementing Object Oriented Concepts using JavaScript
14	Implementing Advanced JavaScript Concepts - 1
15	Implementing Advanced JavaScript Concepts - 2

References:

1. Powel T. A., *HTML and CSS – The Complete Reference*, McGraw Hill, 2018
2. Arrardi J., *Modern CSS,* Apress Publication, 2020
3. Complete Bootstrap : bootstrap.com
4. Javascript Basic to Advanced : javascript.info
5. Javascript Basic to Advanced : javascripttutorial.net

Program:	**MCA**						**Semester : II**	
Course:	**Data Warehouse and Data Mining (PEC-1)**						**Code : MCA32PE01**	
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. DBMS
2. Data Structure

is essential.

Course Objectives

This course aims at enabling students:

1. To understand fundamental concepts, techniques and design principles of data warehousing and data mining.
2. To enable students to understand, implement and evaluate various algorithms in data mining

Course Outcomes

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

1. Apply different preprocessing methods to prepare data in the desired format.
2. Create Data Warehouse schemas and apply OLAP operations for effective multidimensional data analysis.
3. Evaluate frequent patterns using Association Mining Techniques on large datasets.
4. Evaluate various Clustering and Classification Techniques on large datasets

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Data Pre-processing** Data Objects, attribute types, descriptions of data, Measuring Data Similarity and Dissimilarity on binary, numerical and mixed dataset. Data Pre-processing. Introduction to weka./Tanagra /Orange tool for data preprocessing	6
2	**Dimensional Modeling** Data Warehouse Schemas: Star Schema, Snowflake Schema and Fact Constellation Schema. OLAP and operations on Multidimensional Database: Rollup, Roll down, Dice, Slice and Pivot.	6
3	**Introduction to Data Mining and Association Rules** Concept of Data Mining, KDD, Applications of Data Mining. Define Association Rule, Apriori Algorithm and Frequent-pattern Tree Algorithm to find frequent item set and strong association rules.	8
4	**Clustering and Classification** Introductions to Clustering and Classification, Input and Output Attributes, Naïve Bayes Classification, k-Nearest-Neighbor Classifiers (Lazy Learners), Clustering: Major Clustering Algorithms-Partition Clustering: k-means clustering, Issues with the k-means algorithm, Hierarchical clustering: Agglomerative clustering and Divisive clustering. A case study on finding efficient Clusters/classification on sample data set.	10
	Total	**30**

Text Books:

1. J. Han, M. Kamber, *Data Mining: Concepts and Techniques*.Morgan Kaufmann. (2011)
2. Ponniah, P. *Data Warehousing Fundamentals*. John Wiley & Sons.(2011)
3. Gupta G.K., I*ntroduction to Data Mining with Case Studies*.PHI.(2014)
4. Parteek Bhatia. *Data Mining and Data Warehousing-Principles and Practical Techniques*.Cambridge University Press.(2019)
5. Khurana B. S. *Data warehouse and Data Mining*,Vision publication,(2021)

Reference Books:

1. Kimball, R., Ross, M. *The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling*. Wiley.(2013)
2. Richard J. Roiger: *Data Mining: A Tutorial-Based Primer*.CRC Press. (2017)

E-Resources:

1. **Data Warehousing Tutorial** : https://www.tutorialspoint.com/data_warehousing/index.htm
2. **Data Mining Tutorial:** https://www.geeksforgeeks.org/data-mining/

Program:	MCA						Semester : II	
Course:	Web Development using Django (PEC-1)						Code : MCA32PE02	
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. Basic Programming Concepts
2. Basics of Web Development
3. Logical Thinking
4. Database Operations

is essential.

Course Objectives

This course aims at enabling students:

1. Understand the concept of dynamic web pages and the Django template system.
2. Learn how to map URLs to views and handle 404 errors in Django.
3. Gain knowledge of the Model-View-Template (MVT) development pattern in Django.
4. Develop skills in defining and installing database models using Django's ORM.
5. Explore the Django admin interface and its customization capabilities.
6. Learn about form processing, validation, and saving form responses in Django.
7. Understand access control mechanisms using sessions and user authentication in Django.
8. Implement login, logout, user management, and permission handling in Django applications.
9. Gain exposure to asynchronous messaging concepts

Course Outcomes

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

1. Create dynamic web pages using Django's template system and context objects.
2. Implement database models.
3. Implement Django admin interface for efficient management of application data, including users, groups, permissions, and form processing.
4. Implement the Django session framework to manage user sessions, handle session data in views, optimize session usage for performance, and ensure secure session management practices.

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Dynamic Web Pages And Django Template System :** Dynamic Content, Mapping URLs to Views, URL configurations and Loose Coupling, 404 Errors, Dynamic URLs, Django Template System Basics, Creating Template	8

	Objects, Rendering a Template, Rendering a Template, Playing with Context Objects	
2	**Database Model With Django :** The MVT Development Pattern, Configuring Django for Database Access, Understanding Django Apps, Defining Models in Python, Installing the Model, Understanding Model Fields & Options, Creating A Django Model, Adding Model String Representations, Making Changes to a Database Schema.	7
3	**Django Admin Interface :** Activating the Admin Interface, Using the Admin Interface, Users, Groups and Permissions Customizing the Admin Interface's Look and Feel, Customizing the Admin Index Page, When and Why to Use the Admin Interface, Form Processing, Form Validation Save Form Response	8
4	**Access Control With Session And Users :** The Django Session Framework, Sessions in Views, Session Tuning, Installing Django User Authentication, Using Authentication in Views, Login and Logout, Building your Own Login/Logout Views, Adding & Deactivating Users, Asynchronous Messaging, Managing Permissions	7
	Total	**30**

Text Books:

1. George, N. *Build a Website with Django 3*. Packt Publishing, (2020)

Reference Books:

1. Greenfeld, D. R., & Greenfeld, A. R. *Two Scoops of Django 1.11: Best Practices for the Django Web Framework*. Two Scoops Press, (2017)
2. Vincent, W. S. *Django for Beginners: Build Websites with Python and Django. WelcomeToCode*, (2021)

E-Resources:

1. **Django Tutorial :** https://www.w3schools.com/django/
2. **Learn Django Framework :** https://www.geeksforgeeks.org/django-tutorial/
3. **Django Tutorial :** https://www.tutorialspoint.com/django/index.htm

Program:	**MCA**						**Semester : II**
Course:	**UI/UX Design (PEC-1)**						**Code : MCA32PE03**
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. Understanding of Basic Design Principles

is essential.

Course Objectives

This course aims at enabling students:

1. Understand the principles and importance of user-centered design.
2. Learn essential UI design principles and tools.
3. Develop proficiency in UX research methods and techniques.
4. Gain hands-on experience in prototyping, wireframing, and usability testing.
5. Explore advanced UI design concepts and emerging trends in the field.

Course Outcomes

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

1. Apply user-centered design principles to create intuitive and user-friendly interfaces.
2. Design visually appealing and functional UI elements using industry-standard tools.
3. Conduct effective user research and apply findings to inform design decisions.
4. Develop prototypes and wireframes to visualize and test interface designs.
5. Analyze and optimize user experiences through usability testing and iteration.

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Introduction to UI/UX Design** **Understanding User-Centered Design :** Introduction to User Experience (UX) and User Interface (UI) design principles, Importance of empathy in design: understanding user needs, goals, and pain points, Overview of the design thinking process. **UI Fundamentals : Basic principles of UI design:** layout, typography, color theory, and visual hierarchy, Introduction to design tools such as Adobe XD, Sketch, or Figma. **UX Research Methods:** Overview of user research techniques: surveys, interviews, usability testing, and analytics, Creating user personas and user journey maps, Conducting usability tests and analyzing results. **Prototyping and Wireframing:** Introduction to wireframing and prototyping tools, Creating low-fidelity wireframes to outline page layouts and functionality, Prototyping interactive mockups to simulate user interactions.	7
2	**Advanced UI Design** **Responsive Design and Mobile UI :** Principles of responsive web design: fluid grids, flexible images, and media queries, Designing for different	8

	screen sizes and devices, Mobile UI best practices and common design patterns. **Advanced UI Elements:** Designing complex UI components: dropdowns, sliders, tabs, etc., Animation and micro-interactions to enhance user experience, Accessibility considerations in UI design. **Visual Design Principles :** Advanced color theory and psychology in UI design, Gestalt principles and how they apply to UI design, Creating visually engaging UIs through use of whitespace, contrast, and visual balance **UI Design Trends and Future Directions :** Exploration of current UI design trends, Predicting future directions in UI design, Case studies of innovative UI designs and their impact.	
3	**UX Design Process** **Information Architecture :** Principles of organizing and structuring information, Creating sitemaps and navigation systems, Card sorting techniques for information organization **Interaction Design :** Principles of interaction design, feedback, affordances, and signifiers, Mapping user flows and designing intuitive interactions, Implementing user feedback loops for iterative design. **Usability Testing and Evaluation :** Planning and conducting usability tests, Analyzing usability metrics and identifying areas for improvement, Iterative design based on user feedback. **UX Design Documentation :** Creating design documentation: wireframes, user flows, and prototypes, Presenting design rationale and justifying design decisions, Collaborating with developers and other stakeholders.	8
4	**Special Topics in UI/UX Design** **Design Systems and Component Libraries :** Introduction to design systems and their benefits, Creating and maintaining design systems, Integrating design systems into the design workflow **Cross-Cultural Design Considerations :** Understanding cultural differences in design preferences and usability, Adapting designs for international audiences, Case studies of successful cross-cultural design implementations.	7

	Ethical Considerations in UI/UX Design : Ethics in design: privacy, accessibility, and inclusivity, Designing ethically responsible products and experiences, Avoiding dark patterns and manipulative design practices.	
	Total	**30**

Text Books:

1. Krug S., *Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability,* New Riders Publication, 2014
2. Norman D., *The Design of Everyday Things*, Basic Books Publication, 2013

Reference Books:

1. Garrett J. J., *The Elements of User Experience: User-Centered Design for the Web and Beyond,* New Riders Publication, 2010
2. Knight W., *UX for Developers*, Apress Publication, 2018

E-Resources:

1. UI/UX and Figma : https://www.freecodecamp.org/news/ui-ux-design-tutorial-from-zero-to-hero-with-wireframe-prototype-figma/
2. UI/UX Tutorial : https://intellipaat.com/blog/ui-ux-design-tutorial/

Program:	**MCA**						**Semester : I**	
Course:	**Start-Up and New Venture Development (PEC-1)**						**Code : MCA32PE04**	
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 :
No Prior knowledge is required

Course Objectives
This course aims at enabling students:

1. To develop entrepreneurship awareness
2. To inculcate an entrepreneurial mindset into the minds of young professionals
3. To identify entrepreneurial opportunities
4. To leverage skills for founding, leading & managing Startups

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

1. Develop traits and factors influencing the development of entrepreneurship as a profession
2. Develop a strategic plan for launching a Startup
3. Discover skill sets required for successful Entrepreneurship
4. Summarize the role of Government's various support organisations in promoting Entrepreneurship

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Introduction to Entrepreneurship** Why to become an entrepreneur ,Types of Entrepreneurs,Role of Entrepreneurship in Economic Development,Factors affecting Entrepreneurship,Skillsets required for Successful Entrepreneurs	7
2	**Introduction to Startup Management** Concept of Start-Up,The Rise of The Startup Economy,Start Up India Policy ,Registration and Legal Process of Startups.Types of Business Organizations -Sole Proprietorship, Partnership, Limited Liability Partnership (LLP), Private Limited Company	7
3	**Skills for Successful Entrepreneurs** Communication Skills,Creativity and Innovation,Negotiation Skills Risk management,Case Study of Successful Entrepreneurs	8
4	**Role of Government and Institutional Support** Role of Government in promoting Entrepreneurship,MSME policy in India, Start-up India, Make in India schemes,Various Government Schemes Institutional Support for Entrepreneurship	8
	Total	**30**

Text Books:

1. Desai, V. *Dynamics of Entrepreneurship Development.* Himalaya Publishing House, (2017).
2. Holt, D. H. *Entrepreneurship: New Venture Creation.* Prentice Hall, (2019).

Reference Books:

1. Taneja, S., Gupta, S.L. *Entrepreneurship Development New Venture Creation. S.* Chand & Company Ltd, (2015).
2. Charantimath, P. M. *Entrepreneurship Development and Small Business Management*. Pearson Education India*, (2016).*

E-Resources:

1. https://www.startupindia.gov.in/
2. https://www.aim.gov.in/
3. https://www.investindia.gov.in/
4. https://msme.gov.in/
5. https://www.sidbi.in/

Program:	MCA							Semester : II
Course:	Data Science (PEC-2)							Code : MCA32PE09
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. Basics of Python Programming
2. Basics of Business Statistics

is essential.

Course Objectives

This course aims at enabling students:

1. To develop relevant Python programming abilities for analysis of data.
2. To learn and demonstrate the basic statistical analysis of data.
3. To understand the features and applications of machine learning algorithms.
4. To use appropriate tools and methods to collect, process, summarize, and visualize data for analysis.

Course Outcomes

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

1. Understand the basics concepts of Data Science.
2. Apply basic statistical operations using Python programming libraries on datasets.
3. Analyse and implement data visualization techniques for data analysis.
4. Analyse and implement machine learning techniques for data analysis and visualization.

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Introduction to Data Science** Basic Concepts and Definitions, Big Data in the Enterprise, Data Science Industry Use Cases, Realizing Opportunities from Data, New Revenue Growth Opportunities and Applications, Data Analytics and Various Types	7
2	**Statistics for Data Science** Introduction to Business Statistics, Scales of Measurement, Qualitative and Quantitative data, Types of Statistics: Descriptive and Inferential, Measures of Central Tendency: Mean, Median, Mode, Percentiles, Quartiles, Measures of Variations: Range, Interquartile Range, Variance, Standard Deviation, Measures of shape- Skewness, Kurtosis, Introduction to Charts and Graphs	7

3	**Python Libraries** Introduction to Python Libraries, installing and importing, NumPy - Numerical Python Library: Arrays – Important Characteristics and Attributes, NumPy Array vs Python List, Creation of NumPy Arrays from List, Intrinsic Creation of an Arrays, Indexing, Slicing and Iterating an array, Basic Statistical Operations on Arrays, Broadcasting, Loading and Saving Arrays in Files, Pandas - Python Library, pandas Data Structures: Series,Dataframes, Defining a Series from NumPy Arrays and Other Series, Operations and Mathematical Functions on Series, Defining a dataframe: DataFrame() constructor, Assigning Values, Indexing, Membership, NaN Values, Operations Between DataFrame and Series, pandas: Reading and Writing Data using files	8
4	**Data Analysis and Visualization Using Machine Learning Algorithms** The matplotlib Python Library, The matplotlib Architecture, A Simple Interactive Chart, Working with Multiple Figures, Elements and Axes, Charts with pandas: Line Charts, Histograms, Bar Charts, Pie Charts, Scatter Plots, etc., Advanced Charts: Contour Plots, Polar Charts, Plots in 3D, Working with subplots and grids, Examples using datasets, Regression: Linear and Multiple, Classification: Logistic and Decision Tree	8
	Total	**30**

Text Books:

1. Fabio Nelli, *Python for Data Analytics with Pandas, Numpy, and MatPlotLib*, Apress Publication, 2023.

Reference Books:

1. Wes McKinney, *Python for Data Analysis*, O'Reilly Publication, 2017.
2. Naval Bajpai, *Business Statistics*, Pearson Publication. 2010.

E-Resources:

1. NOC: Python for Data Science, https://nptel.ac.in/courses/106106212
2. NOC: Introduction to Data analytics, https://nptel.ac.in/courses/110106072

Program:	**MCA**					**Semester : II**	
Course:	**Cloud Computing (PEC-2)**					**Code : MCA32PE10**	
Credits	**Teaching Scheme (Hrs. / Week)**			**Evaluation Scheme and Marks**			
	Lecture	**Practical**	**Tutorial /**	**FA**	**TW**	**SA**	**Total**

			Activity	**FA-1**	**FA-2**			
2	**2**	**-**	**-**	**10**	**10**	**-**	**30**	**50**

Prior knowledge of :

1. Computer fundamentals and programming.
2. Operating systems and software applications.

is essential.

Course Objectives

This course aims at enabling students:

1. To provide an overview of cloud computing, encompassing its core principles, technologies, challenges, and real-world applications.
2. To understand the virtualization technologies and architectural concepts.
3. To explore the interconnectedness between cloud computing and Service-Oriented Architecture (SOA).
4. To categorize and assess security concerns within the domain of cloud computing.

Course Outcomes

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

1. Analyse the different cloud service models (IAAS, PAAS, SAAS) and deployment models for specific business needs
2. Apply virtualization concepts to create and manage virtual machines, demonstrating proficiency in virtualization technologies
3. Utilize cloud APIs to build practical solutions for cloud integration and management within a Service-Oriented Architecture (SOA) framework
4. Evaluate the core issues of Cloud Computing, such as Security, Privacy, Identity Management, and Access Control

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Cloud Services and Cloud Models** Introduction to Cloud, Cloud Computing vs. Cluster Computing vs. Grid Computing Introduction to Cloud Service Models: IAAS, PAAS, SAAS Characteristics, Benefits and Applications, Comparison of SAAS, PASS and IAAS XAAS- Anything as a Service – Storage as a service, Network as a Service, Database as a Service etc. Cloud Deployment Models-Public, Private, Hybrid Cloud Platforms: Google Cloud Platform, Microsoft Azure, SalesForce, AWS.	6
2	**Understanding Abstraction and Virtualization** Basics of Virtualization & Hypervisors Concept, Types of Virtualizations: Server, Storage and Network, Advantages and Disadvantages of Virtualization Machine Image, Virtual Machine (VM) Open-Source Virtualization Technology Examples: VMware: Full Virtualization, Virtual Box	8

3	**Service Oriented Architecture and Cloud Management** Introducing Service-Oriented Architecture, Defining SOA Communications Cloud APIs (RESTful), Managing and Monitoring SOA Computing, Relating SOA and Cloud Computing	6
4	**Cloud Security** Securing the Cloud: The security boundary, Security service boundary, Security mapping Securing Data: Brokered cloud storage access, Storage location and tenancy, Encryption Establishing Identity and Presence	10
	Total	**30**

Text Books:

1. B. Sosinsky, Cloud Computing Bible, Wiley India, 2011

Reference Books:

1. B. Furht, "Handbook of Cloud Computing", Springer,2010
2. A. T. Velte, T. J. Velte, R. Elsenpeter, Cloud Computing- A Practical Approach, McGrawHill Education, 2019.
3. T. Malhar, S. Kumaraswammy, S. Latif, Cloud Security & Privacy, SPD, O'REILLY, 2009
4. V. Josyula, "Cloud computing – Automated virtualized data center", CISCO Press, 2011
5. Dr. Kumar Saurabh , Cloud Computing, Wiley–India, 2015
6. M. Miller, Cloud Computing Web –Based Applications that change the way you work and Collaborate Online, Pearson, 2008
7. J. Hurwitz, R. Bloor, M. Kaufman, Cloud Computing for Dummies, FernHalper, 2011

E-Resources:

1. Cloud Computing Tutorial
   https://www.tutorialspoint.com/cloud_computing/cloud_computing_tutorial.pdf

Program:	**MCA**						**Semester : II**	
Course:	**Blockchain Technology (PEC-2)**						**Code : MCA32PE11**	
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. Computer Network
2. Object Oriented Programming

is essential.

Course Objectives

This course aims at enabling students:

1. To give the basic overview of the Blockchain technology
2. To develop the skill and knowledge of Hyperledger

Course Outcomes

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

1. Explain the concepts related to Blockchain.
2. Understand various protocols involved in Blockchain enabled applications
3. Use Hyperledger to demonstrate the use of Blockchain
4. Discuss Blockchain use cases in various domains

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Introduction** History: Digital Money to Distributed Ledgers -Design Primitives: Protocols, Security, Consensus, Permissions, Privacy- : Block chain Architecture and Design-Basic crypto primitives: Hash, SignatureHash chain to Block chain-Basic consensus mechanisms.	7
2	**Consensus** Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Block chain consensus protocols: Permissioned Block chains-Design goals-Consensus protocols for Permissioned Block chains.	7
3	**HyperLedger** Decomposing the consensus process-Hyper ledger fabric components-Chain code Design and Implementation: Hyper ledger Fabric II:-Beyond Chain code: fabric SDK and Front End-Hyper ledger composer tool.	8
4	**Blockchain Use Cases** Blockchain in Financial Service(Payments and Secure Trading, Compliance and Mortgage, Financial Trade), Blockchain in Supply Chain, Blockchain in Government (Advantages, Use Cases, Digital Identity), Blockchain Security (Overview, Membership and Access control in Fabric,Privacy in Fabric)	8
	Total	**30**

Text Books:

1. Antonopoulos A., *Mastering Bitcoin: Unlocking Digital Cryptocurrencies*, O'Reilly Media, 2014
2. Gates M., *Block chain: Ultimate guide to understanding block chain, bit coin, crypto currencies, smart contracts and the future of Money*, Wise Fox Publishing, 2017

Reference Books:

1. Swan M., *Blockchain,* O'Reilly Media, 2014

E-Resources:

1. An IBM Redbook Course on Blockchain : https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html
2. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric

Program:	**MCA**							**Semester : II**
Course:	**Business Opportunity Identification (PEC-2)**							**Code : MCA32PE12**
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 an entrepreneurial mindset into the minds of young professionals
2. To identify entrepreneurial opportunities
3. To leverage skills for founding, leading & managing Startups
4. To understand the process of opportunity recognition and evaluation.
5. To learn the processes and practices in business and their applications

Course Outcomes

After learning the course, the students should be able to:
1. Apply market analysis frameworks to assess industry trends
2. Discover the different Business Ideas
3. Utilize techniques to identify different business opportunities
4. Analyze the Business Model Canvas to develop new business models

Detailed Syllabus

Unit No.	**Description**	**Duration (Hrs.)**
1	**Market Analysis and Trends** Understanding market dynamics,Analyzing industry trends and emerging markets,Identifying niche markets and underserved customer segments,Concept of Market Segmentation,Social responsibility and sustainability considerations	7

2	**Business Opportunity Identification** Concept of Business Opportunity,Business idea,Business Opportunities Identification Process,Business Value Chain, different sections of the business value chain for potential opportunities	7
3	**Business Opportunity Identification Techniques** Business Opportunities in India,Different Business Models,Identifying the right Business Model.Opportunities in different industries / Sectors Feasibility Analysis	8
4	**Design Thinking** Overview of Design Thinking.Key principles of Design Thinking.Applying Design Thinking in different contexts (business, social impact, education) ,Examination of successful Design Thinking case studies	8
	Total	**30**

Text Books:

1. Desai, V. *Dynamics of Entrepreneurship Development.* Himalaya Publishing House, (2017).
2. Holt, D. H. *Entrepreneurship: New Venture Creation.* Prentice Hall, (2019).

Reference Books:

1. Taneja, S., Gupta, S.L. *Entrepreneurship Development New Venture Creation*. S. Chand & Company Ltd, (2015).
2. Charantimath, P. M. *Entrepreneurship Development and Small Business Management.* Pearson Education India, (2016).

E-Resources:

1. https://www.startupindia.gov.in/
2. https://www.aim.gov.in/
3. https://www.investindia.gov.in/
4. https://msme.gov.in/
5. https://www.sidbi.in/

Program:	**MCA**						**Semester : II**
Course:	**Data Warehouse and Data Mining Lab (PEC-1 Lab)**						**Code : MCA32PE05**
	Teaching Scheme (Hrs. / Week)			**Evaluation Scheme and Marks**			
Credits	**Theory**	**Practical**	**Tutorial / Activity**	**TW**	**OR**	**PR**	**Total**
2	**-**	**4**	**-**	**-**	**20**	**30**	**50**

Prior knowledge of :

1. SQL queries and Designing ERD.
2. Data Mining Algorithms: Association Mining, Clustering and classification

is essential.

Course Objectives

This course aims at enabling students:

1. To understand fundamental concepts, techniques and design principles of data warehousing and data mining.
2. To enable students to understand, implement and evaluate various algorithms in data mining

Course Outcomes

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

1. Apply different preprocessing methods to prepare data in the desired format.
2. Create Data Warehouse schemas and apply OLAP operations for effective multidimensional data analysis.
3. Evaluate frequent patterns using Association Mining Techniques on large datasets.
4. Evaluate various Clustering and Classification Techniques on large datasets.

Guidelines: 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 exam collectively have the weightage of 30 marks and oral exam has the weightage of 20 marks.

Students are advised to use:

open source/ freeware tool (Oracle Express Edition/ Oracle Live SQL) and Weka

Detailed Syllabus

Asgn. No.	Suggested List of Assignments
1	Data Pre-processing: Assignments on Data Pre-processing using Weka. / Tanagra
2	Dimensional Modeling: Assignments on Creating Data Warehouse schema model and apply operations Multidimensional Database
3	Association Rules: Assignments and case study to evaluate the strength of Association Rules using Aprioi Algorithm
4	Classification: Assignments and case study to apply various classification algorithms on a sample dataset and analyzing the results
5	Clustering: Assignments and case study to apply various clustering algorithms on a sample dataset and analyzing the results

References:

1. J. Han, M. Kamber ,Data Mining: Concepts and Techniques.Morgan Kaufmann. (2011)
2. G.K.Gupta : Introduction to Data Mining with Case Studies.PHI.(2014)
3. Parteek Bhatia: Data Mining and Data Warehousing-Principles and Practical Techniques.Cambridge University Press.(2019)

Program:	**MCA**						**Semester : II**
Course:	**Web Development using Django Lab (PEC-1 Lab)**						**Code : MCA32PE06**
Credits	**Teaching Scheme (Hrs. / Week)**			**Evaluation Scheme and Marks**			
	Theory	**Practical**	**Tutorial / Activity**	**TW**	**OR**	**PR**	**Total**
2	**-**	**4**	**-**	**-**	**20**	**30**	**50**

Prior knowledge of :

1. Basic Programming Concepts
2. Basics of Web Development
3. Logical Thinking
4. Database Operations

is essential.

Course Objectives

This course aims at enabling students:

1. Understand the concept of dynamic web pages and the Django template system.
2. Learn how to map URLs to views and handle 404 errors in Django.
3. Gain knowledge of the Model-View-Template (MVT) development pattern in Django.
4. Develop skills in defining and installing database models using Django's ORM.
5. Explore the Django admin interface and its customization capabilities.
6. Learn about form processing, validation, and saving form responses in Django.
7. Understand access control mechanisms using sessions and user authentication in Django.
8. Implement login, logout, user management, and permission handling in Django applications.
9. Gain exposure to asynchronous messaging concepts.

Course Outcomes

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

1. Create dynamic web pages using Django's template system and context objects.
2. Implement database models.
3. Implement Django admin interface for efficient management of application data, including users, groups, permissions, and form processing.
4. Implement the Django session framework to manage user sessions, handle session data in views, optimize session usage for performance, and ensure secure session management practices.

Guidelines:

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 exam collectively have the weightage of 30 marks and oral exam has the weightage of 20 marks.

Students are advised to use:

A. PyCharm
B. Python 3.X

Detailed Syllabus

Asgn. No.	Suggested List of Assignments
1	**Assignment 1 :** Set up a Django project and app, Create a basic template with static content, Render the template with dynamic data using context objects, Implement URL mapping and handle 404 errors
2	**Assignment 2 :** Define a model with fields and options, Install and migrate the model to the database, Create model instances and perform CRUD operations, Customize model string representations
3	**Assignment 3 :** Activate the Django admin interface, Register models with the admin interface, Perform CRUD operations using the admin interface, Customize the admin interface's look and feel
4	**Assignment 4 :** Create a form model and template, Implement form validation and error handling, Process form data and save to the database
5	**Assignment 5 :** Set up user authentication in Django, Implement login and logout views, Manage users, groups, and permissions, Restrict access to views based on user roles
6	**Assignment 6 :** Set up a message queue (e.g., RabbitMQ or Redis), Implement asynchronous task processing using a task queue, Monitor and manage asynchronous tasks

References:

1. Greenfeld, D. R., & Greenfeld, A. R. *Two Scoops of Django 1.11: Best Practices for the Django Web Framework.* Two Scoops Press, (2017)
2. Vincent, W. S. *Django for Beginners: Build Websites with Python and Django. WelcomeToCode*, (2021)
3. **Django Tutorial :** https://www.w3schools.com/django/
4. **Learn Django Framework :** https://www.geeksforgeeks.org/django-tutorial/
5. **Django Tutorial :** https://www.tutorialspoint.com/django/index.htm

Program:	MCA						Semester : II
Course:	UI/UX Design Lab (PEC-1 Lab)						Code : MCA32PE07
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial / Activity	TW	OR	PR	Total
2	-	4	-	-	20	30	50

Prior knowledge of :

1. HTML
2. CSS
3. Basics of Design Principles

is essential.

Course Objectives

This course aims at enabling students:

1. Provide hands-on experience in applying UI/UX design principles and techniques to real-world design projects.
2. Foster creativity and critical thinking skills in solving design problems and challenges.
3. Develop proficiency in using industry-standard design tools and software.
4. Cultivate collaboration and communication skills through teamwork and peer feedback.
5. Prepare students for careers in UI/UX design through practical project experience and portfolio development.

Course Outcomes

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

1. Apply user-centered design principles to create intuitive and user-friendly interfaces.
2. Demonstrate proficiency in using design tools such as Adobe XD, Sketch, or Figma to create wireframes, prototypes, and mockups.
3. Conduct user research and usability testing to inform design decisions and iterate on designs based on feedback.
4. Create a professional portfolio showcasing their UI/UX design skills, process, and completed projects.

Guidelines:

Students will be assessed based on

A. the practical work done by them throughout the semester
B. the Practical Exam
C. the Oral Exam.

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

Detailed Syllabus	
Asgn. No.	**Suggested List of Assignments**

1	Introduction to UI/UX Design : Overview of UI/UX design principles and process, Introduction to design tools (e.g., Adobe XD, Sketch, Figma), Project kickoff and team formation
2	Design Project Sprint 1 : Conducting user research: interviews, surveys, and usability testing, Creating user personas and journey maps, Ideation and sketching exercises, Wireframing and prototyping
3	Design Project Sprint 2 : Refining wireframes and prototypes based on user feedback, Visual design: typography, color, and branding, Creating high-fidelity mockups and interactive prototypes, Usability testing and iteration
4	Design Project Sprint 3 : Finalizing designs and preparing for presentation, Peer feedback sessions and design critiques, Presenting final designs to class and stakeholders, Portfolio development: documenting design process and completed projects
5	Portfolio Development and Review : Building a professional portfolio website, Crafting case studies for design projects, Peer review and feedback on portfolio presentation
6	Final Project Showcase : Final presentation of portfolios and design projects, Reflection on learning outcomes and course experience

References:

1. Krug S., Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability, New Riders Publication, 2014
2. Norman D., The Design of Everyday Things, Basic Books Publication, 2013
3. Garrett J. J., The Elements of User Experience: User-Centered Design for the Web and Beyond, New Riders Publication, 2010
4. Knight W., UX for Developers, Apress Publication, 2018
5. UI/UX and Figma : https://www.freecodecamp.org/news/ui-ux-design-tutorial-from-zero-to-hero-with-wireframe-prototype-figma/
6. UI/UX Tutorial : https://intellipaat.com/blog/ui-ux-design-tutorial

Program:	**MCA**						**Semester : II**
Course:	**Start Up and New Venture Development Lab (PEC-1 Lab)**						**Code : MCA32PE08**
Credits	**Teaching Scheme (Hrs. / Week)**			**Evaluation Scheme and Marks**			
	Theory	**Practical**	**Tutorial / Activity**	**TW**	**OR**	**PR**	**Total**
2	**-**	**4**	**-**	**-**	**20**	**30**	**50**
Prior knowledge of :							

- No Prior knowledge is required

Course Objectives

This course aims at enabling students:

1. To develop entrepreneurship awareness
2. To inculcate an entrepreneurial mindset into the minds of young professionals
3. To identify entrepreneurial opportunities
4. To leverage skills for founding, leading & managing Startups

Course Outcomes

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

1. Develop traits and factors influencing the development of entrepreneurship as a profession
2. Develop a strategic plan for launching a Startup
3. Discover skill sets required for successful Entrepreneurship
4. Summarize the role of Government's various support organisations in promoting Entrepreneurship

Guidelines:

Students will be assessed based on

A. The participation in all activities by them throughout the semester,
B. The Evaluation Exam, and
C. The Oral Exam.

The participation in all activities and the Evaluation Exam collectively have the weightage of 30 marks and oral exam has the weightage of 20 marks.

Detailed Syllabus

Asgn. No.	Suggested List of Assignments
1	Case Study of Successful Entrepreneurs
2	Case Study of Failed Businesses
3	Study of First-Generation Entrepreneurs
4	Skills for Successful Entrepreneurs
5	Case Study on Start Up India

References:

1. Desai, V. *Dynamics of Entrepreneurship Development.* Himalaya Publishing House, (2017).
2. Holt, D. H. *Entrepreneurship: New Venture Creation.* Prentice Hall, (2019).
3. Taneja, S., Gupta, S.L. *Entrepreneurship Development New Venture Creation*. S. Chand & Company Ltd, (2015).
4. Charantimath, P. M. *Entrepreneurship Development and Small Business Management*. Pearson Education India, (2016).
5. https://www.startupindia.gov.in/
6. https://www.aim.gov.in/
7. https://msme.gov.in/
8. https://www.sidbi.in/

Program:	MCA						Semester : II
Course:	Data Science Lab (PEC-2 Lab)						Code : MCA32PE13
Credits	Teaching Scheme (Hrs. / Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial / Activity	TW	OR	PR	Total
2	-	4	-	-	20	30	50

Prior knowledge of :

1. Basics of Python Programming
2. Basics of Business Statistics

is essential.

Course Objectives

This course aims at enabling students:

1. To develop relevant Python programming abilities for analysis of data.
2. To learn and demonstrate the basic statistical analysis of data.
3. To understand the features and applications of machine learning algorithms.
4. To use appropriate tools and methods to collect, process, summarize, and visualize data for analysis

Course Outcomes

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

1. Understand the basic concepts of the Data Science
2. Apply basic statistical operations using Python programming libraries on datasets.
3. Analyze and implement data visualization techniques for data analysis.
4. Analyze and implement machine learning techniques for data analysis and visualization.

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. for 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

Asgn. No.	Suggested List of Assignments

1	Demonstration of Python programming and Python Interpreter
2	Assignments based on Data Importing and Exporting for Data Analysis
3	Assignment based on business statistics python library and central tendencies
4	Assignment based on probability, distribution, variance, correlation, and standard deviation
5	Demonstration of NumPy and Pandas Libraries - Assignment based on Numpy Library
6	Demonstration of NumPy and Pandas Libraries - Assignment based on Numpy Library
7	Demonstration of data visualization using MatPlotLib and Seaborn libraries - Assignment based on data visualization
8	Assignment based on data preprocessing, training and testing for analysis
9	Demonstration of Machine Learning Algorithms (Supervised & Unsupervised) - Assignment based on Machine Learning Concepts for data preprocessing
10	Demonstration of Regression and Classification Algorithms - Assignment based on Machine Learning Algorithms

References:

1. Fabio Nelli, *Python for Data Analytics with Pandas, Numpy, and MatPlotLib*, Apress Publication, 2023.
2. Wes McKinney, *Python for Data Analysis*, O'Reilly Publication, 2017.
3. Naval Bajpai, *Business Statistics*, Pearson Publication. 2010.
4. Google's online Jupyter Notebook, https://colab.research.google.com/
5. Python Tutorial: https://docs.python.org/3/tutorial/index.html

Program:	**MCA**						**Semester : II**
Course:	**Cloud Computing Lab (PEC-2 Lab)**						**Code : MCA32PE14**
Credits	**Teaching Scheme (Hrs. / Week)**			**Evaluation Scheme and Marks**			
	Theory	**Practical**	**Tutorial / Activity**	**TW**	**OR**	**PR**	**Total**
2	**-**	**4**	**-**	**-**	**20**	**30**	**50**

Prior knowledge of :

1. Computer fundamentals and programming.
2. Operating systems and software applications

is essential.

Course Objectives

This course aims at enabling students:

1. To provide an overview of cloud computing, encompassing its core principles, technologies, challenges, and real-world applications.
2. To understand the virtualization technologies and architectural concepts.
3. To explore the interconnectedness between cloud computing and Service-Oriented Architecture (SOA).
4. To categorize and assess security concerns within the domain of cloud computing

Course Outcomes

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

1. Analyse the different cloud service models (IAAS, PAAS, SAAS) and deployment models for specific business needs.
2. Apply virtualization concepts to create and manage virtual machines, demonstrating proficiency in virtualization technologies.
3. Utilize cloud APIs to build practical solutions for cloud integration and management within a Service-Oriented Architecture (SOA) framework.
4. Evaluate the core issues of Cloud Computing, such as Security, Privacy, Identity Management, and Access Control.

Guidelines:

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 exam collectively have the weightage of 30 marks and oral exam has the weightage of 20 marks.

Detailed Syllabus

Asgn. No.	Suggested List of Assignments
1	**Cloud Services and Cloud Models** Cloud Platform Exploration Create accounts on: Google Cloud, Microsoft Azure, Salesforce, AWS.
2	**XaaS Implementation:** Develop a prototype of a specific "as-a-Service" (XaaS) model, such as Storage as a Service or Database as a Service.
3	**Setting Up a Virtualization Environment:** Install a hypervisor (e.g., VirtualBox) and create virtual machines.
4	Explore the management and configuration of VMs
5	Design a simple SOA-based application.
6	Develop and deploy web services using RESTful APIs
7	Configure virtual networks in a cloud environment.

8	Implement firewall rules and network security settings
9	Monitor resource usage on a cloud platform.
10	Moving Applications to the Cloud.

References:

1. B. Sosinsky, Cloud Computing Bible, Wiley India, 2011
2. B. Furht, "Handbook of Cloud Computing", Springer, 2010
3. A. T. Velte, T. J. Velte, R. Elsenpeter, Cloud Computing- A Practical Approach, McGrawHill Education. 2019
4. T. Malhar, S. Kumaraswammy, S. Latif, Cloud Security & Privacy, SPD, O'REILLY, 2009
5. V. Josyula, "Cloud computing – Automated virtualized data center", CISCO Press, 2011
6. Dr. Kumar Saurabh , Cloud Computing, Wiley–India, 2015
7. M. Miller, Cloud Computing Web –Based Applications that change the way you work and Collaborate Online, Pearson, 2008
8. J. Hurwitz, R. Bloor, M. Kaufman, Cloud Computing for Dummies, FernHalper, 2011
9. Cloud Computing Tutorial https://www.tutorialspoint.com/cloud_computing/cloud_computing_tutorial.pdf

Program:	**MCA**						**Semester : II**
Course:	**Blockchain Technology Lab (PEC-2 Lab)**						**Code : MCA32PE15**
Credits	**Teaching Scheme (Hrs. / Week)**			**Evaluation Scheme and Marks**			
	Theory	**Practical**	**Tutorial / Activity**	**TW**	**OR**	**PR**	**Total**
2	**-**	**4**	**-**	**-**	**20**	**30**	**50**

Prior knowledge of :

1. Computer Networks
2. Object Oriented Programming

is essential.

Course Objectives

This course aims at enabling students:

1. To make the students aware about HyperLedger, Smart Contracts, Etherium
2. To expose the students to various applications of Blockchain

Course Outcomes

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

1. Implement basics of Blockchain
2. Simulate the use of Blockchain in different domains
3. Compile and deploy smart contracts

4. Setup the network using HyperLedger
5. DevelopDecentralized Finance (DeFi) Smart Contract

Guidelines:
Students will be assessed based on
A. The practical work done by them throughout the semester
B. The Practical Exam
C. The Oral Exam.
Practical work and practical exam collectively have the weightage of 30 marks and oral exam has the weightage of 20 marks.

Detailed Syllabus

Asgn. No.	Suggested List of Assignments
1	Exercises based on Blockchain Basics
2	Exercises based on Smart Contract
3	Exercises based on Ethereum
4	Exercises based on HyperLedger
5	Exercises based on Decentralized Finance (DeFi) Smart Contract

References:

1. Antonopoulos A., Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O'Reilly Media, 2014
2. Gates M., Block chain: Ultimate guide to understanding block chain, bit coin, crypto currencies, smart contracts and the future of Money, Wise Fox Publishing, 2017
3. Swan M., Blockchain, O'Reilly Media, 2014
4. An IBM Redbook Course on Blockchain : https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html
5. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric

Program:	**MCA**						**Semester : II**
Course:	**Business Opportunity Identification Lab (PEC-2 Lab)**						**Code : MCA32PE16**
Credits	**Teaching Scheme (Hrs. / Week)**			**Evaluation Scheme and Marks**			
	Theory	**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 an entrepreneurial mindset into the minds of young professionals
2. To identify entrepreneurial opportunities
3. To leverage skills for founding, leading & managing Startups
4. To understand the process of opportunity recognition and evaluation.
5. To learn the processes and practices in business and their applications

Course Outcomes

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

1. Apply market analysis frameworks to assess industry trends
2. Discover the different Business Ideas
3. Utilize techniques to identify different business opportunities
4. Analyze the Business Model Canvas to develop new business models

Guidelines:

Students will be assessed based on

A. The participation in all activities by them throughout the semester,
B. The Evaluation Exam, and
C. The Oral Exam.

The participation in all activities and the Evaluation Exam collectively have the weightage of 30 marks and oral exam has the weightage of 20 marks.

Detailed Syllabus

Asgn. No.	Suggested List of Assignments
1	Activity based on Market Analysis and Market Segmentation
2	Exercises based on Business Opportunity Identification
3	Exercises based on Identifying the Right Business Model
4	Exercises based on Business Model Canvas Framework
5	Exercises based on Design Thinking

References:

1. Desai, V. Dynamics of Entrepreneurship Development. Himalaya Publishing House, 2017.
2. Holt, D. H. Entrepreneurship: New Venture Creation. Prentice Hall, 2019.
3. Taneja, S., Gupta, S.L. Entrepreneurship Development New Venture Creation. S. Chand & Company Ltd, 2015.
4. Charantimath, P. M. Entrepreneurship Development and Small Business Management. Pearson Education India, 2016.
5. https://www.startupindia.gov.in/
6. https://www.aim.gov.in/
7. https://msme.gov.in/
8. https://www.sidbi.in/

Program:	MCA						Semester : II	
Course:	Project Management						Code : MCA32EM01	
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. Problem-solving and Analytical Thinking
2. Mathematics
3. Understanding of Basic Management Concepts
4. Concepts of Software Engineering and Software Testing

is essential.

Course Objectives

This course aims at enabling students:

1. To understand the fundamentals of Software Project Management
2. To investigate software project planning and agile project management
3. To learn Risk Management and Problem-Solving
4. To Enhance Leadership and Team Management Skills

Course Outcomes

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

1. Comprehend Project Management Concepts & Agile Project Management
2. Choose various techniques of Software Project Estimations
3. Gain knowledge of configuration management
4. Analyze staffing process for team

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Introduction to Software Project Management** Overview of project Management,Project management life cycle,Agile Project Management, Risk Management Risk Management Process	6
2	**Project Planning & cost Estimation** Project planning,Gantt Chart, CPM,PERT Chart,Different methods of Cost estimation,COCOMO model,Function Point Analysis,Delphi cost estimation ,Software Project Metrics	10
3	**Configuration Management**	6

	Configuration management & Maintenance plan , Change Management, Version and Release Management Configuration Management Tools Configuration Management in Agile	
4	**Staffing in Software Projects** Organizational structures Team Structure & Staff development plan , Characteristics of Performance management ,High performance Directive and collaborative styles , Team Communication ,Group Behaviors , Managing customer expectations ,Agile Team Management, Emerging Trends in Staffing	8
	Total	**30**

Text Books:

1. Hughes, B., Cotterell, M., & Mall, R. Software Project Management (6th ed.). Tata McGraw Hill, 2017.
2. Wysocki, R. K. Effective Software Project Management. Wiley, 2011.

Reference Books:

1. Pressman, R. S. Software Engineering: A Practitioner's Approach. McGraw Hill, 2014.
2. Schwaber, K. Agile Project Management with Scrum. Microsoft Press, 2004.
3. Royce, W. Software Project Management: A Unified Framework. Addison-Wesley, 1998.
4. Jalote, P. Software Project Management in Practice. Addison-Wesley Professional, 2002.
5. Project Management Institute. A Guide to the Project Management Body of Knowledge (PMBOK Guide). Project Management Institute, 2017.

E-Resources:

1. https://www.computer.org/education/bodies-of-knowledge/software-engineering
2. https://www.pmi.org/pmbok-guide-standards/foundational/pmbok
3. https://www.mindtools.com/ct91phy/project-management
4. https://www.atlassian.com/agile/project-management

Program:	**MCA**						**Semester : II**	
Course:	**Mathematical Foundation for Computer Application-2**						**Code : MCA32BS02**	
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 Mathematics
2. Probability

is essential.

Course Objectives

This course aims at enabling students:

1. To learn the basics of business decision-analysis.
2. To summarize business data numerically and graphically.
3. To understand the importance of business sampling methods, and be able to describe different business sampling methods.
4. To understand the process associated with statistical decisions, defining and formulating problems, analyzing the data, and using the results in decision making.

Course Outcomes

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

1. Apply the concepts of statistics, data representation and Measures of Central Tendency.
2. Determine Sampling and Sampling Distribution
3. Implement various hypothesis testing techniques.
4. Illustrate correlation between the attributes
5. Articulate concepts of time series moving average.

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Introduction to statistics :** Importance of statistics in modern business environment ,Definition of statistics, importance, scope and applications ,Characteristics of statistics, Functions of Statistics, Limitations ,Need of Data, Types of Data Principles of Measurement, Source of Data ,Data classification, Tabulation And presentation	7
2	**Measures Of Central Tendency :** Introduction, Objectives of Statistical average Requisites of a Good Average ,Statistical Averages- Arithmetic Mean ,Properties Of A M, Mean of combined group, Median, Mode, Geometric mean and Harmonic Mean.	7
3	**Sampling, Sampling Distributions And Testing :** Introduction ,Population And Sample-Universe of Population ,Types Of Population- Sample, Advantages of Sampling ,Sampling Theory- Types Of Sampling.	6
4	**Testing Of Hypothesis:** Introduction Testing Hypothesis ,Classification Of Test statistics Testing of Hypothesis ,Z-Test, 't' test ,chi square proportion test	9
5	**Simple Correlation And Regression :** Introduction Correlation-Types of Correlation-measures of correlation-Properties Of Karl Pearson's correlation coefficient Spearman's Rank Correlation coefficient Regression- Regression analysis	8
6	**Time Series Analysis :**	8

	Introduction Utility of the time series ,Components of Time Series Methods of measuring trend ,Method of least squares ,Mathematical Models of Time series ,Forecasting methods using time series	
	Total	**45**

List of Tutorial / Activities

1. Activity on Importance of statistics
2. Activity on Measures Of Central Tendency
3. Activity on Sample Distribution
4. Activity on Testing Hypothesis
5. Activity on Simple Correlation and Regression
6. Activity on Time Series Analysis

Text Books:

1. Gupta, S. C., & Kapoor, V. K.. *Fundamentals of mathematical statistics*. Sultan Chand & Sons.2020.
2. Williams, A. S. W. A. S. Statistics for business and economics. *A TRIZ*.2011.

Reference Books:

1. Gupta, S. P. . Statistical Methods By SP Gupta. *Sultan Chand and Sons, Delhi, India*.2001.
2. Gupta, N. *Business Statistics*, Naval Bajpai, Pearson Education. 2009.
3. Aczel, A. D., & Sounderpandian, J.. *Complete business statistics*. McGraw Hill. 1999.
4. Jani, P. N. *Business statistics: Theory and applications*. PHI Learning Pvt. Ltd.2014.

E-Resources:

1. Statistical Concept:Statistical Methods calculators (atozmath.com)
2. Discrete Mathematics: https://www.tutorialspoint.com/discrete_mathematics/index.htm

Program:	**MCA**						**Semester : II**
Course:	**Research Project**						**Code : MCA32EL02**
Credits	**Teaching Scheme (Hrs. / Week)**			**Evaluation Scheme and Marks**			
	Theory	**Practical**	**Tutorial / Activity**	**TW**	**OR**	**PR**	**Total**
2	**-**	**4**	**-**	**50**	**-**	**-**	**50**

Course Objectives

This course aims at enabling students:

1. To introduce students a software engineering approach thorough problem analysis.
2. To gain an in-depth understanding of specific functional areas.
3. To enhance the ability of technical writing

Course Outcomes

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

1. Formulate the requirements based on problem statements.
2. Apply knowledge of Research Methodology for research analysis and/or design
3. Present research findings, both in written and verbal formats

About Course:

Research Project provides an opportunity to students to develop practical skills and systematic work undertaken in the fields of computer application. This course focuses on practical work to develop problem-solving skills in computing. It helps students develop research and technical writing skills.

Guidelines (Research Work): For projects involving Research Work with a 50-mark evaluation, the following guidelines are to be followed:

1. Students undertaking research projects are encouraged to choose topics relevant to their field of study.
2. The Research 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. Students are required to present the progress of the Research Project during the semester as per the project review schedule.
4. The evaluation of the Research Project will be based on minimum 2 (two) reviews and will carry a total of 50 marks.
5. Research work may involve carrying out a substantial research-based project or activity, analyzing data, research findings and explaining research articles.
6. At the end of the semester, students must submit the Research project report as per the template.

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