Shri Virle Parle Kelwani Mandal's

NMIMS Global University, Dhule

Survey No. 499, Plot No 02, Behind Gurudwara,

Mumbai Agra National Highway,

Dhule -424 001, Maharashtra, India

Curriculum Structure and Syllabus

Of

First Year Master of Computer Applications (MCA)

(Regulation 2025)

SVKM NMIMS

Global University

Effective from Academic Year 2025-26

Vision

"SVKM NMIMS Global University aspires to be a world-renowned institution of higher learning, dedicated to fostering excellence in education, research and innovation with social responsibility"

Mission

1. To foster a dynamic and inclusive learning environment that nurtures the educational and research aspirations of students from diverse backgrounds.
2. To deliver state-of-the-art pedagogy, emphasizing interdisciplinary collaboration and innovation.
3. To uphold the values of ethics and community engagement to cultivate global citizens and leaders who actively contribute to the advancement of society and the world.

INDEX

CURRICULUM FRAMEWORK

(Regulation 2025)

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	9
2	Programme Core Course	12	29	34
3	Programme Elective Course	7	16	19
4	Open Elective	2	4	4.5
5	Vocational and Skill Enhancement Course	1	2	2.5
6	Ability Enhancement Course	2	4	4.5
7	Entrepreneurship/Economics/Management Course	1	2	2.5
8	Experiential Learning Courses	4	20	24
	TOTAL	**31**	**85**	**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	0	6
4	Open Elective	0	0	0	2	2
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	0	1
8	Experiential Learning Courses	1	1	1	1	4
	Total	**8**	**9**	**10**	**3**	**30**

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	14	5	10	0	29
3	Programme Elective Course	0	8	4	0	12
4	Open Elective	0	0	0	8	8
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	0	2
8	Experiential Learning Courses	4	2	2	12	20
	Total	**22**	**21**	**22**	**20**	**85**

Curriculum Structure

First Year

MCA

CURRICULUM STRUCTURE

First Year MCA Semester – I

	First Year MCA (Regulation 2025) (With effect from Academic Year 2025-26)															
	Semester-I															
Course Code	Course Name	Credit Scheme				Teaching Scheme (Hours/Week)			Evaluation Scheme and Marks							Total
									ISE		MSE	TW	PR	OR	ESE	
		L	P	T/A	Total	L	P	T/A	CA-1	CA-2						
MCA31PC01	Java Programming	2	0	0	**2**	2	0	0	10	10	20	0	0	0	60	100
MCA31PC02	Data Structures and Algorithms	3	0	0	**3**	2	0	0	10	10	20	0	0	0	60	100
MCA31PC03	Database Management System (DBMS)	3	0	0	**3**	2	0	0	10	10	20	0	0	0	60	100
MCA31PC04	Java Programming Lab	0	2	0	**2**	0	4	0	0	0	0	0	25	0	25	50
MCA31PC05	DSA Lab with C++	0	2	0	**2**	0	4	0	0	0	0	0	25	0	25	50
MCA31PC06	DBMS Lab	0	2	0	**2**	0	4	0	0	0	0	0	25	0	25	50
MCA31EL01	Research Methodologies and IPR	3	0	1	**4**	3	0	1	10	10	20	0	0	0	60	100
MCA31BS01	Mathematical Foundation for Computer Application-1	3	0	1	**4**	3	0	1	10	10	20	0	0	0	60	100
Total		**12**	**6**	**2**	**22**	**12**	**12**	**2**	**50**	**50**	**100**	**0**	**75**	**0**	**375**	**650**

L-Lecture, P-Practical, T/A-Tutorial/Activity, CA–Continue Assessment, MSE-Mid-Semester Examination, TW-Term Work, OR-Oral, PR-Practical, ESE-End Semester Examination

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
									ISE		MSE	TW	PR	OR	ESE		
		L	P	T/A	Total	L	P	T/A	CA-1	CA-2							
MCA32PC07	Artificial Intelligence and Machine Learning	3	0	0	**3**	2	0	0	10	10	20	0	0	0	60		100
MCA32PC08	AI & ML Lab	0	2	0	**2**	0	4	0	0	0	0	0	25		25		50
MCA32PE01 to MCA32PE03	Elective-1	2	0	0	**2**	2	0	0	10	10	20	0	0	0	60		100
MCA32PE07 to MCA32PE09	Elective-2	2	0	0	**2**	2	0	0	10	10	20	0	0	0	60		100
MCA32PE04 to MCA32PE06	Elective-1 Lab	0	2	0	**2**	0	4	0	0	0	0	0	25		25		50
MCA32PE10 to MCA32PE12	Elective-2 Lab	0	2	0	**2**	0	4	0	0	0	0	0	25		25		50
MCA32EM01	Software Project Management	2	0	0	**2**	2	0	0	10	10	20	0	0	0	60		100
MCA32BS02	Mathematical Foundation for Computer Application-2	3	0	1	**4**	3	0	1	10	10	20	0	0	0	60		100
MCA32EL02	Project Phase-I	0	2	0	**2**	0	4	0	0	0	0	50	0	0			50
Total		**11**	**8**	**1**	**21**	**11**	**16**	**1**	**50**	**50**	**100**	**50**	**75**	**0**	**375**		**700**

L-Lecture, P-Practical, T/A-Tutorial/Activity, CA–Continue Assessment, MSE-Mid-Semester Examination, TW-Term Work, OR-Oral, PR-Practical, ESE-End Semester Examination

Curriculum Structure

Second Year

MCA

Second Year MCA Semester – III

	Second Year MCA (Regulation 2025) (With effect from Academic Year 2025-2026)															
	Semester-III															
Course Code	**Course Name**	**Credit Scheme**				**Teaching Scheme (Hours/Week)**			**Evaluation Scheme and Marks**							**Total**
									ISE		**MSE**	**TW**	**PR**	**OR**	**ESE**	
		L	**P**	**T/A**	**Total**	**L**	**P**	**T/A**	**CA-1**	**CA-2**						
MCA33PC09	Big Data Analytics and Visualization	3	0	0	**3**	2	0	0	10	10	20	0	0	0	60	100
MCA33PC10	Theory of Automata	3	0	0	**3**	2	0	0	10	10	20	0	0	0	60	100
MCA33PC11	Big Data Analytics and Visualization with R Programming Lab	0	2	0	**2**	0	4	0	0	0	0	0	25	0	25	50
MCA33PC12	Networking with Linux Lab	0	2	0	**2**	0	4	0	0	0	0	0	25	0	25	50
MCA33PE17 to MCA33PE20	Elective-3	2	0	0	**2**	2	0	0	10	10	20	0	0	0	60	100
MCA33PE21 to MCA33PE24	Elective-3 Lab	0	2	0	**2**	0	4	0	0	0	0	0	25	0	25	50
MCA33AE01	Technical 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	Skill Enhancement	0	2	0	**2**	0	4	0	0	0	0	50	0	0		50
MCA33EL03	Project Phase-II	0	2	0	**2**	0	4	0	0	0	0	50	0	0		50
	Total	**6**	**12**	**2**	**22**	**6**	**24**	**2**	**30**	**30**	**60**	**200**	**75**	**0**	**255**	**650**

L-Lecture, P-Practical, T/A-Tutorial/Activity, CA–Continue Assessment, MSE-Mid-Semester Examination, TW-Term Work, OR-Oral, PR-Practical, ESE-End Semester Examination

Second Year MCA Semester – IV

Second Year MCA (Regulation 2024) (With effect from Academic Year 2025-2026)															
Semester-IV															
Course Code	**Course Name**	**Credit Scheme**				**Teaching Scheme (Hours/Week)**			**Evaluation Scheme and Marks**						**Total**
									ISE		**MSE**	**TW**	**PR**	**ESE**	
		L	**P**	**T/A**	**Total**	**L**	**P**	**T/A**	**CA-1**	**CA-2**					
MCA34OE01	Open Elective - MOOC-1	0	0	4	**4**	0	0	2	0	0	0	50	0	0	50
MCA34OE02	Open Elective - MOOC-2	0	0	4	**4**	0	0	2	0	0	0	50	0	0	50
MCA34EL04	Internship	0	12	8	**12**	0	24	0	0	0	0	150	0	150	300
Total		**3**	**12**	**5**	**20**	**3**	**24**	**4**	**0**	**0**	**0**	**250**	**0**	**150**	**400**

L-Lecture, P-Practical, T/A-Tutorial/Activity, CA–Continue Assessment, MSE-Mid-Semester Examination, TW-Term Work, OR-Oral, PR-Practical, ESE-End Semester Examination

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

FYMCA (Sem II)			
Course Code	**Elective 1**	**Course Code**	**Elective 2**
MCA32PE01	Natural Language Processing	MCA32PE07	Data Science
MCA32PE02	UI/UX Design	MCA32PE08	Blockchain Technology
MCA32PE03	Microsoft .Net Technologies using C#	MCA32PE09	Mobile Application Development (Android Programming)
MCA32PE04	Natural Language Processing Lab	MCA32PE10	Data Science Lab
MCA32PE05	UI/UX Design Lab	MCA32PE11	Blockchain Technology Lab
MCA32PE06	Microsoft .Net Technologies Lab using C#	MCA32PE12	Mobile Application Development (Android Programming) Lab

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

SYMCA (Sem III)	
Course Code	**Elective 3**
MCA33PE13	Ruby on Rails
MCA33PE14	Digital Image Processing & Computer Vision
MCA33PE15	Dynamic Application Development and Frameworks
MCA33PE16	Lab on Ruby on Rails
MCA33PE17	Digital Image Processing & Computer Vision Lab
MCA33PE18	Dynamic Application Development and Frameworks Lab
Course Code	**Skill Enhancement**
MCA33VS01	Linux (Spoken Tutorial Course)
	Advance C++ (Spoken Tutorial Course)
	Computer Skill (Project based on Figma & Illustrator)

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

SYMCA (Sem IV)			
Course Code	**Open Elective -MOOC-1**	**Course Code**	**Open Elective -MOOC-2**
MCA34OE01	Advanced Probability Theory	MCA34OE02	German - III
	Air pollution and Control		Education for Sustainable Development
	Business Fundamentals for Entrepreneurs		English language for competitive exams

Semester – I

Course Code	Course Name				
MCA31PC01	Java Programming				
Teaching Scheme: Contact Hours (Per Week)			Credits Assigned		
Theory	Tutorial	Total	Theory	Tutorial	Total
2	0	2	2	0	2
Examination Scheme (Marks)					
Internal Semester Examination (ISE)			End Sem. Examination (MSE)	Term Work	Total (Marks)
Continuous Assessment CA)	MSE	Total (IA) (CA+MSE)			
20	20	40	60	0	100

Pre-requisite: Student must know basic knowledge of OOP concepts.

Course Objectives: Course aim to learn and perform

Sr. No.	Course Objective
1	To Understand the Fundamentals of Java Programming Language and To Learn Object-Oriented Programming (OOP) Concepts.
2	To Enhance Problem-Solving Skills Using Java and To Gain Proficiency in Using Java Standard Libraries and APIs.
3	To Develop GUI-Based Applications Using Java.
4	To Understand Multithreading and Concurrency in Java.
5	To Prepare Students for Writing Efficient and Maintainable Code.

Course Outcomes (CO): On successful completion of course learner / student will be able to

Sr. No.	Course Outcome
CO1	To understand fundamental java programming constructs such as data types, Control statements and loops.
CO2	Develop java program using classes and objects.
CO3	Develop java program for implementing code reusability concept.
CO4	Develop program to implement multithreading and exception handling.
CO5	To design and develop GUI based Java applications and managing database.

Course Contents:

Module No.	Detailed Contents	Hrs.	CO No.
1	**Introduction to Java:** Introduction: History of Java, Features of Java, JDK, JRE, and JVM, Setting up the Java Development Environment, Java Source File Structure, Compilation, Executions. **Java Basics:** Data Types and Variables, Operators and Expressions, Control Flow Statements (if-else, switch-case) Looping Statements (for, while, do-while), Arrays, **Self-Learning Topics:** Nesting of methods.	6	1

2	**Object-Oriented Programming (OOP) Concepts and Strings:** **Classes &Objects:** Class Fundamentals, Object & Object reference, Object Life time & Garbage Collection, Constructors, Access Control, Modifiers, Inner Class & Anonymous **Methods:** Defining Methods, Argument Passing Mechanism, Method Overloading, Recursion, Dealing with Static Members Inheritance, Method Overriding, Polymorphism, Encapsulation, Abstraction, Interfaces, Abstract& Static Classes **Self-Learning Topics:** String Class, String Buffer and StringBuilder, String Methods	6	2
3	**Inheritance and Interface:** **Inheritance:** concept of inheritance, types of Inheritance: single inheritance, multilevel inheritance, hierarchical inheritance, method overriding, final variables, final methods, use of super, abstract methods and classes **Interfaces:** Define interface, implementing interface, accessing interface variables and methods, extending interfaces. **Package:** Define package, types of packages, naming and creating package, accessing package. **Self-Learning Topics:** Import statement, static import, adding class and interfaces to a package.	6	3
4	**Exception Handling and Multithreading:** **Errors and Exception:** Types of errors and exceptions, try and catch statement, throws and finally statement, built-in exceptions, throwing our own exception. **Multithreaded programming:** creating a thread: By extending to thread class and by implementing runnable Interface, Life cycle of thread: Thread methods, thread exceptions, thread priority and methods **Self-Learning Topics:** Synchronization.	6	4
5	**Event handling using Abstract Window Toolkit (AWT), Swings Components & Database:** Basics of Components, Using Containers, Layout Managers, Introduction to AWT **Swing Components:** Introduction, Components Layouts, Individual components Label, Button, Checkbox, Radio Button, Choice, List, Menu, Text Field, Text Area. **Event-Delegation-Model, Listeners:** Mouse Listeners, Key Listeners & Text Listener **Introduction to swing:** Swing features, difference between AWT and Swing. **Swing components:** Icons and Labels, TextField, ComboBox, Button, Checkbox, RadioButton, Introduction to Event Handling. **Introduction to JDBC, ODBC:** JDBC architecture. **Self- Learning Topics:** Advanced Swing Components, Types of JDBC drivers.	6	5

Text Books:

Reference No	Reference Name
1	Core Java for Beginners: A Simplified Approach (Covers Java SE 13) (Paperback, Sharanam Shah, Vaishali Shah)
2	Yashavant P. Kanetkar, Let us Java- 5th edition Paperback , 2019

Reference Books:

Reference No	Reference Name
1	Prof. Reeta Singh, Prof. Mahesh Mahajan, Core Java: A Complete Solution for Beginners, Crown Publishing, 2024, ISBN: 978-93-6081-199-0
2	E. Balagurusamy, Programming with Java, Tata McGraw-Hill Education India, 2014, ISBN-13: 978-93-5134-320-2
3	Schildt Herbert, Java Complete Reference, Mcgraw Hill Education, New Delhi . ISBN:978-93-3921-209-4
4	Holzner, Steven et al, Java 8 Programming Black Book, Dreamtech Press, New Delhi. ISBN: 978-93-5119-758-4

Web References:

Reference No	Reference Name
1	https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2	https://www.tutorialspoint.com/java/index.htm
3	https://www.javatpoint.com/java-tutorial
4	https://www.w3schools.com/java/

Assessment:

Continuous Assessment (CA): 20 marks

Following measures can be used for the continuous assessment as:

- Assessment consists of two CA of 20 marks.
- The first CA is to be conducted when approx. 30-40% of the syllabus is completed and second CA is to be conducted after completion of 100% syllabus.
- Duration of the class test shall be one hour.

MSE: 20 marks

- Assessment consists of one MSE of 20 marks.
- The MSE is to be conducted when approx. 50 -60% of the syllabus is completed.
- Duration of the class test shall be one hour.

Internal Semester Examination (ISE): 40 marks

- The Internal Assessment marks (out of 40) will be the total of the MSE and

the continuous assessment.

Term Work: NA

- The term work will be based on the tutorial performance of the student.

End Semester Theory Examination: 60 Marks

1. Weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

Course Code	Course Name				
MCA31PC02	Data Structures and Algorithms				
Teaching Scheme: Contact Hours (Per Week)			Credits Assigned		
Theory	Tutorial	Total	Theory	Tutorial	Total
3	0	3	3		3
Examination Scheme (Marks)					
Internal Semester Examination (ISE)			End Sem. Examination (MSE)	Term Work	Total (Marks)
Continuous Assessment CA)	MSE	Total (IA) (CA+MSE)			
20	20	40	60	0	100

Pre-requisite: Students should have foundational knowledge in data representation techniques, basic set theory, principles of counting, logical reasoning, and introductory programming concepts, including the use of variables, loops, and conditional statements.

Course Objectives: Course aim to learn and perform

Sr. No.	Course Objective
1	To understand the fundamentals of data structures and algorithms.
2	To analyze the time and space complexity of algorithms.
3	To learn various data structure operations and their applications in problem-solving.
4	To implement efficient algorithms for searching, sorting, and traversal operations.
5	To apply advanced data structures for complex applications such as graphs, trees, and hashing.

Course Outcomes (CO): On successful completion of course learner / student will be able to

Sr. No.	Course Outcome
CO1	Students will be able to design and analyze algorithms using complexity measures.
CO2	Students will gain expertise in implementing various data structures to solve real-world problems.
CO3	Students will develop the ability to traverse and manipulate trees and graphs efficiently.
CO4	Students will apply hashing and advanced searching techniques in practical applications.
CO5	Students will gain proficiency in sorting algorithms and evaluate their performance.

Course Contents:

Module No.	Detailed Contents	Hrs.	CO No.
1	**Introduction to Data Structures and Algorithms**: Algorithmic Notation: Format Conventions, Statement and Control Structures. Time and Space Analysis: Data types and Abstract data types, Types of Data structures; Primitive, Non primitive, Linear and Nonlinear Data structures. **Self-Learning Topics:** Big-O, Big-Ω, and Big-Θ Notations	6	1
2	**Linear Data Structures:** Array: Storage representation, operations and applications (Polynomial addition and subtraction) Stack: operations and applications (infix, postfix and prefix expression handling), Queue: operations and applications, Circular Queues: operations and applications, Concept of Double ended Queue and Priority Queue, Linked representation of stack and queue. **Self-Learning Topics:** Dynamic Arrays and Memory Allocation, Real-Life Queue Applications (Scheduling, Traffic Management)	7	2
3	**Linked Lists:** Types of Linked Lists: Linear, Circular, Doubly Linked List, Operations and Applications of Linear linked list (Polynomial addition and subtraction), Circular linked list and Doubly linked list. **Self-Learning Topics:** Comparison of Linked Lists with Arrays	8	3
4	**Trees and Hash Tables:** Trees: Binary Trees (Representation, Operations, Traversals), Threaded Binary Tree, AVL Trees (Single/Double Rotations), M-Way Trees (Definition), B-Trees (Insertion and Deletion Operations) Hash Tables: Hash Functions, Collision Resolution (Separate Chaining, Open Addressing), Rehashing, Extendible Hashing **Self-Learning Topics:** Applications of Binary Trees in File Systems.	8	4
5	**Graphs:** Graphs and Their Applications: Representation (Matrix/Adjacency) and Traversal (Depth First Search/Breadth First Search), Spanning Trees, Minimal Spanning Tree (Prim's and Kruskals's algorithm), Shortest Paths and All Pair Shortest Path: Dijkstra's, Floyd-Warshall Algorithms. **Self-Learning Topics:** Applications of Graphs in Social Networks and Routing	8	5

6	**Searching and Sorting:** Searching: Linear Search, Binary Search (Array/Binary Tree) Sorting Techniques: Bubble Sort, Insertion Sort, Selection Sort, Quicksort, Mergesort, Heapsort, Radix Sort **Self-Learning Topics:** Comparison of Sorting Algorithms	**8**	**6**

Text Books:

Reference No	Reference Name
1	Tremblay, J. & Sorenson, P.G., (2001), An Introduction to Data Structures with Application, Mcgraw Hill India, ISBN: 978-0074624715, 0074624717
2	Balagurusamy, E., (2013), Data Structures using C, 1 st Edition, Mcgraw Hill Education, ISBN: 978-1259029547, 1259029549

Reference Books:

Reference No	Reference Name
1	Langsam, Y., Augenstein, M.J. & Tenenbaum A.M., (2015), Data Structures using C and C++, 2 nd Edition, Pearson Education ISBN: 978-9332549319, 9332549311
2	Weiss, M.A., (2002), Data Structures and Algorithm Analysis in C, 2 nd Edition, Pearson India, ISBN: 978-8177583588, 8177583581
3	Horowitz, E., Sartaj S. & Mehta, D. (2008), Fundamentals of Data Structures in C++, Universities Press ISBN: 978-8173716065, 8173716064
4	Lafore, R., (2003), Data Structures & Algorithms in Java, 2nd Edition, Pearson India, ISBN: 978-8131718124, 8131718123
5	Kruse, R., Tondo, C.L., Leung B., & Mogalla S, (2006), Data Structures and ProgramDesign in C, Pearson India, ISBN: 978-8177584233
6	Prof. Mahesh Mahajan, Dr. Reeta Singh, Prof. Pallavi Deore, Prof. Shubham Mahale, Prof. Khalid Alfatmi, (2025), Advanced Data Structure and Algorithm Analysis using C++, Crown Publishing, India. ISBN: 978-93-6426-875-2

Web References:

Reference No	Reference Name
1	Coursera - Data Structures and Algorithms Specialization
2	Khan Academy - Algorithms
3	NPTEL - Data Structures

Tutorials:

Assessment:
Continuous Assessment (CA): 20 marks
Following measures can be used for the continuous assessment as:

- Assessment consists of two CA of 20 marks.

- The first CA is to be conducted when approx. 30-40% of the syllabus is completed and second CA is to be conducted after completion of 100% syllabus.

- Duration of the class test shall be one hour.

MSE: 20 marks

- Assessment consists of one MSE of 20 marks.
- The MSE is to be conducted when approx. 50 -60% of the syllabus is completed.
- Duration of the class test shall be one hour.

Internal Semester Examination (ISE): 40 marks

- The Internal Assessment marks (out of 40) will be the total of the MSE and the continuous assessment.

Term Work: NA

- The term work will be based on the tutorial performance of the student.

End Semester Theory Examination: 60 Marks

1. Weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

Course Code	Course Name				
MCA31PC03	Data Base Management System				
Teaching Scheme: Contact Hours (Per Week)			Credits Assigned		
Theory	Tutorial	Total	Theory	Tutorial	Total
3	0	3	3	0	3
Examination Scheme (Marks)					
Internal Semester Examination (ISE)			End Sem. Examination (MSE)	Term Work	Total (Marks)
Continuous Assessment CA)	MSE	Total (IA) (CA+MSE)			
20	20	40	60	0	100

Pre-requisite: Student must know data collection and representation, Set theory, Basic principles of counting.

Course Objectives: Course aim to learn and perform

Sr. No.	Course Objective
1	The course emphasizes the understanding of the fundamentals of relational systems including data models, database architectures, and database manipulations.
2	To develop conceptual understanding of database management system
3	To understand how a real-world problem can be mapped to schemas
4	To educate students with different Database Languages.
5	Understand the needs of database processing and learn techniques for controlling the consequences of concurrent data access.

Course Outcomes (CO): On successful completion of course learner / student will be able to

Sr. No.	Course Outcome
CO1	To analyze Database design methodology.
CO2	Acquire knowledge of fundamentals of Database Management System.
CO3	Analyze the difference between traditional file system and DBMS.
CO4	To deal with different Database languages.
CO5	Draw various data models for Database, writing and executing queries to get expected results.

Course Contents:

Module No.	Detailed Contents	Hrs.	CO No.
1	**Introduction:** Data base System Applications, Purpose of Database Systems, View of Data – Data Abstraction – Instances and Schemas – data Models – the ER Model – Relational Model – Other Models – Database Languages – DDL – DML – database Access for applications Programs – data base Users and Administrator – Transaction Management – data base Architecture – Storage Manager – the Query Processor	9	1

	Data base design and ER diagrams – ER Model - Entities, Attributes and Entity sets – Relationships and Relationship sets – ER Design Issues – Concept Design – Conceptual Design for University Enterprise. Introduction to the Relational Model – Structure – Database Schema, Keys – Schema Diagrams		

2	**Relational Query Languages**: Relational Query Languages, Relational Operations. Relational Algebra – Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews – Relational calculus – Tuple relational Calculus – Domain relational calculus. Overview of the SQL Query Language – Basic Structure of SQL Queries, Set Operations, Aggregate Functions – GROUPBY – HAVING, Nested Sub queries, Views, Triggers.	8	2
3	**Normalization** Introduction, Non loss decomposition and functional dependencies, First, Second, and third normal forms – dependency preservation, Boyee/Codd normal form. Higher Normal Forms - Introduction, Multi-valued dependencies and Fourth normal form, Join dependencies and Fifth normal form.	8	3
4	**Transaction Concept-** Transaction State- Implementation of Atomicity and Durability – Concurrent – Executions – Serializability- Recoverability – Implementation of Isolation – Testing for serializability- Lock –Based Protocols – Timestamp Based Protocols- Validation- Based Protocols – Multiple Granularity. Recovery and Atomicity – Log – Based Recovery – Recovery with Concurrent Transactions – Buffer Management – Failure with loss of nonvolatile storage-Advance Recovery systems- Remote Backup systems.	9	4
5	**File organization and Query Optimization: –** File organization – various kinds of indexes. Query Processing – Measures of query cost - Selection operation – Projection operation, - Join operation – set operation and aggregate operation – Relational Query Optimization – Transacting SQL queries – Estimating the cost – Equivalence Rules.	9	5

Text Books:

Reference No	Reference Name
1	Ramakrishnam, Gehrke, Database Management Systems, Bayross, McGraw-Hill,3rd Edition
2	Ivan Bayross, "SQL,PL/SQL -The Programming language of Oracle", B.P.B. Publications
3	Data base System Concepts, Silberschatz, Korth, McGraw hill, Sixth Edition.(All UNITS except III th)

Reference Books:

Reference No	Reference Name
1	Ramez Elmasri & Shamkant B.Navathe, Fundamentals of Database Systems, Pearson Education
2	Robert Sheldon, Geoff Moes, Begning MySQL, Wrox Press.
3	Programming ASP.NET, D.Esposito, Microsoft Press (Dreamtech), Reprint 2011. ASP.N
4	Joel Murach, Murach's MySQL, Murach
5	Prof. Reeta Singh, Prof. Mahesh Mahajan, Advanced Database Management System(ADBMS), Crown Publishing, 2024, ISBN: 978-93-6081-560-8
6	Fundamentals of Database Systems, Elmasri Navathe Pearson Education.

Web References:

Reference No	Reference Name
1	edX: Databases Courses
2	Simplilearn: DBMS Tutorial
3	W3Schools: DBMS Tutorial
4	GeeksforGeeks: DBMS Tutorial
5	JavaTpoint: DBMS Tutorial

Assessment:

Continuous Assessment (CA): 20 marks

Following measures can be used for the continuous assessment as:

- Assessment consists of two CA of 20 marks.
- The first CA is to be conducted when approx. 30-40% of the syllabus is completed and second CA is to be conducted after completion of 100% syllabus.
- Duration of the class test shall be one hour.

MSE: 20 marks

- Assessment consists of one MSE of 20 marks.
- The MSE is to be conducted when approx. 50 -60% of the syllabus is completed.
- Duration of the class test shall be one hour.

Internal Semester Examination (ISE): 40 marks

- The Internal Assessment marks (out of 40) will be the total of the MSE and the continuous assessment.

Term Work: NA

- The term work will be based on the tutorial performance of the student.

End Semester Theory Examination: 60 Marks

1. Weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

Course Code	Course Name				
MCA31PC04	Java Programming Lab				
Contact Hours (Per Week)	Credits Assigned	Examination Scheme (Marks)			
		Term Work	Continuous Assessment (CA)	End Semester Examination (ESE)	Total
2	2	-	25	25	50

Pre-requisite: Basic understanding of Object-Oriented Programming concepts.

Lab Course Objectives:

Sr. No.	Course Objective
1	Understand concepts OOP like object, class.
2	Develop program to implement different control structures.
3	Implement array and vectors in Java.
4	Implement concepts of inheritance for code reusability.
5	Design GUI using different AWT components.

Lab Course Outcomes (CO): On successful completion of course learner/student will be able to

Sr. No.	Course Outcome
CO1	Implement programs to evaluate different types of Expressions and control structures.
CO2	Implement array and vectors in Java.
CO3	Implement concepts of inheritance for code reusability.
CO4	Identify the different types of errors using exception handling and Implementation of multithreading.
CO5	Design GUI using different AWT components.

Continuous Assessment (CA):

Term Work: Will be based on Continuous Assessment

- Laboratory work will be based on the syllabus with minimum 10 experiments. The experiments should be completed in the allotted time duration.
- Practical will be evaluated by the subject teacher and documented according to a rubric

End Semester Practical Examination:

Practical and oral examination will be based on suggested practical list and entire syllabus.

Reference Books:

Reference No	Reference Name
1	Prof. Reeta Singh, Prof. Mahesh Mahajan, Core Java: A Complete Solution for Beginners, Perfect Writer Publishing, 2024, ISBN: 978-93-6081-199-0

Text Books:

Reference No	Reference Name
1	Yashavant P. Kanetkar, Let us Java- 5th edition Paperback , 2019

Web References:

Reference No	Reference Name
1	https://onlinecourses.nptel.ac.in/noc25_cs57/preview
2	https://onlinecourses.nptel.ac.in/noc25_cs34/preview
3	https://www.tutorialspoint.com/java/index.htm
4	https://www.geeksforgeeks.org/java/
5	www.javatpoint.com

Suggested list of experiments:

Practical No	Problem Statement
1	Write programs to evaluate different types of expressions.
2.	Write programs to demonstrate use of: • if statements (all forms of if statement) • Switch – Case statement • Different types of Loops (for, while and do-while).
3	Write programs to demonstrate: • Use of Array. • Use of Vectors.
4	Develop a program for implementation of different types of constructors.
5	Develop program to implement: • Single inheritance. • Multilevel inheritance.
6	Develop program for implementation of interface.
7	Write programs for implementation of try, catch and finally block.
8	Write programs using multithreading.
9	Write program to design any type of form using AWT components.
10	Write program to design a calculator to demonstrate the use of grid layout using swing components.
11	Write program to handle key events and mouse events.
12	Write program to implement following operations on database: • Insert record. • Update record. • Delete record.

Note: At least 10 programs

Course Code	Course Name				
MCA31PC05	DSA Lab with C++				
Contact Hours (Per Week)	Credits Assigned	Examination Scheme (Marks)			
		Term Work	Continuous Assessment (CA)	End Semester Examination (ESE)	Total
2	2	-	25	25	50

Pre-requisite: Basic understanding of Object-Oriented Programming concepts.

Lab Course Objectives:

Sr. No.	Course Objective
1	To understand the fundamental concepts of data structures and algorithms.
2	To learn the implementation of basic and advanced data structures like arrays, linked lists, stacks, queues, trees, heaps, and graphs.
3	To gain practical knowledge of algorithmic problem-solving approaches for real-world applications.
4	To explore various sorting, searching, and traversal techniques.
5	To develop the ability to implement data structures for efficient programming.

Lab Course Outcomes (CO): On successful completion of course learner/student will be able to

Sr. No.	Course Outcome
CO1	Demonstrate understanding and implementation of arrays, linked lists, stacks, queues, and trees.
CO2	Apply sorting and searching techniques to organize and retrieve data efficiently.
CO3	Implement matrix operations and polynomial manipulation using data structures.
CO4	Develop solutions using tree traversal, graph traversal, and shortest path algorithms.
CO5	Design and implement algorithms for real-world problem-solving with optimal use of data structures.

Continuous Assessment (CA):

Term Work: Will be based on Continuous Assessment

- Laboratory work will be based on the syllabus with minimum 10 experiments. The experiments should be completed in the allotted time duration.
- Practical will be evaluated by the subject teacher and documented according to a rubric

End Semester Practical Examination:

Practical and oral examination will be based on suggested practical list and entire syllabus.

Reference Books:

Reference No	Reference Name
1	**"Data Structures Using C"** by Reema Thareja (Oxford University Press)
2	Ellis Horowitz, S. Sahni, D. Mehta, Fundamentals of Data Structures in C++, Galgothia Publication, ISBN No. 978-81-751-5278-6

Text Books:

Reference No	Reference Name
1	Y. Langsam, M. Augenstin and A. Tannenbaum, Data Structures using C and C++, Pearson Education Asia, Second Edition, ISBN No. 978-81-203-1177-0

Web References:

Reference No	Reference Name
1	https://www.digimat.in/nptel/courses/video/106106133/L25.html
2	https://nptel.ac.in/courses/106/101/106101208/

Suggested list of experiments:

Practical No	Problem Statement
1	Write a program to perform various operations on arrays, including: Insertion, deletion, searching, and reversing.
2.	Write a program to demonstrate Matrix Addition, Subtraction, Multiplication, and Transpose
3	Write a program to demonstrate Stack Implementation Using Arrays and Linked Lists
4	Write a program to demonstrate Basic Queue and Circular Queue Operations Using Arrays
5	Write a program to demonstrate Singly Linked List with Insertion, Deletion, and Searching
6	Write a program to demonstrate Circular Linked List with Insertion, Deletion, and Searching
7	Write a program to demonstrate Doubly Linked List with Insertion, Deletion, and Searching
8	Write a program to demonstrate Binary Search Tree (BST) with Insertion, Deletion, and Searching
9	Write a program to demonstrate Tree Traversal Operations: In-order, Pre-order, and Post-order
10	Implementing Heap with different operations.
11	Create a minimum spanning tree using any method Kruskal's Algorithm or Prim's Algorithm
12	Write a program to demonstrate Implementation of Sorting Algorithm Bubble Sort, Quick Sort, Merge Sort

Note: At least 10 programs

Course Code	Course Name				
MCA31PC06	Lab On DBMS				
Contact Hours (Per Week)	Credits Assigned	Examination Scheme (Marks)			
		Term Work	Continuous Assessment (CA)	End Semester Examination (ESE)	Total
2	2	-	25	25	50

Pre-requisite: Basic understanding of fundamentals of any programming language.

Lab Course Objectives:

Sr. No.	Course Objective
1	Provide foundation knowledge in database concepts, technology and practice to prepare students into expert database application developers.
2	Understand SQL programming through a variety of database problems.
3	Develop database applications using front-end tools and back-end DBMS.

Lab Course Outcomes (CO): On successful completion of course learner/student will be able to

Sr. No.	Course Outcome
CO1	To understand Database design methodology
CO2	Develop a relational database schema for a given scenario, including tables, relationships, and constraints.
CO3	Utilize the DML/DDL commands and programming PL/SQL including stored procedures, stored functions, cursors, views and Triggers for modify data
CO4	Realize various data models for Database and Write queries in SQL.
CO5	Familiar with basic database storage structures and access techniques

Continuous Assessment (CA):

Term Work: Will be based on Continuous Assessment

- Laboratory work will be based on the syllabus with minimum 10 experiments. The experiments should be completed in the allotted time duration.
- Practical will be evaluated by the subject teacher and documented according to a rubric

End Semester Practical Examination:

Practical and oral examination will be based on suggested practical list and entire syllabus.

Reference Books:

Reference No	Reference Name
1	Y. Langsam, M. Augenstin and A. Tannenbaum, Data Structures using C and C++, Pearson Education Asia, Second Edition, ISBN No. 978-81-203-1177-0

2	Prof. Reeta Singh, Prof. Mahesh Mahajan, Advanced Database Management System(ADBMS), Crown Publishing, 2024, ISBN: 978-93-6081-560-8

Text Books:

Reference No	Reference Name
1	Ramakrishnam, Gehrke, Database Management Systems, Bayross, McGraw-Hill,3rd Edition

Web References:

Reference No	Reference Name
1	GeeksforGeeks: DBMS Tutorial
2	JavaTpoint: DBMS Tutorial
3	W3Schools: DBMS Tutorial
4	Coursera: Database Management Courses
5	edX: Databases Courses

Suggested list of experiments:

Practical No	Problem Statement
1	Implement DDL Statement. • Create table , Modify table, Drop table.
2.	Implement following clauses. • Simple select clause • Accessing specific data with Where Clause • Ordered By/ Distinct/Group By Clause
3	Implement DML Statement. • Adding/Modify/Delete data using Insert/ Update/ Delete
4	Implement following Constraints. • NULL and NOT NULL, Primary Key Constraint, Foreign Key Constraint • Unique Constraint, Check Constraint, Default Constraint
5	Practical for Retrieving Data Using following clauses. • Simple select clause • Accessing specific data with Where • Ordered By • Distinct • Group By
6	Implement Date and Time Functions.
7	Implement Aggregate Functions. • AVG, COUNT, MAX, MIN, SUM, CUBE
8	Practical Based on implementing all String functions
9	Implement use of UNION, INTERSECTION, SET DIFFERENCE.
10	Implement Nested Queries & all types of JOIN operation.
11	Implement use of database connectivity with front end tools like – VB.NET, C#.NET Etc

Note: At least 10 programs

Course Code	Course Name				
MCA31BS01	Research Methodologies and IPR				
Teaching Scheme: Contact Hours (Per Week)			Credits Assigned		
Theory	Tutorial	Total	Theory	Tutorial	Total
3	1	4	3	1	4
Examination Scheme (Marks)					
Internal Semester Examination (ISE)			End Sem. Examination (MSE)	Term Work	Total (Marks)
Continuous Assessment CA)	MSE	Total (IA) (CA+MSE)			
20	20	40	60	0	100

Pre-requisite: Students must know data collection and representation, set theory, basic principles of counting, statistics fundamentals, and ethical research practices.

Course Objectives: Course aim to learn and perform

Sr. No.	Course Objective
1	Understand research concepts, processes, and their types.
2	Identify suitable research methodologies for data collection, analysis, and design.
3	Recognize and apply problem-solving techniques for research.
4	Promote ethical practices in research.
5	Explore and illustrate the role of AI in research.

Course Outcomes (CO): On successful completion of course learner / student will be able to

Sr. No.	Course Outcome
CO1	Demonstrate knowledge about research concepts and methods.
CO2	Perform literature reviews and prepare key elements of a research proposal
CO3	Compare and explain the differences between quantitative and qualitative research.
CO4	Develop a research topic using specific research designs.
CO5	Understand the use of AI tools and plagiarism detection software in research writing.

Course Contents:

Module No.	Detailed Contents	Hrs.	CO No.

1	**Introduction to Research Methodology:** Meaning of Research, Objectives of Research, **Types and Approaches of Research**- Basic, Applied, Descriptive, Analytical, Qualitative, Quantitative, Significance of Research, Research Goals and Quality Research, Variables, Hypotheses and Data; Structure, Positivism and Post- Positivism; Scientific Methods, Reasoning and Arguments; Mathematical Methods of Proof and Research Fallacies.	**7**	**1**
2	**Computer Science Research Context**: Nature of Computer Science, Scientific Methods in Computer science, Types of Research in Computer Science, Research Methods in Computer Science, Research Paradigms in Computer Science, Grand Challenges for Computer Science Research.	7	2
3	**Measurements:** Sampling, External Validity, Levels of Measurement, Scaling and Qualitative Measures. Research Design: Internal Validity, Types of Designs, Experimental Design, Probabilistic Equivalence, Hybrid Experimental Designs and Quasi-Experimental Design.	**8**	**3**
4	**Sampling:** Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non-Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size.	**8**	**4**
5	**Data Analysis:** Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.	9	**5**
6	**Research Skills:** Reviewing Literature and Research Papers; Writing Research Papers, Thesis, Reports and Project Proposals; Formatting, Appendices, Citation Formats and Style; General Conventions, Issues, Plagiarism and Copyrights. **Report Writing and Ethical Research: Report Writing-** Steps in Preparing a Research Report, Types of Reports., Layout and Mechanics of Report Writing. **Ethics in Research-**Plagiarism, Citation, and Acknowledgments., Intellectual Property and Patent Filing Steps. **Using AI Tools in Research-**Tools for Idea Generation, Grammar, Plagiarism Detection, Citation, and Proofreading.	**7**	**6**
7	**Intellectual Property Rights (IPR)** Introduction to IPR: Role in Economic and Cultural Development., Types of IPR: Patents, Trademarks, Copyrights, Industrial Designs, Geographical Indications. **IP Ecosystem in India-**National Agencies: DPIIT, NRDC, Patent Facilitation Centres., Key Acts in India: Patents Act, Copyright Act, Trade Marks Act.	**5**	**7**

Text Books:

Reference No	Reference Name
1	Research Methodology: Methods and Techniques C.R. Kothari, Gaurav Garg New Age International 4th Edition, 2018
2	Research Methodology a step- by step guide for beginners. (For the topic Reviewing the literature under module 2) Ranjit Kumar SAGE Publications Ltd 3rd Edition, 2011
3	Study Material (For the topic Intellectual Property under module 5) Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013

Reference Books:

Reference No	Reference Name
1	Research Methods: the concise knowledge base Trochim Atomic Dog Publishing 2005
2	Conducting Research Literature Reviews: From the Internet to Paper Fink A Sage Publications 2009
3	Ranjit Kumar, Research Methodology: A step-by-step guide for beginners, Sage Publications, 2023.
4	Naval Bajpai, Business Statistics, Pearson Publication. 2010.
5	Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2012

Web References:

Reference No	Reference Name
1	NOC: Research Methodology, https://nptel.ac.in/courses/127106227
2	NOC: Research Methodology and IPR, https://onlinecourses.swayam2.ac.in/ntr24_ed08/previe w
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

Tutorials:

Sr. No.	Topic	Hrs
1	Identifying and formulating a research problem in the area of interest.	1
2	Conducting a review of relevant literature and presenting a case study of the research problem.	1
3	Developing an appropriate research design using a case study approach.	1
4	Planning and executing a sampling strategy for the research problem through a case study.	1

5	Selecting and applying appropriate techniques with a case study example.	1
6	Formulating hypotheses and identifying data collection methods using a case study.	1
7	Organizing, processing, and analyzing data for the research problem with a case study demonstration.	1
8	Applying hypothesis testing techniques using a case study as an example.	1
9	Interpreting findings and preparing a research report through a case study.	1
10	Overview of AI tools, including: o AI applications in research with case studies. o Using Google Scholar for AI-powered literature searches. o Utilizing Grammarly for plagiarism detection and grammar checking.	1

Assessment:

Continuous Assessment (CA): 20 marks

Following measures can be used for the continuous assessment as:

- Assessment consists of two CA of 20 marks.
- The first CA is to be conducted when approx. 30-40% of the syllabus is completed and second CA is to be conducted after completion of 100% syllabus.
- Duration of the class test shall be one hour.

MSE: 20 marks

- Assessment consists of one MSE of 20 marks.
- The MSE is to be conducted when approx. 50 -60% of the syllabus is completed.
- Duration of the class test shall be one hour.

Internal Semester Examination (ISE): 40 marks

- The Internal Assessment marks (out of 40) will be the total of the MSE and the continuous assessment.

Term Work: NA

- The term work will be based on the tutorial performance of the student.

End Semester Theory Examination: 60 Marks

1. Weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

Course Code	Course Name				
MCA31BS01	Mathematical Foundation for Computer Application-1				
Teaching Scheme: Contact Hours (Per Week)			Credits Assigned		
Theory	Tutorial	Total	Theory	Tutorial	Total
3	1	4	3	1	4
Examination Scheme (Marks)					
Internal Semester Examination (ISE)			End Sem. Examination (MSE)	Term Work	Total (Marks)
Continuous Assessment CA)	MSE	Total (IA) (CA+MSE)			
20	20	40	60	0	100

Pre-requisite: Student must know data collection and representation, Set theory, Basic principles of counting.

Course Objectives: Course aim to learn and perform

Sr. No.	Course Objective
1	Statistical measures on various types of data
2	Correlation and regression techniques for estimation
3	Probability aspects to take proper decision
4	Understand the concepts of random variable and expectation
5	Application of discrete and continuous probability distributions and Various methods of hypothesis testing

Course Outcomes (CO): On successful completion of course learner / student will be able to

Sr. No.	Course Outcome
CO1	Apply different statistical measures on various types of data
CO2	Evaluate using regression analysis.
CO3	Analyze different types of Probability and their applications.
CO4	Apply the concepts of random variables to expectation and
CO5	Apply probability distribution to real world problems and formulate and test the hypothesis for business problem using various methods

Course Contents:

Module No.	Detailed Contents	Hrs.	CO No.
1	**Introduction to measures of central tendency, dispersion and Skewness:** Central tendency of raw data, Discrete and grouped frequency data, Absolute measures and relative measures of dispersion, Karl Pearson's coefficient of skewness and Bowley coefficient of skewness **Self- Learning Topics:** Graphical representation of data and find various central tendencies of Real data	9	1

2	**Correlation and Regression:** **Correlation:** Karl Pearson's coefficient of correlation, Spearman's Rank correlation coefficient. **Regression:** Linear regression and two lines of regression. least square methods of linear regression. **Self-Learning Topics:** Apply correlation and regression on real world data and its graphical representation	9	2
3	**Introduction to probability & conditional probability:** Introduction to probability, Random experiment, Sample space, Events, Axiomatic Probability, Algebra of events. Conditional Probability, Multiplication theorem of Probability, Independent events, Bayes Theorem **Self-Learning Topics:** Applications based on Bayes theorem	9	3
4	**Random variable and Expectation:** Discrete random variable, Continuous random variable, Two-dimensional random variable, Joint probability distribution, Stochastic independence, Properties of Expectation and Variance, Covariance. **Self-Learning Topics:** Study of various random variables and its independence	9	4
5	**Theoretical probability distributions:** Binomial, Poisson, Normal. **Testing of hypothesis:** Hypothesis testing, Type I and Type II errors. Tests of significance–Student's t- test, large sample test (z-test), Chi-Square test **Self- Learning Topics:** Study of properties of standard normal variate **:** Study of elementary sampling methods.	9	5

Text Books:

Reference No	Reference Name
1	Jay L. Devore, Probability and Statistics for Engineering and the Sciences, 9th Edition
2	Dr. Anil Kumar Srivastava, A Text Book on Probability and Statistics.

Reference Books:

Reference No	Reference Name
1	S.C. Gupta, Fundamentals of Statistics, Himalaya Publishing house, 7th edition.
2	S.C. Gupta, V. K. Kapoor, S. Chand, Fundamentals of Mathematical Statistics,Sultam and Chand sons publication, First Edition
3	Kishore Trivedi, Probability and Statistics with Reliability, Queuing, And Computer Science Applications, PHI, First Edition

4	Schaum's Outline of Probability and Statistics, 4th Edition, 4th Edition By Murray Spiegel, R. Srinivasan and John Schiller
5	J.Susan Milton, Jesse C. Arnold, Introduction to Probability & Statistics, Tata Mc Graw Hill, Fourth Edition
6	Dr.J. Ravichandran, Probability & Statistics for Engineers, Wiley
7	Dr. Seema Sharma, Statistics for Business and Economics, Wiley
8	Ken Black, Applied Business Statistics, Wiley, Seventh Edition

Web References:

Reference No	Reference Name
1	IIT Kharagpur–Probability and Statistics by Dr. Somesh Kumar https://nptel.ac.in/courses/111105041/
2	IIT Madras – Introduction to Probability and Statistics by Dr. G. Srinivasan https://nptel.ac.in/courses/111/106/111106112/
3	IIT Kanpur – Descriptive Statitics with R Software by Prof. Shalabh https://nptel.ac.in/courses/111/104/111104120/
4	IIT Roorkee – Business Statistics by Prof. Mukesh Kumar Barua https://nptel.ac.in/courses/110/107/110107114/
5	MIT – Introduction to Probability and statistics by Jeremy Orloff and Jonathan Bloomhttps://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/index.htm
6	An Introduction to Statistical Learning with Applications in R by Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani http://faculty.marshall.usc.edu/gareth-james/ISL/data.html

Tutorials:

Sr. No.	Topic	Hrs
1	Find Mean, median, mode and coefficient of deviation of given data	1
2	Find Karl Pearson's coefficient of skewness and Bowley's coefficient of skewness	1
3	Calculate Karl Pearson's coefficient of correlation	1
4	To fit linear regression and estimate	1
5	Examples on addition and multiplication theorem of probability	1
6	Examples based on Bayes‟ theorem	1
7	Examples based on independence of discrete random variables.	1
8	Examples based on independence of continuous random variables.	1
9	Example on Poisson distribution	1
10	Example on normal distribution	1
11	Example on t-test	1
12	Example on Chi-square test	1

Assessment:

Continuous Assessment (CA): 20 marks

Following measures can be used for the continuous assessment as:

- Assessment consists of two CA of 20 marks.
- The first CA is to be conducted when approx. 30-40% of the syllabus is completed and second CA is to be conducted after completion of 100% syllabus.
- Duration of the class test shall be one hour.

MSE: 20 marks

- Assessment consists of one MSE of 20 marks.
- The MSE is to be conducted when approx. 50 -60% of the syllabus is completed.
- Duration of the class test shall be one hour.

Internal Semester Examination (ISE): 40 marks

- The Internal Assessment marks (out of 40) will be the total of the MSE and the continuous assessment.

Term Work: NA

- The term work will be based on the tutorial performance of the student.

End Semester Theory Examination: 60 Marks

1. Weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

Semester – II

Course Code	Course Name				
MCA32PC07	Artificial Intelligence and Machine Learning				
Teaching Scheme: Contact Hours (Per Week)			Credits Assigned		
Theory	Tutorial	Total	Theory	Tutorial	Total
3	–	3	3	–	3
Examination Scheme (Marks)					
Internal Semester Examination (ISE)			End Sem. Examination (MSE)	Term Work	Total (Marks)
Continuous Assessment CA)	MSE	Total (IA) (CA+MSE)			
20	20	40	60	0	100

Pre-requisite:

- Advanced Database Management System
- Mathematical Foundation for Computer Science

Course Objectives: The course aims to

Sr. No.	Course Objective
1	Understand different AI concepts and Develop an understanding of problem-solving techniques in Artificial I
2	Acquire knowledge of artificial intelligence search strategies.
3	Learn to design and build neural network models
4	Provide an understanding of the foundational principles of Machine Learning Techniques
5	Understand how to enhance accuracy and resilience in forecasting by merging predictions from multiple models

Course Outcomes (CO): On successful completion of course learner / student will be able to

Sr. No.	Course Outcome
CO1	Understand different AI concepts and Develop an understanding of problem-solving techniques in Artificial Intelligence
CO2	Apply Artificial intelligence techniques for problem-solving and acquire knowledge of artificial intelligence search strategies
CO3	Identify and analyze different types of models of artificial neural networks
CO4	Analyze the fundamentals of machine learning, the learning algorithms, and the paradigms of supervised and unsupervised learning
CO5	Analyze and interpret the predictive performance of machine learning models

Course Contents:

Module No.	Detailed Contents	Hrs.	CO No.
1	**Introduction:** Artificial Intelligence, Application of AI, AI Problems, Problem Formulation, Intelligent Agents, Types of Agents, Agent Environments, PEAS representation for an Agent, Architecture of Intelligent Agents. Syntax & Semantic for Propositional logic, Syntax & Semantic for First Order Predicate Logic, Properties for Well-Formed Formula (WFF), Resolution: Resolution Basics, Conversion to clausal form, Resolution of proposition logic, Unification of predicates. **Self-Study Topics:** Expert systems	9	CO1
2	**Search Strategies:** Solving problems by searching, Search- Issues in the Design of Search Programs, UnInformed Search- BFS, DFS; Informed Search (Heuristic Search Techniques) - Generate-And- Test, Hill Climbing, Best-First Search, A* Algorithm, Alpha-beta search algorithm, Problem Reduction, AO*Algorithm, Constraint Satisfaction, Means-Ends Analysis **Self-Study Topics:** Tabu search	9	CO2
3	**Neural Networks:** Neural Networks- Introduction to Neural Networks, Model of Artificial Neuron, Learning rules, and various activation functions. Perceptron Networks, Adaline, Multilayer Perceptrons, Optimization algorithm- Gradient decent, Tuning the Network Size **Self-Study Topics:** Maxnet algorithm	9	CO3
4	**Introduction to Machine Learning:** Introduction. Motivation and role of machine learning in computer science and problem-solving, Different types of learning, Hypothesis space and inductive bias, Training and test sets, cross-validation, Evaluation Confusion Matrix, Precision, Recall Bias and Variance, Concept of overfitting, underfitting, Parameters, Hyper parameters Feature Selection: forward search, backward search, univariate, multivariate feature selection approach, Feature reduction (Principal Component Analysis) Supervised Learning and Unsupervised Learning, Introduction to reinforcement learning **Self-Study Topics:** Density Based Clustering, Kmedoid, Feature selection – feature ranking and subset selection	9	CO4

5	**Forecasting and Learning Theory:** Regression: Non-linear regression, Logistic regression, Probability and Bayes Learning: Bayesian Learning, Naïve Bayes, Bayesian Belief networks, Introduction, Optimal Separating Hyperplane, Separating data with 8 CO5 7,8, 9,10 82 maximum margin, Support Vector Machine (SVM), Finding the maximum margin, The Non-Separable Case: Soft Margin Hyperplane, Kernel Trick, Defining Kernels Clustering: Expectation – Maximization Algorithm, Supervised Learning after Clustering, Choosing the number of clusters Bias/variance tradeoff, Tuning Model Complexity **Self-Study Topics:** Maximum Likelihood Estimation	**9**	CO5

Reference Books:

Reference No	Reference Name
1	George F Luger, Artificial Intelligence, Fifth Edition-2009, Pearson Education Publications ,ISBN-978-81-317-2327-2
2	Stuart Russell, Peter Norvig, Artificial Intelligence – A Modern Approach, , Pearson Education / Prentice Hall of India, 3rd Edition, 2009.ISBN- 13: 9780136042594
3	Elaine Rich, Kevin Knight, S.B. Nair, Artificial Intelligence, 3rd Edition, Tata McGraw Hill-2008., ISBN 10: 0070087709 / ISBN 13: 9780070087705
4	Anandita Das, Artificial Intelligence and Soft Computing for Beginners-,2nd Edition, Shroff Publication, ISBN- 9789351106159
5	Nils J. Nilsson, Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers, Harcourt Asia Pvt. Ltd., 2000, ISBN-1-55860-535- 5
6	Kumar Satish, Neural Networks, Second edition Tata McGraw Hill-,2013, ISBN1259006166, 9781259006166

Web References:

Reference No	Reference Name
1	nptel.ac.in-A first course in Artificial Intelligence-Deepak Khemani,
2	nptel.ac.in -Introduction to machine learning – Balaraman Ravindran, IIT Madras

Assessment:

Continuous Assessment (CA): 20 marks

Following measures can be used for the continuous assessment as:

- Assessment consists of two CA of 20 marks.
- The first CA is to be conducted when approx. 30-40% of the syllabus is completed and second CA is to be conducted after completion of 100% syllabus.
- Duration of the class test shall be one hour.

MSE: 20 marks

- Assessment consists of one MSE of 20 marks.
- The MSE is to be conducted when approx. 50 -60% of the syllabus is completed.
- Duration of the class test shall be one hour.

Internal Semester Examination (ISE): 40 marks

- The Internal Assessment marks (out of 40) will be the total of the MSE and the continuous assessment.

Term Work: NA

- The term work will be based on the tutorial performance of the student.

End Semester Theory Examination: 60 Marks

1. Weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

Course Code	Course Name				
MCA32PC08	Artificial Intelligence and Machine Learning Lab				
Contact Hours (Per Week)	Credits Assigned	Examination Scheme (Marks)			
		Term Work	Continuous Assessment (CA)	End Semester Examination (ESE)	Total
2	2	-	25	25	50

Pre-requisite: Basic knowledge of Mathematics, Statistics and Data Mining concepts.

Lab Course Objectives:

Sr. No.	Course Objective
1	Understand problem solving concepts of Artificial Intelligence..
2	Implement Artificial Neural Network algorithms
3	Understanding and implementing different feature extraction and selection techniques
4	Impart a thorough understanding of basic Machine Learning algorithms and its applications
5	Build model using appropriate Machine Learning algorithms for real world problems

Lab Course Outcomes (CO): On successful completion of course learner/student will be able to

Sr. No.	Course Outcome
CO1	Apply the basic concepts of Artificial Intelligence and its applications using PROLOG..
CO2	Understand basics of Python Programming language and Implement Artificial Neural Network algorithms
CO3	Analyze data preprocessing techniques for feature extraction and selection.
CO4	Develop models using appropriate Machine Learning algorithms for real world problems.

Continuous Assessment (CA):

Term Work: Will be based on Continuous Assessment

- Laboratory work will be based on the syllabus with minimum 13 experiments. The experiments should be completed in the allotted time duration.
- Practical will be evaluated by the subject teacher and documented according to a rubric

End Semester Practical Examination:

Practical and oral examination will be based on suggested practical list and entire syllabus.

Reference Books:

Reference No	Reference Name
1	Aurelian Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition.
2	Paul J. Deitel, Python Fundamentals
3	Stuart Russell, Peter Norvig ,Artificial Intelligence – A Modern Approach, Pearson Education / Prentice Hall of India, 3rd Edition, 2009
4	EthemAlpaydın, Introduction to Machine Learning, PHI, Third Edition, ISBN No. 978-81-203- 5078-6
5	Peter Harrington, Machine Learning in Action. Manning Publications, April 2012ISBN 9781617290183

Web References:

Reference No	Reference Name
1	https://talentsprint.com/pages/artificial-intelligence-machine-learningiiit-hprogram/program-details.pdf
2	https://learning.oreilly.com/library/view/learning-robotics using/9781783287536/cover.html
3	http://www.qboticslabs.com
4	https://subscription.packtpub.com/book/big_data_and_business_intelli gence
5	https://scikit-learn.org/0.16/modules/generated/sklearn.lda. LDA.html

Suggested list of experiments:

Practical No	Problem Statement
1	Implementation of Logic programming using PROLOG DFS for water jug problem
2.	Implementation of Logic programming using PROLOG BFS for tic-tac-toe problem
3	Implementation of Logic programming using PROLOG Hill-climbing to solve 8- Puzzle Problem
4	Introduction to Python Programming: Learn the different libraries - NumPy, Pandas, SciPy, Matplotlib, Scikit Learn.
5	Implement Perceptron algorithm for OR operation
6	Improve the prediction accuracy by estimating the weight values for the training data using stochastic gradient descent.(Perceptron)
7	Implement Adaline algorithm for AND operation
8	Implementation of Features Extraction and Selection, Normalization, Transformation, Principal Components Analysis
9	Implementation of Logistic regression

10	Implementation of Classifying data using Support Vector Machine (SVM).
11	Implement Elbow method for K means Clustering
12	Implementation of Bagging Algorithm: Random Forest
13	Implementation of Boosting Algorithms: AdaBoost, Stochastic Gradient Boosting, Voting Ensemble

Note: At least 12 programs

Course Code	Course Name				
MCA32PE01	Natural Language Processing				
Teaching Scheme: Contact Hours (Per Week)			Credits Assigned		
Theory	Tutorial	Total	Theory	Tutorial	Total
2	0	2	2	0	2
Examination Scheme (Marks)					
Internal Semester Examination (ISE)			End Sem. Examination (MSE)	Term Work	Total (Marks)
Continuous Assessment CA)	MSE	Total (IA) (CA+MSE)			
20	20	40	60	0	100

Pre-requisite: Student must know basic knowledge of OOP concepts.

Course Objectives: Course aim to learn and perform

Sr. No.	Course Objective
1	To introduce students to the principles and challenges of NLP and its applications in both classical and modern contexts.
2	To explore foundational tasks such as morphological analysis, syntactic parsing, and semantic analysis, and advanced NLP applications like text summarization, sentiment analysis, and opinion mining.
3	To familiarize students with grammar formalisms, language models, and tools used in computational linguistics.
4	To equip students with hands-on knowledge of statistical, machine learning, and rule-based approaches to NLP tasks.
5	To explore real-world applications like text summarization, sentiment analysis, and opinion mining.

Course Outcomes (CO): On successful completion of course learner / student will be able to

Sr. No.	Course Outcome
CO1	Understand fundamental concepts, tasks, and challenges in NLP.
CO2	Implement core NLP techniques, such as tokenization, POS tagging, parsing, and word-sense disambiguation.
CO3	Design and analyze NLP models using advanced algorithms and frameworks.
CO4	Explore state-of-the-art approaches in semantic analysis, sentiment analysis, and multilingual NLP tasks.
CO5	Analyze and evaluate real-world NLP applications like sentiment analysis and text summarization.

Course Contents:

Module No.	Detailed Contents	Hrs.	CO No.

1	**Introduction to NLP:** History and evolution of NLP **Applications:** Speech-to-Text (STT), Text-to-Speech (TTS), Machine Translation, Text Summarization, Question Answering, Sentiment Analysis, Grammar/Spell Checkers, Information Retrieval, and Named Entity Recognition (NER), **Challenges in NLP**: Ambiguity, Resource scarcity, Multilingualism, **NLP Abstraction Levels**: Morphological, syntactic, semantic, and pragmatic, **Overview of NLP tasks:** Tokenization, Segmentation, Chunking, Parsing, NER, WSD **Self-Learning Topics:** Python libraries for NLP (NLTK, spaCy)	5	1
2	**Word-Level and Morphological Analysis:** **Morphology**: Inflectional vs. derivational morphology, Tokenization, Stemming and Lemmatization, Stop Word removal, Regular Expressions, Finite-State Automata (FSA), and Finite-State Transducers (FST), Morphological Parsing: Rule-based and Paradigm-based approaches, Porter Stemming Algorithm. **N-gram Language Models**: Definition, Types (Unigram, Bigram, Trigram), Smoothing techniques and spelling correction using N-grams. Language-specific challenges (English vs. Indian Languages) **Self-Learning Topics:** Morphological analysis using ML approaches	**8**	2
3	**Syntax Analysis:** Part-Of-Speech tagging(POS)-Tag set for English (Penn Treebank) , Rule based POS tagging, Stochastic POS tagging, Issues –Multiple tags & words, Unknown words. Named Entity Recognition (NER), Introduction to CFG, Sequence labeling: Markov Model, Hidden Markov Model (HMM) **Self learning topics:** WordNet	**8**	3
4	**Semantic Analysis:** Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses –Homonymy, Polysemy, Synonymy, Hyponymy, Bag of Words (BoW), Term Frequency-Inverse Document Frequency (TF-IDF), Word embeddings (Word2Vec, GloVe), Robust Word Sense Disambiguation (WSD), Dictionary based approach **Self-Learning Topics:** Word2Vec Model	**7**	4
5	Advanced NLP Applications and Language Modeling: **Text Processing Applications**: Text Summarization (e.g., LEXRANK) and evaluation techniques, Text Classification (e.g., Naïve Bayes) **Sentiment Analysis and Opinion Mining**: Lexicon-based and machine learning-based approaches, Aspect-based Sentiment Analysis (ABSA) **Self-Learning Topics:** Transformer-based pre-trained models and their applications	**6**	5

Text Books:

Reference No	Reference Name
1	**Jurafsky, D., & Martin, J. H. (2020)**. *Speech and Language Processing* (3rd Edition). Pearson Education.
2	**Indurkhya, N., & Damerau, F. J. (2010)**. *Handbook of Natural Language Processing* (2nd Edition). CRC Press.

Reference Books:

Reference No	Reference Name
1	Manning, C., & Schutze, H. (1999). *Foundations of Statistical Natural Language Processing*. MIT Press.
2	Bharati, A., Chaitanya, V., & Sangal, R. (1995). *Natural Language Processing: A Paninian Perspective*. Prentice Hall India.
3	Steven Bird, Ewan Klein, & Edward Loper (2009). *Natural Language Processing with Python*. O'Reilly Media.
4	Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.CRC Press Taylor and Francis Group Siddiqui and Tiwary U.S., Natural Language Processing and Information Retrieval, Oxford University Press (2008).

Web References:

Reference No	Reference Name
1	Stanford NLP Course: https://see.stanford.edu/Course/CS224N
2	Stanford NLP Slides: https://web.stanford.edu/~jurafsky/NLPCourseraSlides.html
3	ACL Resources: https://stp.lingfil.uu.se/~nivre/docs/ACLslides.pdf
4	NPTEL NLP Lectures: http://www.nptelvideos.in/2012/11/natural-language-processing.html
5	YouTube Playlist on NLP: https://www.youtube.com/playlist?list=PL6397E4B26D00A269

Assessment:

Continuous Assessment (CA): 20 marks

Following measures can be used for the continuous assessment as:

- Assessment consists of two CA of 20 marks.
- The first CA is to be conducted when approx. 30-40% of the syllabus is completed and second CA is to be conducted after completion of 100% syllabus.
- Duration of the class test shall be one hour.

MSE: 20 marks

- Assessment consists of one MSE of 20 marks.
- The MSE is to be conducted when approx. 50 -60% of the syllabus is completed.
- Duration of the class test shall be one hour.

Internal Semester Examination (ISE): 40 marks

- The Internal Assessment marks (out of 40) will be the total of the MSE and the continuous assessment.

Term Work: NA

- The term work will be based on the tutorial performance of the student.

End Semester Theory Examination: 60 Marks

1. Weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

Course Code	Course Name				
MCA32PE02	UI/UX Design				
Teaching Scheme: Contact Hours (Per Week)			Credits Assigned		
Theory	Tutorial	Total	Theory	Tutorial	Total
2	0	2	2	0	2
Examination Scheme (Marks)					
Internal Semester Examination (ISE)			End Sem. Examination (MSE)	Term Work	Total (Marks)
Continuous Assessment CA)	MSE	Total (IA) (CA+MSE)			
20	20	40	60	0	100

Pre-requisite: Student must know data collection and representation, Set theory, Basic principles of counting.

Course Objectives: Course aim to learn and perform

Sr. No.	Course Objective
1	The course emphasizes the understanding of the fundamentals of relational systems including data models, database architectures, and database manipulations.
2	To develop conceptual understanding of database management system
3	To understand how a real-world problem can be mapped to schemas
4	To educate students with different Database Languages.
5	Understand the needs of database processing and learn techniques for controlling the consequences of concurrent data access.

Course Outcomes (CO): On successful completion of course learner / student will be able to

Sr. No.	Course Outcome
CO1	To analyze Database design methodology.
CO2	Acquire knowledge of fundamentals of Database Management System.
CO3	Analyze the difference between traditional file system and DBMS.
CO4	To deal with different Database languages.
CO5	Draw various data models for Database, writing and executing queries to get expected results.

Course Contents:

Module No.	Detailed Contents	Hrs.	CO No.
1	**Fundamentals of Visual Design:** Elements of design, Organisational principles of composition, Type anatomy & typesetting, Communication through colour, Project – type-based poster and social media creative	7	1
2	**Design for Digital:** Visual design system for a brand, Visual persuasion, Storyboarding, Combining type and images / type and icons, Design for social media, Project – visual storytelling for social media	7	2

3	**Fundamentals of UX Design:** Information architecture and sitemaps, User journey maps, Understanding navigation, **Interaction design:** task flows, Overview of grids & page types, Developing low/high fidelity wireframes,	5	3
4	**Visual Design and UI:** Principles of visual design, including Gestalt Theory, Color & typography for UI, Interactions and micro-interactions, Understanding various sections of a screen (Web, iOS and Android), Converting wireframes into high fidelity visual design, **Design for devices:** understanding web & mobile	5	4
5	**UX Strategy:** **Information modelling:** hierarchies and relationship Gathering requirements, working with content: inventory, sorting, schema, labelling, way-finding, Overview of e-commerce platforms, Understanding mobile apps, Design process, Introduction to project management, **Brand strategy:** business goal, purpose, values, audience, persona and positioning **Elements of visual identity:** typography, color, iconography, patterns	8	5

Text Books:

Reference No	Reference Name
1	Ramakrishnam, Gehrke, Database Management Systems, Bayross, McGraw-Hill,3rd Edition
2	Ivan Bayross, "SQL,PL/SQL -The Programming language of Oracle", B.P.B. Publications

Reference Books:

Reference No	Reference Name
1	Designing Interfaces: Patterns for Effective Interaction Design" by Jenifer Tidwell, Charles Brewer, and Aynne Valencia
2	Universal Principles of Design" by William Lidwell, Kritina Holden, and Jill Butler
3	UX Research: Practical Techniques for Designing Better Products" by Brad Nunnally and David Farkas
4	Sketching User Experiences: The Workbook" by Bill Buxton, Saul Greenberg, Sheelagh Carpendale, and Nicolai Marquardt

Web References:

Reference No	Reference Name
1	https://www.nngroup.com
2	https://intellipaat.com/ui-ux-design-course
3	https://www.geeksforgeeks.org/difference-between-ui-and-ux-design

Assessment:

Continuous Assessment (CA): 20 marks

Following measures can be used for the continuous assessment as:

- Assessment consists of two CA of 20 marks.
- The first CA is to be conducted when approx. 30-40% of the syllabus is completed and second CA is to be conducted after completion of 100% syllabus.
- Duration of the class test shall be one hour.

MSE: 20 marks

- Assessment consists of one MSE of 20 marks.
- The MSE is to be conducted when approx. 50 -60% of the syllabus is completed.
- Duration of the class test shall be one hour.

Internal Semester Examination (ISE): 40 marks

- The Internal Assessment marks (out of 40) will be the total of the MSE and the continuous assessment.

Term Work: NA

- The term work will be based on the tutorial performance of the student.

End Semester Theory Examination: 60 Marks

1. Weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

Course Code	Course Name				
MCA32PE03	Microsoft .Net Technologies using C#				
Teaching Scheme: Contact Hours (Per Week)			Credits Assigned		
Theory	Tutorial	Total	Theory	Tutorial	Total
2	0	2	2	0	2
Examination Scheme (Marks)					
Internal Semester Examination (ISE)			End Sem. Examination (MSE)	Term Work	Total (Marks)
Continuous Assessment CA)	MSE	Total (IA) (CA+MSE)			
20	20	40	60	0	100

Pre-requisite: Student must know data collection and representation, Set theory, Basic principles of counting.

Course Objectives: Course aim to learn and perform

Sr. No.	Course Objective
1	Introduction of whole asp.net with C#
2	Using of all standard controls if .net
3	Learning about rich controls
4	Understand how build a master page website using .net
5	ADO.net Fundamentals and architecture

Course Outcomes (CO): On successful completion of course learner / student will be able to

Sr. No.	Course Outcome
CO1	Students will be able to identify and describe the core concepts of ASP.NET, C.
CO2	Students will be able to develop dynamic and interactive web applications by applying ASP.NET controls.
CO3	Students will be able to define and describe the purpose and functionality of rich controls in ASP.NET using C#.
CO4	Students will be able to analyze user requirements and database needs to design efficient, scalable, and secure web applications using ASP.NET
CO5	Students will be able to develop dynamic and interactive web applications by applying ASP.NET controls, C# programming concepts, and ADO.NET for database operations.

Course Contents:

Module No.	Detailed Contents	Hrs.	CO No.

1	**Introduction of ASP.Net:** • HTTP ,Web Environment, Web Applications, Related and Alternative technologies • ASP.NET Architecture, Control-based Programming, User Interface Elements Web Page , Web Page Lifecycle (ASP.NET), Page Controls • Page & Session and Application State Management, Overview of events in page • Validation (Required Field Validator Control, Regular Expression Validator Control, Compare Field Validator Control, Range Validator Control, Validation Summary Control, Custom Validator Control)	9	1
2	**Standard Controls:** Displaying information ,Label Controls ,Literal Controls ,Bulleted List ,Accepting User Input ,Textbox controls ,Radio Button and Radio Button List Controls ,Check Box and Check Box List Controls ,Button controls , Link Button Control, Image Button Control, Using Hyperlink Control, Drop Down List, List Box, Displaying Images, Image Control ,Image Map Control, Using Panel Control, Using Hyperlink Control	8	2
3	**Using the Rich Controls:** Accepting File Uploads, saving files to filesystem, Calendar Control, displaying advertisements, Displaying Different Pageview, Displaying a Tabbed Page View, Wizard Control	5	3
4	**Designing Websites with master pages:** Creating master pages, creating default contents, Nesting master pages, Registering master pages in web configuration **Understanding Site Maps**: Using the Sitemap Path Control, Formatting the Sitemap Path Control, Using the Menu Control, Using Tree View Control	5	4
5	**Fundamentals of ADO.Net :** ADO.Net architecture, Connection Class, Command Class, Data Reader Class, Transactions , Data Components and Data Set , Building Data Access Component , Disconnected Data , Data Set , Data Adapter , Data View	7	5

Text Books:

Reference No	Reference Name
1	Murach's ASP.NET 4 Web Programming with C# 2010, 4th Edition, Anne Boehm, JoelMurach,SPD
2	C# and ASP.NET Projects, by ShivprasadKoirala, Rajesh Pillai, Pravin Joshi , Publisher: BPB,ISBN-13:978-8183332170

Reference Books:

Reference No	Reference Name

1	Practical ASP.NET 3.5 Projects for Beginners: 1 (X-Team)by B. M. Harwani,Shroff Publishers,ISBN-13:978-8184047073
2	ASP.NET 4.0 programming, J. Kanjilal, TataMcGraw-Hill
3	Programming ASP.NET, D.Esposito, Microsoft Press (Dreamtech), Reprint 2011. ASP.N
4	.NET 4.5 Programming 6-in-1, Black Book, by Kogent Learning Solutions Inc., Publisher: Dreamtech Press, ISBN-13:978-9350045107

Web References:

Reference No	Reference Name
1	Introduction to ASP.Net with C# https://www.w3schools.com/asp/default.ASP
2	.net Variables https://www.w3schools.com/asp/razor_cs_variables.asp
3	ASP.Net page life cycle and Life Cycle Events https://www.javatpoint.com/asp-net-life-cycle
4	ADO.Net introduction https://www.javatpoint.com/ado-net-introduction
5	ADO.Net Data set https://www.tutorialspoint.com/asp.net/asp.net_ado_net.htm

Assessment:

Continuous Assessment (CA): 20 marks

Following measures can be used for the continuous assessment as:

- Assessment consists of two CA of 20 marks.
- The first CA is to be conducted when approx. 30-40% of the syllabus is completed and second CA is to be conducted after completion of 100% syllabus.
- Duration of the class test shall be one hour.

MSE: 20 marks

- Assessment consists of one MSE of 20 marks.
- The MSE is to be conducted when approx. 50 -60% of the syllabus is completed.
- Duration of the class test shall be one hour.

Internal Semester Examination (ISE): 40 marks

- The Internal Assessment marks (out of 40) will be the total of the MSE and the continuous assessment.

Term Work: NA

- The term work will be based on the tutorial performance of the student.

End Semester Theory Examination: 60 Marks

1. Weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

Course Code	Course Name				
MCA32PE07	Data Science				
Teaching Scheme: Contact Hours (Per Week)			Credits Assigned		
Theory	Tutorial	Total	Theory	Tutorial	Total
2	0	2	2	0	2
Examination Scheme (Marks)					
Internal Semester Examination (ISE)			End Sem. Examination (MSE)	Term Work	Total (Marks)
Continuous Assessment CA)	MSE	Total (IA) (CA+MSE)			
20	20	40	60	0	100

Pre-requisite: Machine Learning, Data Structures & Algorithms.

Course Objectives: Course aim to learn and perform

Sr. No.	Course Objective
1	To introduce students to the basic concepts of data science.
2	To acquire an in-depth understanding of data exploration and data visualization.
3	To be familiar with various anomaly detection techniques.
4	To understand the data science techniques for different applications.

Course Outcomes (CO): On successful completion of course learner / student will be able to

Sr. No.	Course Outcome
CO1	To gain fundamental knowledge of the data science process.
CO2	To apply data exploration and visualization techniques.
CO3	To apply anomaly detection techniques.
CO4	To gain an in-depth understanding of time-series forecasting.
CO5	Apply different methodologies and evaluation strategies and To apply data science techniques to real world applications.

Course Contents:

Module No.	Detailed Contents	Hrs.	CO No.
1	**Introduction to Data Science:** **Introduction to Data Science:** Introduction to Data Science, Data Science Process **Motivation to use Data Science Techniques:** Volume, Dimensions and Complexity, Data Science Tasks and Examples, Overview of Data Preparation, Modeling, Difference between data science and data analytics **Self-Learning Topics:** Difference between data science. Data mining and data warehouse.	6	1

2	**Data Exploration:** Types of data, Properties of data **Descriptive Statistics:** Univariate Exploration: Measure of Central Tendency, Measure of Spread, Symmetry, Skewness: Karl Pearson Coefficient of skewness, Bowley's Coefficient, Kurtosis Multivariate Exploration: Central Data Point, Correlation, Different forms of correlation, Karl Pearson Correlation Coefficient for bivariate distribution. **Inferential Statistics:** Overview of Various forms of distributions: Normal, Poisson, Test Hypothesis, Central limit theorem, Confidence Interval, Z-test, t-test, Type-I, Type-II Errors **Self-Learning Topics:** ANOVA	6	2
3	**Methodology and Data Visualization:** **Methodology:** Overview of model building, Cross Validation, K-fold cross validation, leave-1 out, Bootstrapping. **Data Visualization:** Univariate Visualization: Histogram, Quartile, Distribution Chart Multivariate Visualization: Scatter Plot, Scatter Matrix, Bubble chart, Density Chart, Roadmap for Data Exploration **Self-Learning Topics:** Visualizing high dimensional data: Parallel chart, Deviation chart, Andrews Curves.	6	3
4	**Anomaly Detection:** Outliers, Causes of Outliers, Anomaly detection techniques, Outlier Detection using Statistics, Outlier Detection using Distance based method, Outlier detection using density-based methods, SMOTE **Self-Learning Topics:** SMOTE using Python	6	4
5	**Time Series Forecasting:** Taxonomy of Time Series Forecasting methods, Time Series Decomposition. **Smoothening Methods:** Average method, Moving Average smoothing, Time series analysis using linear regression, ARIMA Model **Performance Evaluation:** Mean Absolute Error, Root Mean Square Error, Mean Absolute Percentage Error, Mean Absolute Scaled Error **Self-Learning Topics:** Evaluation parameters for Classification, regression and clustering.	6	5

Text Books:

Reference No	Reference Name
1	Vijay Kotu, Bala Deshpande, Data Science Concepts and Practice‖, Elsevier, M.K. Publishers.
2	Samir Madhavan, Mastering Python for Data Science, PACKT Publishing.

Reference Books:

Reference No	Reference Name

1	Jake VanderPlas, Python Data Science Handbook‖, O'reilly Publications.
2	Francesco Ricci, LiorRokach, BrachaShapira, Paul B. Kantor, Recommender Systems Handbook, Springer.
3	S.C. Gupta, V. K. Kapoor, Fundamentals of Mathematical Statistics‖, S. Chand and Sons, New Delhi.

Web References:

Reference No	Reference Name
1	https://onlinecourses.nptel.ac.in/noc22_cs32/preview
2	https://onlinecourses.nptel.ac.in/noc21_cs69/preview

Assessment:

Continuous Assessment (CA): 20 marks

Following measures can be used for the continuous assessment as:

- Assessment consists of two CA of 20 marks.
- The first CA is to be conducted when approx. 30-40% of the syllabus is completed and second CA is to be conducted after completion of 100% syllabus.
- Duration of the class test shall be one hour.

MSE: 20 marks

- Assessment consists of one MSE of 20 marks.
- The MSE is to be conducted when approx. 50 -60% of the syllabus is completed.
- Duration of the class test shall be one hour.

Internal Semester Examination (ISE): 40 marks

- The Internal Assessment marks (out of 40) will be the total of the MSE and the continuous assessment.

Term Work: NA

- The term work will be based on the tutorial performance of the student.

End Semester Theory Examination: 60 Marks

1. Weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

Course Code	Course Name				
MCA32PE08	Blockchain Technology				
Teaching Scheme: Contact Hours (Per Week)			Credits Assigned		
Theory	Tutorial	Total	Theory	Tutorial	Total
2	--	2	2	--	2
Examination Scheme (Marks)					
Internal Semester Examination (ISE)			End Sem. Examination (MSE)	Term Work	Total (Marks)
Continuous Assessment CA)	MSE	Total (IA) (CA+MSE)			
20	20	40	60	0	100

Pre-requisite: Student must know data collection and representation, Set theory, Basic principles of counting.

Course Objectives: Course aim to learn and perform

Sr. No.	Course Objective
1	To provide conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
2	To cover the technological underpinnings of blockchain operations as distributed data structures and decision-making systems, their functionality and different architecture types.
3	To provide a critical evaluation of existing "smart contract capabilities and platforms, and examine their future directions, opportunities, risks and challenges.

Course Outcomes (CO): On successful completion of course learner / student will be able to

Sr. No.	Course Outcome
CO1	Ability to conceptualize and implement blockchain solutions tailored to specific business needs, identifying opportunities to increase transparency, reduce fraud, and improve efficiency.
CO2	Ability to explain how blockchain functions in a decentralized, secure environment.
CO3	Understanding of cryptographic techniques and how they ensure the integrity, confidentiality, and security of blockchain transactions.
CO4	Students will gain practical experience using popular blockchain platforms such as Bitcoin, Ethereum, Hyperledger, and others, with an emphasis on smart contracts, decentralized applications (dApps), and token creation.
CO5	Students will have a clear understanding of the fundamental concepts behind blockchain technology, including its architecture, key components (blocks, chains, nodes), and consensus mechanisms (e.g., Proof of Work, Proof of Stake).

Course Contents:

Module No.	Detailed Contents	Hrs.	CO No.

1	**Blockchain:** Introduction, History, Centralised versus Decentralised systems, Layers of blockchain, Importance of blockchain, Blockchain uses and use cases. **Working of Blockchain:** Blockchain foundation Cryptography, Game Theory, Computer Science Engineering. Properties of blockchain solutions, blockchain transactions, distributed consensus mechanisms, Blockchain mechanisms, Scaling blockchain **Working of Bitcoin:** Money, Bitcoin, Bitcoin blockchain, bitcoin network, bitcoin scripts, Full Nodes and SVPs. Bitcoin wallets.	6	CO1
2	**Ethereum:** three parts of blockchain, Ether as currency and commodity. Building trustless systems, Smart contracts. Ethereum Virtual Machine. The Mist browser, Wallets as a Computing Metaphor, The Bank Teller Metaphor, Breaking with Banking History, How Encryption Leads to Trust, System Requirements, Using Parity with Geth, Anonymity in Cryptocurrency, Central Bank Network, Virtual Machines, Applications, EVM State Machines, Guts of the EVM. Blocks, Mining's Place in the State Transition Function, Renting Time on the EVM. Gas. Working with Gas, Accounts, Transactions, and Messages,Transactions and Messages, Estimating Gas Fees for Operations, Opcodes in the EVM Solidity Programming: Introduction, Global Banking Made Real, Complementary Currency, Programming the EVM, Design Rationale, Importance of Formal Proofs, Automated Proofs, Testing, Formatting Solidity Files, Reading Code, Statements and Expressions in Solidity, Value Types, Global Special Variables, Units, and Functions,	**6**	**CO2**
3	**Hyperledger:** Overview, Fabric, composer, installing hyperledger fabric and composer, deploying, running the network, error troubleshooting **Smart Contracts and Tokens:** EVM as Back End. Assets Backed by Anything. Cryptocurrency Is a Measure of Time, Function of Collectibles in Human Systems, Platforms for High-Value Digital Collectibles, Tokens as Category of Smart Contract, Creating a Token. Deploving the Contract. Plaving with Contracts.	**6**	**CO3**
4	**Mining Ether:** Why? Ether's Source, Defining Mining, Difficulty, Self-Regulation, and the Race for Profit, How Proof of Work Helps Regulate Block Time, DAG and Nonce, Faster Blocks, Stale Blocks, Difficulties, Ancestry of Blocks and Transactions, Ethereum and Bitcoin, Forking, Mining, Geth on Windows, Executing Commands in the EVM via the Geth Console. Launching Geth with Flags, Mining on the Testnet, GPU Mining Rigs, Mining on a Pool with Multiple GPUs. **Cryptoecnomics:** Introduction, Usefulness of cryptoeconomics, Speed of blocks, Ether Issuance scheme. Common Attack Scenarios.	**6**	**CO4**

5	**Blockchain Application Development**: Decentralized Applications, Blockchain Application Development, Interacting with the Bitcoin Blockchain, Interacting Programmatically with Ethereum-Sending Transactions, Creating a Smart Contract, Executing Smart Contract Functions, Public VS. Private Blockchains, Decentralized Application Architecture, **Building an Ethereum DApp:** The DApp, Setting Up a Private Ethereum Network, Creating the Smart Contract, Deploying the Smart Contract, Client Application, **DApp deployment:** Seven Ways to Think About Smart Contracts, Dapp Coutract Data Models, EVM back-end and front-end communication, JSON- RPC, Web 3, JavaScript API Using Meteor with the EV Executing Coat Recommendations Contracts in Console, Prototyping. A Third-Party Deploument Libraries**. Creating Private Chains.**	**6**	**CO5**

Reference Books:

Reference No	Reference Name
1	Bikramaditya Singhal, Gautam Dhameja, Privansu Sekhar Panda Beginning Blockchain A Beginner's Guide to Building Blockchain Solutions.Apress 2018
2	Chris Dannen Introducing Ethereum and Solidity Apress 2017
3	Elan Elrom The Blockchain Developer Apress 2019
4	Andreas M Antonopoulos Dr. Gavin Wood Mastering Ethereum O'Reilly First 2018
5	Vikram Dhillon David Metcalf Max Hooper Blockchain Enabled Applications Apress 2017

Web References:

Reference No	Reference Name
1	https://nptel.ac.in/courses/106104220
2	https://nptel.ac.in/courses/106105184
3	https://blockchain.gov.in/Home

Assessment:

Continuous Assessment (CA): 20 marks

Following measures can be used for the continuous assessment as:

- Assessment consists of two CA of 20 marks.
- The first CA is to be conducted when approx. 30-40% of the syllabus is completed and second CA is to be conducted after completion of 100% syllabus.
- Duration of the class test shall be one hour.

MSE: 20 marks

- Assessment consists of one MSE of 20 marks.
- The MSE is to be conducted when approx. 50 -60% of the syllabus is

completed.

- Duration of the class test shall be one hour.

Internal Semester Examination (ISE): 40 marks

- The Internal Assessment marks (out of 40) will be the total of the MSE and the continuous assessment.

Term Work: NA

- The term work will be based on the tutorial performance of the student.

End Semester Theory Examination: 60 Marks

1. Weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

Course Code	Course Name				
MCA32PE09	Mobile Application Development (Android Programming)				
Teaching Scheme: Contact Hours (Per Week)			Credits Assigned		
Theory	Tutorial	Total	Theory	Tutorial	Total
2	--	2	2	--	2
Examination Scheme (Marks)					
Internal Semester Examination (ISE)			End Sem. Examination (MSE)	Term Work	Total (Marks)
Continuous Assessment CA)	MSE	Total (IA) (CA+MSE)			
20	20	40	60	0	100

Pre-requisite:. Basic Programming Concepts ,Basic Understanding of Java or Kotlin ,Basic Understanding of Databases ,Basic Knowledge of Computer Science

Course Objectives: Course aim to learn and perform

Sr. No.	Course Objective
1	Creating robust mobile applications and learn how to integrate them with other services
2	Creating intuitive, reliable mobile apps using the android services and components
3	Create a seamless user interface that works with different mobile screens

Course Outcomes (CO): On successful completion of course learner / student will be able to

Sr. No.	Course Outcome
CO1	Build enterprise level mobile applications with Kotlin on Android
CO2	Understand both the basic and advanced concepts of Kotlin
CO3	Understand why use Kotlin over Java
CO4	Explain and use key Android programming concepts

Course Contents:

Module No.	Detailed Contents	Hrs.	CO No.
1	**Android Overview:** Android OS, Dalvik Virtual Machine, Features of Android, API Level Introduction, Linux Kernel, Libraries, Android Libraries, Android Application Framework, Introduction to Application component Android Studio: Android Studio Overview, Android Project internals, configuration files. Launching emulator o Editing emulator settings Emulator shortcuts Logcat usage Introduction to DDMS	6	CO1

2	**Activities and Intent:** Android Activities Introduction, Life Cycle, Working with Activities, Android Services: Introduction, Life Cycle, Working with Services, Introduction to Broadcast receiver, Content Provider, Fragments and Intent Filters, Intent Objects, Extras Bundle, **Android UI Interface:** UI Layouts, Types of Layout, Configuration of Layouts, View Identification, UI Controls, Event Handling, Adapters and Widgets,	6	CO2
3	**Content Provider:** Working with Shared Preferences, storing and retrieving shared key-value pairs. Using Internal Storage, retrieving cache files, Working with External Storage, and working with files shared by other applications. Intent Filters, Explicit Intents, Implicit Intents, Working with Intents	6	CO3
4	**Advances in Android:** Android Debugging, Other view, Notification, Toast, Thread, AsyncTask, Handler & Runnable, gradle plugins, localization, NFC, SMS sending receiving, Phonecalls, Sending Emails, GPS, MAPS, Location based service, Sensors, Network Connectivity Services, adb tools, Interfacing with Php and MySql for storing data. SQLite Overview, Query Introduction, GreedDao: Android ORM for Sqlite Database,Core Classes, Modelling entities, Session, Queries, Relations, Joins, Create a mini-project	6	CO4
5	**Other Mobile Application Development:** iOS Platform Overview, basics iOS Dev Center, iOS SDK, Understanding the Skeleton APP, Simple Application creation. Understanding cordova, Environment understanding, Application Skeleton, Basics on Cordova Core Components and Cordova Plugins	**6**	**CO5**

Text Books:

Reference No	Reference Name
1	Professional Android™ 4 Application Development, Reto Meier, John Wiley & Sons, Inc. 2012.
2	Android Application Development, Black Book, Pradeep Kothari, Kogent Learning Solutions, DreamTech Press
3	Google Android Developers - https://developer.android.com/index.html

Reference Books:

Reference No	Reference Name
1	Expert Android Studio, Murat Yenar, Onur Dundar, Wrox
2	Android Studio Cookbook, Mike van Drongelen, PACKT Publication
3	Android Programming for Beginners by John Horton (Author), PACKT Publication
4	Hello, Android: Introducing Google's Mobile Development Platform, Third Edition, Ed

Web References:

Reference No	Reference Name
1	https://elearn.nptel.ac.in/shop/iit-workshops/completed/introduction-to-android-app-development/?v=c86ee0d9d7ed
2	https://onlinecourses.swayam2.ac.in/nou21_ge41/
3	https://archive.nptel.ac.in/courses/106/106/106106156/
4	Kotlin Programming Language

Assessment:

Continuous Assessment (CA): 20 marks

Following measures can be used for the continuous assessment as:

- Assessment consists of two CA of 20 marks.
- The first CA is to be conducted when approx. 30-40% of the syllabus is completed and second CA is to be conducted after completion of 100% syllabus.
- Duration of the class test shall be one hour.

MSE: 20 marks

- Assessment consists of one MSE of 20 marks.
- The MSE is to be conducted when approx. 50 -60% of the syllabus is completed.
- Duration of the class test shall be one hour.

Internal Semester Examination (ISE): 40 marks

- The Internal Assessment marks (out of 40) will be the total of the MSE and the continuous assessment.

Term Work: NA

- The term work will be based on the tutorial performance of the student.

End Semester Theory Examination: 60 Marks

1. Weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

Course Code	Course Name				
MCA32PE04	Natural Language Processing Lab				
Contact Hours (Per Week)	Credits Assigned	Examination Scheme (Marks)			
		Term Work	Continuous Assessment (CA)	End Semester Examination (ESE)	Total
2	2	-	25	25	50

Pre-requisite: Students must know data collection and representation, set theory, basic principles of counting, probability, statistics, and linguistic fundamentals.

Lab Course Objectives:

Sr. No.	Course Objective
1	To understand and apply basic text preprocessing techniques for textual data.
2	To implement and analyze text representation models such as Bag of Words and TF-IDF.
3	To learn probabilistic language models (e.g., n-grams) and evaluate them using metrics like perplexity.
4	To explore and utilize word embeddings for representing textual data in vector spaces.
5	To implement advanced NLP tasks, such as text classification, sequence labeling, and machine translation, using traditional and deep learning models.

Lab Course Outcomes (CO): On successful completion of course learner/student will be able to

Sr. No.	Course Outcome
CO1	Ability to preprocess textual data and perform basic NLP operations such as tokenization, stemming, and lemmatization.
CO2	Proficiency in implementing text representation models like Bag of Words, TF-IDF, and word embeddings.
CO3	Capability to build and evaluate language models and perform tasks like sentiment analysis and POS tagging.
CO4	Understanding of sequence labeling tasks and translation systems using modern approaches like BiLSTM-CRF or sequence-to-sequence models.
CO5	Skill in developing and deploying machine learning and deep learning models for advanced NLP applications.

Continuous Assessment (CA):

Term Work: Will be based on Continuous Assessment

- Laboratory work will be based on the syllabus with minimum 10 experiments. The experiments should be completed in the allotted time duration.
- Practical will be evaluated by the subject teacher and documented according to a rubric

End Semester Practical Examination:

Practical and oral examination will be based on suggested practical list and entire syllabus.

Reference Books:

Reference No	Reference Name
1	Bird, S., Klein, E., & Loper, E. (2009). *Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit*. O'Reilly Media.
2	Ruder, S. (2019). *Recent Advances in Natural Language Processing with Deep Learning*.

Text Books:

Reference No	Reference Name
1	Jurafsky, D., & Martin, J. H. (2023). *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition* (3rd Edition). Prentice Hall.
2	Goldberg, Y. (2017). *Neural Network Methods for Natural Language Processing*. Morgan & Claypool.

Web References:

Reference No	Reference Name
1	NLTK / spaCy Official Documentation
2	TF-IDF Explained - Scikit-learn
3	Word2Vec Explained - Towards Data Science
4	Sequence-to-Sequence Models - TensorFlow
5	Kaggle Tutorial: Sentiment Analysis

Suggested list of experiments:

Practical No	Problem Statement
1	Apply basic text preprocessing steps: tokenization, stopword removal, stemming, and lemmatization using Python libraries like NLTK or spaCy.
2.	Implement a Bag of Words model and compute the Term Frequency-Inverse Document Frequency (TF-IDF) for a given corpus.
3	Write an n-gram language model and evaluate its perplexity on a sample text.
4	Demonstrate training Word2Vec embeddings on a custom corpus.
5	Write code to perform POS tagging using NLTK's pretrained models.
6	Write a program using SpaCy to extract named entities from a text document.
7	Write a program to classify sentiments using a machine learning model like Naive Bayes or Logistic Regression.
8	Apply word embeddings using Word2Vec or GloVe to represent words as vectors in a continuous vector space.
9	Implement a text classification task (e.g., spam email detection) using traditional machine learning models (SVM, Naive Bayes) or deep learning models (LSTM, CNN)

10	Perform sequence labeling tasks like Named Entity Recognition (NER) or POS tagging using CRF (Conditional Random Fields) or deep learning methods (BiLSTM-CRF).
11	Implement a simple machine translation model using an existing dataset (e.g., English to French).
12	Build and train a Recurrent Neural Network (RNN) or LSTM/GRU-based language model for text generation.

Note: At least 10 programs

Course Code	Course Name				
MCA32PE05	Lab UI/UX				
Contact Hours (Per Week)	Credits Assigned	Examination Scheme (Marks)			
		Term Work	Continuous Assessment (CA)	End Semester Examination (ESE)	Total
2	2	-	25	25	50

Pre-requisite: Basic understanding of fundamentals of any programming language.

Lab Course Objectives:

Sr. No.	Course Objective
1	Experiment with typography to create visually pleasing layouts.
2	Design simple icons using Photoshop tools.
3	Learn to create visually appealing web banners using Photoshop.

Lab Course Outcomes (CO): On successful completion of course learner/student will be able to

Sr. No.	Course Outcome
CO1	To understand Database design methodology
CO2	Develop a relational database schema for a given scenario, including tables, relationships, and constraints.
CO3	Utilize the DML/DDL commands and programming PL/SQL including stored procedures, stored functions, cursors, views and Triggers for modify data
CO4	Realize various data models for Database and Write queries in SQL.
CO5	Familiar with basic database storage structures and access techniques

Continuous Assessment (CA):

Term Work: Will be based on Continuous Assessment

- Laboratory work will be based on the syllabus with minimum 10 experiments. The experiments should be completed in the allotted time duration.
- Practical will be evaluated by the subject teacher and documented according to a rubric

End Semester Practical Examination:

Practical and oral examination will be based on suggested practical list and entire syllabus.

Reference Books:

Reference No	Reference Name
1	About Face: The Essentials of Interaction Design" by Alan Cooper, Robert Reimann, David Cronin, and Christopher Noessel

Text Books:

Reference No	Reference Name
1	The Design of Everyday Things" by Don Norman

Web References:

Reference No	Reference Name
1	https://www.nngroup.com
2	https://www.smashingmagazine.com
3	https://uxdesign.cc
4	https://www.interaction-design.org
5	https://www.awwwards.com

Suggested list of experiments:

Practical No	Problem Statement
1	Creating a Simple Landing Page Layout (Photoshop)
2.	Designing a Mobile App Splash Screen (Figma)
3	Button Design and States (Photoshop)
4	Wireframing a Login Screen (Figma)
5	Designing a Banner for a Website (Photoshop)
6	Typography Experimentation (Figma)
7	Creating an Icon Set (Photoshop)
8	Designing a Navigation Bar (Figma)
9	Designing a Card Layout (Photoshop)
10	Prototyping a Clickable Flow (Figma)
11	Mobile Food Delivery App (using figma)

Note: At least 10 programs

Course Code	Course Name				
MCA32PE06	Microsoft .Net Technologies Lab using C#				
Contact Hours (Per Week)	Credits Assigned	Examination Scheme (Marks)			
		Term Work	Continuous Assessment (CA)	End Semester Examination (ESE)	Total
2	2	-	25	25	50

Pre-requisite: Basic understanding of fundamentals of any programming language.

Lab Course Objectives:

Sr. No.	Course Objective
1	Introduction of whole asp.net with c#
2	Using of all standard controls if .net
3	Learning about rich controls
4	Understand how build a master page website using .net
5	ADO.net Fundamentals and architecture

Lab Course Outcomes (CO): On successful completion of course learner/student will be able to

Sr. No.	Course Outcome
CO1	Students will be able to identify and describe the core concepts of ASP.NET, C.
CO2	Students will be able to develop dynamic and interactive web applications by applying ASP.NET controls.
CO3	Students will be able to define and describe the purpose and functionality of rich controls in ASP.NET using C#.
CO4	Students will be able to analyze user requirements and database needs to design efficient, scalable, and secure web applications using ASP.NET
CO5	Students will be able to develop dynamic and interactive web applications by applying ASP.NET controls, C# programming concepts, and ADO.NET for database operations.

Continuous Assessment (CA):

Term Work: Will be based on Continuous Assessment

- Laboratory work will be based on the syllabus with minimum 10 experiments. The experiments should be completed in the allotted time duration.
- Practical will be evaluated by the subject teacher and documented according to a rubric

End Semester Practical Examination:

Practical and oral examination will be based on suggested practical list and entire syllabus.

Reference Books:

Reference No	Reference Name

1	Y. Langsam, M. Augenstin and A. Tannenbaum, Data Structures using C and C++, Pearson Education Asia, Second Edition, ISBN No. 978-81-203-1177-0

Text Books:

Reference No	Reference Name
1	C# and ASP.NET Projects, by ShivprasadKoirala, Rajesh Pillai, Pravin Joshi , Publisher: BPB,ISBN-13:978-8183332170

Web References:

Reference No	Reference Name
1	https://www.w3schools.com/asp/default.ASP
2	https://www.w3schools.com/asp/razor_cs_variables.asp
3	https://www.javatpoint.com/asp-net-life-cycle
4	https://www.javatpoint.com/ado-net-introduction
5	https://www.tutorialspoint.com/asp.net/asp.net_ado_net.htm

Suggested list of experiments:

Practical No	Problem Statement
1	Write a program use of ASP.NET for use of various validation control.
2.	Write a program use of ASP.NET for File Uploads
3	Write an ASP.NET program to saving files to filesystem
4	Write an ASP.NET program to Displaying Different Pageview
5	Write a program use of ASP.NET for use of various User Input control.
6	Write an ASP.NET program to Displaying advertisements
7	Write an ASP.NET program to Creating master pages, Nesting master pages
8	Write an ASP.NET program to Using the Menu Control
9	Write an ASP.NET program to Using Tree View Control
10	Design a small application use of ASP.NET with C# and SQL Database connectivity-I
11	Design a small application use of ASP.NET with C# and SQL Database connectivity-II

Note: At least 10 programs

Course Code	Course Name				
MCA32PE10	Data Science Lab				
Contact Hours (Per Week)	Credits Assigned	Examination Scheme (Marks)			
		Term Work	Continuous Assessment (CA)	End Semester Examination (ESE)	Total
2	2	-	25	25	50

Pre-requisite: Basic Python and Basic understanding of elementary Math.

Lab Course Objectives:

Sr. No.	Course Objective
1	To explore various stages in the data science lifecycle.
2	To understand data preparation, exploration and visualization techniques.
3	To model and evaluate different supervised/unsupervised learning techniques.

Lab Course Outcomes (CO): On successful completion of course learner/student will be able to

Sr. No.	Course Outcome
CO1	Apply various stages of the data science lifecycle for the selected case study.
CO2	Demonstrate data preparation, exploration and visualization techniques.
CO3	Implement and evaluate different supervised and unsupervised techniques.
CO4	Demonstrate Hypothesis testing.
CO5	Demonstrate correlation analysis

Continuous Assessment (CA):

Term Work: Will be based on Continuous Assessment

- Laboratory work will be based on the syllabus with minimum 10 experiments. The experiments should be completed in the allotted time duration.
- Practical will be evaluated by the subject teacher and documented according to a rubric

End Semester Practical Examination:

Practical and oral examination will be based on suggested practical list and entire syllabus.

Reference Books:

Reference No	Reference Name
1	Jake VanderPlas, Python Data Science Handbook‖, O'reilly Publications.

Text Books:

Reference No	Reference Name

1	Vijay Kotu, Bala Deshpande, Data Science Concepts and Practice‖, Elsevier, M.K. Publishers.

Web References:

Reference No	Reference Name
1	https://onlinecourses.nptel.ac.in/noc22_cs32/preview
2	https://onlinecourses.nptel.ac.in/noc21_cs69/preview

Suggested list of experiments:

Practical No	Problem Statement
1	Explore the descriptive and inferential statistics on the given dataset.
2.	Apply data cleaning techniques (e.g., Data Imputation).
3	Explore data visualization techniques.
4	Implement and explore performance evaluation metrics for Data Models (Supervised/Unsupervised Learning).
5	Use SMOTE technique to generate synthetic data. (To solve the problem of class imbalance).
6	Outlier detection using distance based/density-based method.
7	Implement time series forecasting.
8	Import a dataset and perform univariate analysis on the numeric columns to analyze the shape of the data. Write inference of the output. [Python or R or Excel]
9	Demonstrate Hypothesis testing, and ANOVA using a dataset [use Python, R or Excel]
10	Demonstrate correlation analysis. Use heatmap for visualization. Write inferences.
11	Import a csv or Excel dataset and demonstrate data wrangling, view shape, dimension, column names of the dataset, ways to select data using column number, column names, simple and compound conditional selection, update and modify dataset.
12	Perform univariate, bivariate and multivariate analysis using visualization techniques in Python, R or Excel

Note: At least 10 programs

Course Code	Course Name				
MCS32PE11	Blockchain Technology Lab				
Contact Hours (Per Week)	Credits Assigned	Examination Scheme (Marks)			
		Term Work	Continuous Assessment (CA)	End Semester Examination (ESE)	Total
2	2	-	25	25	50

Pre-requisite: Basic Understanding of Crypto-currencies, Programming Skills, Data Structures and Algorithms, Understanding of Consensus Mechanisms

Lab Course Objectives:

Sr. No.	Course Objective
1	Different consensus algorithms used in Blockchain
2	Real-world applications of Blockchain
3	To analyze Blockchain Ethereum Platform using Solidity
4	To Describe Blockchain Case Studies
5	Crypto currency, Bitcoin and Smart contracts

Lab Course Outcomes (CO): On successful completion of course learner/student will be able to

Sr. No.	Course Outcome
CO1	Interpret the fundamentals and basic concepts in Blockchain
CO2	Compare the working of different blockchain platforms
CO3	Analyze the importance of blockchain in finding the solution to the real-world problems
CO4	Identify relative application where block chain technology can be effectively used and implementation.
CO5	Use Crypto wallet for cryptocurrency-based transactions

Continuous Assessment (CA):

Term Work: Will be based on Continuous Assessment

- Laboratory work will be based on the syllabus with minimum 9 experiments. The experiments should be completed in the allotted time duration.
- Practical will be evaluated by the subject teacher and documented according to a rubric

End Semester Practical Examination:

Practical and oral examination will be based on suggested practical list and entire syllabus.

Reference Books:

Reference No	Reference Name

1	Artemis Caro, “Blockchain: The Beginners Guide to Understanding the Technology Behind Bitcoin & Cryptocurrency”.
2	Scott Marks, “Blockchain for Beginners: Guide to Understanding the Foundation and Basics of the Revolutionary Blockchain Technology”, CreateSpace Independent Publishing Platform

Text Books:

Reference No	Reference Name
1	Mark Watney, “Blockchain for Beginners”.
2	Alwyn Bishop, “Blockchain Technology Explained”

Web References:

Reference No	Reference Name
1	NPTEL Course “Introduction to Block Chain Technology & Applications” https://nptel.ac.in/courses/106/104/106104220/
2	NPTEL Course on “Blockchain Architecture & Use Cases” https://nptel.ac.in/courses/106/105/106105184/

Suggested list of experiments:

Practical No	Problem Statement
1	Write the following programs for Blockchain in Python: A. A simple client class that generates the private and public keys by using the builtin Python RSA algorithm and test it.
	B. A transaction class to send and receive money and test it.
	C. Create a blockchain, a genesis block and execute it.
	D. Create a mining function and test it.
	E. Add blocks to the miner and dump the blockchain
	F. Create multiple transactions and display them.
2.	Install and configure Go Ethereum and the Mist browser. Develop and test a sample application.
3	Implement and demonstrate the use of the following in Solidity: A. Variable, Operators, Loops, Decision Making, Strings, Arrays, Enums, Structs, Mappings, Conversions, Ether Units, Special Variables
	B. Functions, Function Modifiers, View functions, Pure Functions, Fallback Function, Function Overloading, Mathematical functions, Cryptographic functions
4	Implement and demonstrate the use of the following in Solidity: A. Withdrawal Pattern, Restricted Access.
	B. Contracts, Inheritance, Constructors, Abstract Contracts, Interfaces.
	C. Libraries, Assembly, Events, Error handling.
5	Install hyperledger fabric and composer. Deploy and execute the application.

6	Write a program to demonstrate mining of Ether.
7	Demonstrate the running of the blockchain node.
8	Demonstrate the use of Bitcoin Core API.
9	Create your own blockchain and demonstrate its use
10	Build Dapps with angular

Note: At least 9 programs

Course Code	Course Name

MCA32PE12	Mobile Application Development (Android Programming) Lab				
Contact Hours (Per Week)	Credits Assigned	Examination Scheme (Marks)			
		Term Work	Continuous Assessment (CA)	End Semester Examination (ESE)	Total
2	2	-	25	25	50

Pre-requisite: Basic Programming Concepts ,Basic Understanding of Java or Kotlin ,Basic Understanding of Databases ,Basic Knowledge of Computer Science

Lab Course Objectives:

Sr. No.	Course Objective
1	To learn the Android Operating system, Gradle and Mobile application development using Android Studio.
2	Students will be able to understand Development and Key points
3	Student will be able to learn & implement Android Applications
4	Student will analyze on defining name of applications with apk using android language in studio
5	learn ability to provide computer-based solution for the real-world problems applying standard practices with software.

Lab Course Outcomes (CO): On successful completion of course learner/student will be able to

Sr. No.	Course Outcome
CO1	Understand Android OS, Gradle, Android Studio
CO2	Debug Android Application
CO3	Develop UI based Mobile Application using Android Studio
CO4	Design application for Mobile using various sensors
CO5	Design and develop an application using Database

Continuous Assessment (CA):

Term Work: Will be based on Continuous Assessment

- Laboratory work will be based on the syllabus with minimum 9 experiments. The experiments should be completed in the allotted time duration.
- Practical will be evaluated by the subject teacher and documented according to a rubric

End Semester Practical Examination:

Practical and oral examination will be based on suggested practical list and entire syllabus.

Reference Books:

Reference No	Reference Name
1	Reto Meier, “Profession Android Application Development”, Wrox Publication
2	Marko Gargenta and Masumi Nakamura, “Learning Android” O’REILLY
3	Lucas Jordan and Peiter Greyling, “Practical Android Projects”, Apress
4	Official Channel of Android Developer on Youtube: https://www.youtube.com/user/androiddevelopers
5	Kotlin Programming Language

Suggested list of experiments:

Practical No	Problem Statement
1	Design an application representing a simple calculator
2.	Develop an application for working with Menus and Screen Navigation
3	Develop an application for working with Notifications
4	Develop an application demonstrating Internal Storage to store private data on the device memory.
5	Design a simple to-do list application using SQLite
6	Develop an application for connecting to the internet and sending email.
7	Develop an application for working with graphics and animation.
8	Develop an application for working with device camera.
9	Develop an application for working with location based services.
10	Using Worker thread write Android code for a click listener that downloads an image from a separate thread and displays it in an ImageView

Note: At least 9 programs

Course Code	Course Name				
MCA32EM01	Software Project Management				
Teaching Scheme: Contact Hours (Per Week)			Credits Assigned		
Theory	Tutorial	Total	Theory	Tutorial	Total
2	0	2	2	0	2
Examination Scheme (Marks)					
Internal Semester Examination (ISE)			End Sem. Examination (MSE)	Term Work	Total (Marks)
Continuous Assessment CA)	MSE	Total (IA) (CA+MSE)			
20	20	40	60	0	100

Pre-requisite: Students must know project lifecycle basics, data collection and representation, set theory, basic principles of counting, and time management techniques.

Course Objectives: Course aim to learn and perform

Sr. No.	Course Objective
1	To understand the fundamental principles and processes of Software Project Management.
2	To gain knowledge of responsibilities and roles of a project manager in software projects.
3	To be familiar with methodologies and techniques for project estimation, scheduling, and tracking.
4	To learn effective risk and quality management practices in software development.
5	To explore modern tools and trends in software project management.

Course Outcomes (CO): On successful completion of course learner / student will be able to

Sr. No.	Course Outcome
CO1	Apply project management principles and techniques in software projects.
CO2	Evaluate and select appropriate project management strategies based on project context.
CO3	Identify key phases and challenges in software project lifecycles and apply solutions.
CO4	Manage risks and ensure quality in software development projects.
CO5	Utilize project management tools effectively to plan, execute, and monitor projects.

Course Contents:

Module No.	Detailed Contents	Hrs.	CO No.
1	**Introduction to Software Project Management:** Basics of Software Project Management, Project Life Cycle and Process Models (Waterfall, Agile, Spiral, RAD), Role of Project Manager and Team, Key Challenges in Software Projects, Overview of Stakeholders and Objectives Setting. **Self-Learning Points**: Research advantages and limitations of different process, models. Explore examples of failed and successful projects.	6	1
2	**Project Planning and Scheduling**- Project Planning Overview, Work Breakdown Structure (WBS) and Milestone Setting, Estimation Techniques: COCOMO, Function Point Analysis, Scheduling Tools: Gantt Charts, PERT, CPM, Resource Allocation and Time Management **Self-Learning Points:** Create a WBS for a sample project (e.g., website development). Use scheduling tools like Gantt Project or Microsoft Project.	**6**	**2**
3	**Risk Management and Control:** Identifying and Categorizing Risks, Risk Analysis and Mitigation Strategies, Monitoring and Tracking Progress, Earned Value Analysis (EVA), Change Management **Self-Learning Points**: Identify risks in a real-world scenario (e.g., event planning)., Practice EVA calculations and risk analysis techniques.	**6**	**3**
4	**Software Quality and Testing:** Software Quality Concepts: FURPS and ISO Standards, Quality Assurance and Control Processes, Testing Strategies: White Box, Black Box, Unit, Integration, and System Testing, Tools for Software Quality and Testing, Defect Management **Self-Learning Points**: Compare ISO 9001 standards with CMMI or Six Sigma., Explore open-source testing tools like Selenium or JUnit.	**6**	**4**
5	**Modern Trends and Tools in Project Management:** Emerging Trends: DevOps, Agile Project Management, Case Studies in Software Project Management, Popular Tools: Jira, Trello, CASE Tools, Planning and Scheduling Tools Microsoft Project, Introduction to AI in Project Management Ethical Issues and Professional Practices. **Self-Learning Points:** Watch tutorials on Agile and Scrum., Create a project board using Trello or Jira., Research AI applications in project management.	**6**	**5**

Text Books:

Reference No	Reference Name

1	Software Project Management by Bob Hughes, Mike Cotterell, and Rajib Mall (McGraw Hill).
2	Software Engineering: A Practitioner's Approach by Roger S. Pressman (McGraw Hill).
3	Software Project Management in Practice by Pankaj Jalote (Pearson Education)

Reference Books:

Reference No	Reference Name
1	Software Engineering Project Management by Richard H. Thayer (Wiley).
2	Managing Software Projects by Frank Tsui (Jones & Bartlett Learning).
3	Software Quality Engineering by Daniel Galin (Wiley).

Web References:

Reference No	Reference Name
1	NPTEL: https://onlinecourses.nptel.ac.in/noc19_cs70/preview
2	**Coursera**: "Project Management for Software Engineers" by University of Alberta.

Assessment:

Continuous Assessment (CA): 20 marks

Following measures can be used for the continuous assessment as:

- Assessment consists of two CA of 20 marks.
- The first CA is to be conducted when approx. 30-40% of the syllabus is completed and second CA is to be conducted after completion of 100% syllabus.
- Duration of the class test shall be one hour.

MSE: 20 marks

- Assessment consists of one MSE of 20 marks.
- The MSE is to be conducted when approx. 50 -60% of the syllabus is completed.
- Duration of the class test shall be one hour.

Internal Semester Examination (ISE): 40 marks

- The Internal Assessment marks (out of 40) will be the total of the MSE and the continuous assessment.

Term Work: NA

- The term work will be based on the tutorial performance of the student.

End Semester Theory Examination: 60 Marks

1. Weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

Course Code	Course Name				
MCA31BS01	Mathematical Foundation for Computer Application-2				
Teaching Scheme: Contact Hours (Per Week)			Credits Assigned		
Theory	Tutorial	Total	Theory	Tutorial	Total
3	1	4	3	1	4
Examination Scheme (Marks)					
Internal Semester Examination (ISE)			End Sem. Examination (MSE)	Term Work	Total (Marks)
Continuous Assessment CA)	MSE	Total (IA) (CA+MSE)			
20	20	40	60	0	100

Pre-requisite: Basic knowledge of Mathematics and Statistics.

Course Objectives: Course aim to learn and perform

Sr. No.	Course Objective
1	Study the formulation of Linear programming problems and obtain the optimum solution using various methods.
2	Solve the transportation, assignment problems and obtain their optimal solution.
3	Use competitive strategy for analysis and learn to take decisions in various business environments.
4	Understand simulation models and analyze their performance in real world systems.

Course Outcomes (CO): On successful completion of course learner / student will be able to

Sr. No.	Course Outcome
CO1	Formulate mathematical model for a broad range of problems in business and industry.
CO2	Apply mathematics and mathematical modelling to forecast implications of various choices in real world problems various choices in real world problems using transportation method.
CO3	Apply mathematics and mathematical modelling to forecast implications of various choices in real world problems various choices in real world problems using assignment method.
CO4	Think strategically and decide the optimum alternative from various available options using game theory & decision theory.
CO5	Evaluate performance parameters of real system using simulation.

Course Contents:

Module No.	Detailed Contents	Hrs.	CO No.

1	**Linear Programming Problem:** Introduction, Formulation of linear programming problem and basic feasible solution: graphical method, Simplex method, artificial variables, Big M method, Two Phase method. **Self-Learning Topics:** special cases of LPP	9	1
2	**Transportation Problem:** Definition of Transportation Problem, Initial basic feasible solution: North-West Corner method, Least Cost method, Vogel's Approximation method, optimum solution: MODI method. **Self-Learning Topics:** optimization using stepping stone method	9	2
3	**Assignment Problem & Travelling Salesman Problem:** Definition of assignment Problem: Hungarian method (minimization & maximization), Travelling Salesman Problem: Hungarian method. **Self-Learning Topics:** Simple applications in daily life	9	3
4	**Game Theory:** Rules of Game Theory, Two person zero sum game, solving simple games (2x2 games), solving simple games (3x3 games). **Decision Theory:** Decision making under certainty, under uncertainty, Maximax Criterion, Maximin Criterion, Savage Minimax Regret criterion, Laplace criterion of equal Likelihoods, Hurwicz criterion of Realism **Self-Learning Topics:** Solution of game theory problem by graphical method, Decision tree for decision- making problem.	9	4
5	**Simulation:** Introduction to simulation, steps in simulation, advantages of simulation, limitations of simulation, applications of simulation, Monte-Carlo method: simple examples, single server queue model. **Self-Learning Topics:** Generation of pseudo random numbers and their properties.	9	5

Text Books:

Reference No	Reference Name
1	K. Nagarajan, Textbook of Operations Research: A Self Learning Approach.
2	Dr. Dnyaneshwar R. Waghole, Operation Research, Nirali Prakashan.

Reference Books:

Reference No	Reference Name
1	Hamdy A. Taha, University of Arkansas, "Operations Research: An Introduction", Pearson, 9th Edition, ©2011, ISBN-13: 9780132555937

2	Sharma, S.D. and Sharma, H., "Operations Research: Theory, methods and Applications", KedarNath Ram Nath, 2010, 15, reprint
3	J. K. Sharma, "Operations Research : Theory And Applications" , Macmillan India Limited, 2006 (3 Edition),ISBN 1403931518, 9781403931511
4	Prem Kumar Gupta & D S Hira, S. Chand publications , "Operations Research", 7/e, ISBN-13: 978-8121902816, ISBN-10: 9788121902816
5	A. Ravindran, Don T. Phillips, James J. Solberg, "Operations Research: Principles and Practice", 2nd Edition, January 1987, ISBN: 978-0-471-08608-6
6	Frederick S. Hillier, Gerald J. Lieberman, Introduction to Operations Research, McGraw-Hill, 2001,Edition7, illustrated, ISBN 0071181636, 9780071181631
7	Jerry Banks, John S. Carson, Barry L. Nelson, Contributor Barry L. Nelson "Discrete-event System Simulation", Prentice Hall, 1996, Edition 2, illustrated, ISBN 0132174499, 9780132174497

Web References:

Reference No	Reference Name
1	Operations Research, Prof.Kusum Deep, IIT-MADRAS, https://nptel.ac.in/courses/111/107/111107128
2	Introduction to Operations Research, Prof. G. Srinivasan, IIT ROORKEE, https://nptel.ac.in/courses/110/106/110106062
3	Fundamentals of Operations Research, Prof. G. Srinivasan, IIT MADRAS, https://nptel.ac.in/courses/112/106/112106134/
4	Modeling and simulation of discrete event systems,Prof.P. Kumar Jha, IIT ROORKEE, https://nptel.ac.in/courses/112107220/
5	Game Theory, Prof. K. S. MallikarjunaRao, IIT-BOMBAY, https://nptel.ac.in/courses/110/101/110101133/

Tutorials:

Sr. No.	Topic	Hrs
1	Linear programming problem using graphical method	1
2	Linear programming problem using simplex method	1
3	Linear programming problem using Big M method	1
4	Linear programming problem using Two Phase Method	1
5	Finding the basic feasible solution using North West Corner Cell Method and Least Cost Method.	1
6	Finding the basic feasible solution using Vogel's Approximation Method.	1
7	Finding the optimal solution using Modi Method.	1
8	Assignment Problem using Hungarian method.	1
9	Travelling salesman Problem using Hungarian method.	1
10	Solving Two-person zero sum game.	1

11	Decision Making Under Uncertainty.	1
12	Monte-Carlo Method.	1

Assessment:

Continuous Assessment (CA): 20 marks

Following measures can be used for the continuous assessment as:

- Assessment consists of two CA of 20 marks.
- The first CA is to be conducted when approx. 30-40% of the syllabus is completed and second CA is to be conducted after completion of 100% syllabus.
- Duration of the class test shall be one hour.

MSE: 20 marks

- Assessment consists of one MSE of 20 marks.
- The MSE is to be conducted when approx. 50 -60% of the syllabus is completed.
- Duration of the class test shall be one hour.

Internal Semester Examination (ISE): 40 marks

- The Internal Assessment marks (out of 40) will be the total of the MSE and the continuous assessment.

Term Work: NA

- The term work will be based on the tutorial performance of the student.

End Semester Theory Examination: 60 Marks

1. Weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

Course Code	Course Name				
MCA32EL02	Project Phase-I				
Teaching Scheme: Contact Hours (Per Week)			Credits Assigned		
Theory	Practical	Total	Theory	Practical	Total
0	4	4	0	2	2
Examination Scheme (Marks)					
Internal Semester Examination (ISE)			End Sem. Examination (MSE)	Term Work	Total (Marks)
Continuous Assessment CA)	MSE	Total (IA) (CA+MSE)			
0	0	0	0	50	50

Pre-requisite: Basic knowledge of any programming language and database.

Course Objectives: Course aim to learn and perform

Sr. No.	Course Objective
1	Conceptualize knowledge with emphasis on teamwork, effective communication, critical thinking and problem-solving skills.
2	Adapt to a rapidly changing environment by having learned and applied new skills and new technologies.
3	Acquaint with the process of applying basic computer applications and provide solutions to the problems in various application domains.

Course Outcomes (CO): On successful completion of course learner / student will be able to

Sr. No.	Course Outcome
CO1	Demonstrate the ability to produce a technical document.
CO2	Apply software project management skills during project work.
CO3	Build small groups to work effectively in team on medium scale computing projects.
CO4	Design and evaluate solutions for complex problems.

Guidelines for Project Phase-I:

1. Students shall form a group of 2 to 3 students.
2. Students should do survey and identify needs, which shall be converted into problems in consultation with the faculty Supervisor / Guide / HOD / Internal Committee of faculties. The project contact hours shall be allotted in the timetable and 4 hours workload shall be considered for the guide / supervisor.
3. Students shall submit an implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of project.
4. A log book to be prepared by each group, wherein the group can record weekly work progress, Guide / Supervisor can verify and record notes/comments.
5. Faculty may give inputs during project activity; however, focus shall be on self-learning.
6. Students in a group shall understand the problem effectively, propose multiple

solutions and select the best possible solution in consultation with Guide / Supervisor.
7. Students shall convert the best solution into a working model using various components of their domain areas and demonstrate.
8. The solution to be validated with proper justification and project report to be compiled in standard format of SVKM's NMIMS GLOBAL UNIVERSITY, DHULE.

Assessment of Project Phase-I:

a) Term work:

- The progress of the project to be evaluated on a continuous basis.
- In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.

b) Mini Project Examination:

- Project evaluation will be done at Institute level by alumni or industry experts.
- Report should be prepared as per the guidelines issued by the University.
- The students shall present a seminar on project and demonstrate their understanding of need / problem.
- Project shall be evaluated through a presentation and demonstration of working model by the student project group to a panel of examiner at Institute level.
- **Project shall be assessed based on following points:**

1. Quality of survey / need identification.
2. Clarity of Problem definition based on need.
3. Innovativeness in solutions.
4. Feasibility of proposed problem solutions and selection of best solution.
5. Cost effectiveness.
6. Societal impact.
7. Full functioning of working model as per stated requirements.
8. Effective use of skill sets.
9. Contribution of an individual as a member or leader.
10. Clarity in written and oral communication.

c) Distribution of Term work marks shall be as below;

Marks awarded by guide / supervisor based on log book	10 Marks
Self-contribution and use of skillset in project	10 Marks
Quality of Project report	05 Marks
Oral	20 Marks
Attendance	05 Marks