

THIRD SEMESTER

Name of the Program	Master of Computer Application (MCA)			Year/ Semester:	II/III	
Course Name	Advanced Web Technology	Course Code:	MCA0301T	Type:	Theory	
Credits	04			Total Sessions Hours:	60 Hours	
Evaluation Spread	Internal Continuous Assessment:	30 Marks		End Term Exam:	70 Marks	
☒ Core	☐ Major	☐ Minor	☐ Elective	☐ Co-curricular	☒ Vocational	
Course Objectives	1. To introduce the fundamentals of web development, including HTML, CSS, and browser architecture. 2. To enable learners to write and execute client-side scripts using JavaScript for interactivity. 3. To develop dynamic, component-based front-end applications using ReactJS. 4. To provide foundational knowledge of server-side scripting using Node.js and handling basic HTTP server functionalities.					
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:						
Course Outcome (CO)	Attributes					
CO1	Design and structure web pages using HTML5 and apply styles using CSS effectively.					
CO2	Develop interactive web interfaces using JavaScript with form validation and DOM manipulation.					
CO3	Build responsive and component-based single-page applications using ReactJS.					
CO4	Demonstrate the ability to work with Node.js for file system operations and create basic web servers.					
Pedagogy	Interactive, discussion-bases, student-centered, presentation.					
Internal Evaluation Mode	Mid-term Examination: 12 Marks Attendance: 04 Marks Quiz Test: 04 Marks Assignment: 05 Marks Presentation: 05 Marks					
Session Details	Topic				Hours	Mapped CO
Unit 1	Introduction to Web Development and Browser Architecture, Basics of HTML, Structure of HTML, Formatting tags, Links, List, Tables, Frames, Images, HTML forms, Overview and Features of HTML5. Introduction to CSS, Structure and Syntax of CSS, Internal CSS, External CSS, Inline CSS, Using CSS, Background Images, Colors and Properties, Manipulating Texts, using Fonts, Borders, Padding lists.				14	CO1
Unit 2	Introduction to JavaScript, Features, JavaScript Syntax and Structure, Variables and Data Types, Operators and Expressions, Control Structures (if, else, switch), Loops (for, while, do-while), Functions, Arrays, Objects and Object Properties, Built-in Objects (String, Math, Date), DOM Manipulation, Event and Event Handling, Form Validation.				14	CO2
Unit 3	Introduction to ReactJS, Installation and Setup, React Architecture, Creating a React Application, JSX Syntax, React Components, Styling in React , Props and Component Communication, Event Handling, State Management using useState, Component Lifecycle, Form Handling, Routing with React Router (basic navigation only)				16	CO3

Unit 4	Introduction to Node.js, Features and Advantages of Node.js, Installing Node.js and npm, Node.js Architecture and Event-driven Model, Understanding Modules (Built-in and Custom), Creating and Using Modules, npm Package Management, File System Module (read, write, append, delete), Working with Paths and Directories, Creating a Basic Web Server using HTTP Module, Handling Requests and Responses										16	CO4
CO-PO and PSO Mapping												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	2					1	1		
CO2	2	3	3	1	1	3	2	2	2	1	1	1
CO3	3	2	2	3	1	2		1	1	3	1	1
CO4	2	3	3	2		3	1		2	3	1	
Strong contribution-3, Average contribution-2, Low contribution-1,												
Suggested Readings:												
Text- Books	"Web Technologies: HTML, JavaScript, PHP, Java, JSP, ASP.NET" by Achyut S. Godbole and Atul Kahate "HTML, CSS, JavaScript and Web Publishing" by Laura Lemay and Rafe Colburn "Web Technology: A Developer's Perspective" by N. P. Gopalan and J. Akilandeswari											
Reference Books	"Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics" by Jennifer Niederst Robbins "Eloquent JavaScript: A Modern Introduction to Programming (3rd Edition)" by Marijn Haverbeke "React Up and Running: Building Web Applications" by Stoyan Stefanov "Node.js Design Patterns: Design and implement production-grade Node.js applications using proven patterns and techniques" by Mario Casciaro and Luciano Mammino											
e-Learning	•											
Recapitulation & Examination Pattern												
Internal Continuous Assessment:												
Component	Marks	Pattern										
Mid Semester	12	Section A: Contains 05 MCQs/Fill in the blanks/One Word Answer/ True-False type of questions. Each question carries 01 Marks. Section B: Contains 02 descriptive questions and each question carries 2 marks. Section C: Contains 04 descriptive questions out of which 03 questions are to be attempted. Each question carries 05 Marks. <i>50% of the marks obtained in the mid semester examination will be added to the internal assessment.</i>										
Quiz Test	04	Contains 04 descriptive questions . Each question carries 01 Mark .										
Assignment	05	Assignment to be made on topics and instruction given by subject teacher										
Presentation	05	Presentation to be made on topics and instruction given by subject teacher										
Attendance	04	As per policy										
Total Marks	30											

Course created by: Mrs. Alfiya Mahmood

Signature:

Approved by: Prof. (Dr.) Santosh Kumar

Signature:

Name of the Program	Master of Computer Application (MCA)			Year/ Semester:	II/III	
Course Name	Advanced Web Technology LAB	Course Code:	MCA0301P	Type:	Practical	
Credits	01			Total Sessions Hours:	30 Hours	
Evaluation Spread	Internal Continuous Assessment:	15 Marks		End Term Exam:	35 Marks	
☒ Core	☐ Major	☐ Minor	☐ Elective	☐ Co-curricular	☐ Vocational	
Course Objectives	1. To provide hands-on experience with HTML5, CSS3, and JavaScript for web page creation. 2. To implement dynamic front-end applications using ReactJS. 3. To introduce server-side scripting through Node.js for simple web applications. 4. To develop small, functional full-stack applications integrating client and server sides.					
Course Outcomes (CO): <i>After the successful course completion, learners will develop following attributes:</i>						
Course Outcome (CO)	Attributes					
CO1	Create structured and styled static web pages using HTML and CSS.					
CO2	Implement interactive and dynamic features using JavaScript.					
CO3	Build component-based single-page applications using ReactJS.					
CO4	Develop simple server-side applications using Node.js.					
Pedagogy	Interactive, discussion-bases, student-centered, presentation.					
Internal Evaluation Mode	• Mid-term Practical Examination: 08 Marks • Viva-Voce: 04 Marks • Practical File - 03 Marks					
Session Details	Topic				Ho urs	Mapped CO
Unit 1	1. Creating a basic HTML page with proper formatting, lists, tables, and media elements. 2. Applying Internal, External, and Inline CSS styles. 3. Creating a web form with input validation attributes.				8	CO1
Unit 2	4. DOM manipulation: changing content, styles, and attributes dynamically. 5. Event handling in JavaScript and simple animations. 6. Creating a JavaScript program for form validation.				7	CO2
Unit 3	7. Building a React form with event handling. 8. Creating a basic React app with components and props. 9. Developing a React component to update and display data.				7	CO3

Unit 4		10. Introduction to Node.js and creating a simple server. 11. Creating a Basic Server using HTTP Module. 12. Build a simple Node.js server that serves a static HTML file as a response.								8	CO4	
CO-PO and PSO Mapping												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	P O8	PSO 1	PSO2	PSO3	PSO4
CO1	2	2	3	2					1	1		
CO2	2	3	3	1	1	3	2	2	2	1	1	1
CO3	3	2	2	3	1	2		1	1	3	1	1
CO4	2	3	3	2		3	1		2	3	1	
Strong contribution-3, Average contribution-2, Low contribution-1,												
Suggested Readings:												
Text- Books		1. "Web Technologies: HTML, JavaScript, PHP, Java, JSP, ASP.NET" by Achyut S. Godbole and Atul Kahate. 2. "Web Technology: A Developer's Perspective" by N. P. Gopalan and J. Akilandeswari										
Reference Books		1. "Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics" by Jennifer Niederst Robbins 2. "Eloquent JavaScript: A Modern Introduction to Programming (3rd Edition)" by Marijn Haverbeke										
e-Learning		• https://www.w3schools.com • https://reactjs.org • https://nodejs.org										
Recapitulation & Examination Pattern												
Internal Continuous Assessment:												
Component		Marks	Pattern									
Mid Semester		08	Section A: Contains 03 practical questions out of which 02 questions are to be attempted. Each question carries 04 Marks .									
Attendance		03	Will be decided by subject teacher									
Viva-Voce		04	As per policy									
Total Marks		15										

Course created by: Mrs. Alfiya Mahmood

Signature:

Approved by: Prof. (Dr.) Santosh Kumar

Signature:

Name of the Program	Master of Computer Application (MCA)			Year/ Semester:	II/III	
Course Name	Python Programming	Course Code:	MCA0302T	Type:	Theory	
Credits	04			Total Sessions Hours:	60 Hours	
Evaluation Spread	Internal Continuous Assessment:	30 Marks		End Term Exam:	70 Marks	
☒ Core	☐ Major	☐ Minor	☐ Elective	☐ Co-curricular	☐ Vocational	
Course Objectives	1. To introduce the fundamentals of programming logic and problem-solving using Python as a first programming language. 2. To familiarize students with Python’s basic syntax, data types, operators, control flow, and core programming constructs. 3. To enable students to effectively use built-in data structures, string operations, and functions for developing structured programs. 4. To develop an understanding of object-oriented programming concepts and apply them in Python for real-world problem modeling.					
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:						
Course Outcome (CO)	Attributes					
CO1	Understand the fundamental concepts of programming and demonstrate the ability to write basic Python programs using variables, data types, control structures, and input/output operations.					
CO2	Develop Python programs using built-in data structures and functions, apply string operations, and write modular code using user-defined functions and recursion.					
CO3	Apply object-oriented programming principles in Python by creating and using classes and objects, and perform file operations and exception handling effectively.					
CO4	Utilize Python’s standard libraries for data handling and modular programming, implement basic data processing tasks, and follow standard debugging and coding best practices.					
Pedagogy	Interactive, discussion-bases, student-centered, presentation.					
Internal Evaluation Mode	Mid-term Examination: 12 Marks Attendance: 04 Marks Quiz Test: 04 Marks Assignment: 05 Marks Presentation: 05 Marks					
Session Details	Topic				Hours	Mapped CO
Unit 1	Unit 1: Introduction to Python and Programming Basics Getting Started with Python: Installing Python, Working with Python interpreters and IDEs, Basic Syntax and Operations, Keywords, identifiers, variables, and data types, Input and output operations, Type conversion and simple expressions, Control Flow: Conditional statements (`if`, `if-else`, `if-elif-else`), Loops (`for`, `while`), Loop control statements (`break`, `continue`, `pass`).				14	CO1

Unit 2	Unit 2: Data Structures and Functions in Python Core Data Structures: Lists and list operations, Tuples and immutability, Sets and set operations, Dictionaries and key-value access, String Handling: Creating and manipulating strings, Common string methods and formatting, String slicing and membership operations, Functions: Defining and calling functions, Arguments, return values, scope, Built-in functions and user-defined functions, Lambda functions and anonymous expressions, Recursion and Code Organization, Simple recursive examples, Writing modular programs using functions.	16	CO2
Unit 3	Object-Oriented Programming: Classes and objects, Instance and class variables, Methods, constructors, destructors, OOP Principles: Inheritance and method overriding, Encapsulation and access modifiers, Polymorphism concepts, Error and Exception Handling: Types of errors, Try-except blocks, Finally clause and `raise` statement,	15	CO3
Unit 4	Unit 4: Introduction to NumPy Introduction to NumPy: Importance of NumPy, installing and importing the library, creating 1D, 2D, and multi-dimensional arrays using array(), arange(), linspace(), zeros(), ones(), and eye() functions. Array Properties and Data Types: Understanding array shape, size, ndim, dtype, and itemsize, Array Indexing and Slicing: Accessing elements, slicing techniques in 1D and 2D arrays, using advanced indexing, Array Operations: Performing element-wise arithmetic, broadcasting. Mathematical and Statistical Functions: Using built-in functions like sum(), mean(), std(), min(), max(), argmax(), argmin().	15	CO4

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	2					1	1		
CO2	2	3	3	1	1	3	2	2	2	1	1	1
CO3	3	2	2	3	1	2		1	1	3	1	1
CO4	2	3	3	2		3	1		2	3	1	

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books	1. “Python Programming: An Introduction to Computer Science” Author: John M. Zelle Publisher: Franklin, Beedle & Associates 2. “Think Python: How to Think Like a Computer Scientist” Author: Allen B. Downey Publisher: O’Reilly Media
Reference Books	1. “Learning Python” Author: Mark Lutz Publisher: O’Reilly Media 2. “Python Programming” Author: Reema Thareja Publisher: Oxford University Press
e-Learning	NPTEL (National Programme on Technology Enhanced Learning) Course: Introduction to Programming in Python – by Prof. Madhavan Mukund, CMI Platform: NPTEL / SWAYAM Coursera Course: Python for Everybody – University of Michigan Instructor: Dr. Charles Severance (Dr. Chuck)

	• W3Schools Python Tutorial Website: https://www.w3schools.com/python/ • Python Official Documentation Website: https://docs.python.org/3/	
Recapitulation & Examination Pattern		
Internal Continuous Assessment:		
Component	Marks	Pattern
Mid Semester	12	Section A: Contains 05 MCQs/Fill in the blanks/One Word Answer/ True-False type of questions. Each question carries 01 Marks. Section B: Contains 02 descriptive questions and each question carries 2 marks. Section C: Contains 04 descriptive questions out of which 03 questions are to be attempted. Each question carries 05 Marks. <i>50% of the marks obtained in the mid semester examination will be added to the internal assessment.</i>
Quiz Test	04	Contains 04 descriptive questions . Each question carries 01 Mark .
Assignment	05	Assignment to be made on topics and instruction given by subject teacher
Presentation	05	Presentation to be made on topics and instruction given by subject teacher
Attendance	04	As per policy
Total Marks	30	

Course created by:

Signature:

Approved by:

Signature:

Name of the Program	Master of Computer Application (MCA)			Year/ Semester:	II/III	
Course Name	Python Programming LAB	Course Code:	MCA0302P	Type:	Practical	
Credits	01			Total Sessions Hours:	30 Hours	
Evaluation Spread	Internal Continuous Assessment:	15 Marks		End Term Exam:	35 Marks	
☒ Core	☐ Major	☐ Minor	☐ Elective	☐ Co-curricular	☐ Vocational	
Course Objectives	1. To introduce the fundamentals of programming logic and problem-solving using Python as a first programming language. 2. To familiarize students with Python’s basic syntax, data types, operators, control flow, and core programming constructs. 3. To enable students to effectively use built-in data structures, string operations, and functions for developing structured programs. 4. To develop an understanding of object-oriented programming concepts and apply them in Python for real-world problem modeling.					
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:						
Course Outcome (CO)	Attributes					
CO1	Understand the fundamental concepts of programming and demonstrate the ability to write basic Python programs using variables, data types, control structures, and input/output operations.					
CO2	Develop Python programs using built-in data structures and functions, apply string operations, and write modular code using user-defined functions and recursion.					
CO3	Apply object-oriented programming principles in Python by creating and using classes and objects, and perform file operations and exception handling effectively.					
CO4	Utilize Python’s standard libraries for data handling and modular programming, implement basic data processing tasks, and follow standard debugging and coding best practices.					
Pedagogy	Interactive, discussion-bases, student-centered, presentation.					
Internal Evaluation Mode	• Mid-term Practical Examination: 08 Marks • Viva-Voce: 04 Marks • Practical File - 03 Marks					
Session Details	Topic				Ho urs	Mapped CO
Unit 1	• Write a program that accepts user details and performs arithmetic operations on two numbers. • Create a program to input a student’s marks and print the corresponding grade. • Write a program to print a multiplication table using a loop.				8	CO1
Unit 2	• Add conditions to skip or break based on user input. • Create and manipulate a list of numbers, a tuple of student names, a set of subjects, and a dictionary of student data. • Write a program that accepts a sentence, counts vowels/consonants, and prints reversed words.				7	CO2

Unit 3	- Implement a factorial calculator using recursion, and a separate function to check for palindrome strings. - Create a class Student with attributes (name, roll no, marks) and methods to display details and calculate grade.										7	CO3
Unit 4	- Create 1D and 2D arrays, perform basic arithmetic operations, and apply statistical functions like mean and standard deviation. - Create 1D and 2D arrays using NumPy and display basic array attributes like shape, size, and data type.										8	CO4
CO-PO and PSO Mapping												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	P O8	PSO 1	PSO2	PSO3	PSO4
CO1	2	2	3	2					1	1		
CO2	2	3	3	1	1	3	2	2	2	1	1	1
CO3	3	2	2	3	1	2		1	1	3	1	1
CO4	2	3	3	2		3	1		2	3	1	
Strong contribution-3, Average contribution-2 , Low contribution-1,												
Suggested Readings:												
Text- Books	1. “Python Programming: An Introduction to Computer Science” Author: John M. Zelle Publisher: Franklin, Beedle & Associates 2. “Think Python: How to Think Like a Computer Scientist” Author: Allen B. Downey Publisher: O’Reilly Media											
Reference Books	1. “Learning Python” Author: Mark Lutz Publisher: O’Reilly Media 2. “Python Programming” Author: Reema Thareja 3. Publisher: Oxford University Press											
e-Learning	NPTEL (National Programme on Technology Enhanced Learning) Course: Introduction to Programming in Python – by Prof. Madhavan Mukund, CMI Platform: NPTEL / SWAYAM											
Recapitulation & Examination Pattern												
Internal Continuous Assessment:												
Component	Marks	Pattern										
Mid Semester	08	Section A: Contains 03 practical questions out of which 02 questions are to be attempted. Each question carries 04 Marks.										
Attendance	03	Will be decided by subject teacher										
Viva-Voce	04	As per policy										
Total Marks	15											

Course created by

Signature:

Approved by: Prof. (Dr.) Santosh Kumar

Signature:

Name of the Program	Master of Computer Application (MCA)			Year/ Semester:	II / III	
Course Name	Research Methodology	Course Code:	MCA303T	Course Name	Research Methodology	
Credits	04			Total Sessions Hours:	60 Hours	
Evaluation Spread	Internal Continuous Assessment:	30 Marks		End Term Exam:	70 Marks	
☒ Core	☐ Major	☐ Minor	☐ Elective	☒ Core	☐ Major	
Course Objectives	1. To give basic knowledge about the Research Methodology. 2. To understand and comprehend the basics in research methodology and applying them in research/ project work. 3. To address the issues inherent in selecting a research problem and discusses the techniques and tools to be employed in completing a research project. 4. To prepare report writing and framing Research proposals.					
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:						
Course Outcome (CO)	Attributes					
CO1	Understand the meaning and objectives of research.					
CO2	Understand the basics of sampling design.					
CO3	Develop skills in qualitative and quantitative data analysis and presentation and advanced critical thinking skills.					
CO4	Demonstrate the ability to choose methods appropriate to research objectives.					
Pedagogy	Interactive, discussion-bases, student-centered, presentation.					
Internal Evaluation Mode	Mid-term Examination: 12 Marks Attendance: 04 Marks Quiz Test: 04 Marks Assignment: 05 Marks Presentation: 05 Marks					
Session Details	Topic				Hours	Mapped CO
Unit 1	Introduction: Meaning of Research, Objectives of Research, Types of Research, Research Process, Research Problem formulation; Data types; Sources of Error, steps involved in research, defining research problem.				15	CO1
Unit 2	Research Design: Features of a good research design; Different Research Designs; Measurement in Research, Census & Sample Surveys; Steps in Sampling Design; Types of Sample designs-Probability & Non Probability sampling.				15	CO2
Unit 3	Data Collection: Classification of Data, Methods of Data Collection, Sampling, Sampling techniques procedure and methods, Ethical considerations in research Data Analysis and interpretation: Data analysis, Types of analysis, Statistical techniques and choosing an appropriate statistical technique, Hypothesis, Hypothesis Testing: Chi-square test, t-test, statistical inference, Interpretation of results.				15	CO3

Unit 4	Presentation: Diagrams; graphs; charts. Report writing; Layout of Research report; Types of Reports; Mechanism of writing a Research report; Precautions for writing report. Use of MS Office in Report writing and making Presentations.	15	CO4
---------------	--	-----------	------------

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	2					1	1		
CO2	2	3	3	1	1	3	2	2	2	1	1	1
CO3	3	2	2	3	1	2		1	1	3	1	1
CO4	2	3	3	2		3	1		2	3	1	

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books	1. C. R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques , New Age International publishers, Third Edition. 2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition, SAGE, 2005
Reference Books	1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition 2. Creswell, John W. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications, 2013.
e-Learning	• https://www.geeksforgeeks.org/introduction-to-research-methodology/ • https://onlinecourses.swayam2.ac.in/cec20_hs17/preview

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	Section A: Contains 05 MCQs/Fill in the blanks/One Word Answer/ True-False type of questions. Each question carries 01 Marks. Section B: Contains 02 descriptive questions and each question carries 2 marks. Section C: Contains 04 descriptive questions out of which 03 questions are to be attempted. Each question carries 05 Marks. <i>50% of the marks obtained in the mid semester examination will be added to the internal assessment.</i>
Quiz Test	04	Contains 04 descriptive questions . Each question carries 01 Mark .
Assignment	05	Assignment to be made on topics and instruction given by subject teacher
Presentation	05	Presentation to be made on topics and instruction given by subject teacher
Attendance	04	As per policy
Total Marks	30	

Course created by:

Signature:

Approved by:

Signature:

Name of the Program	Master of Computer Application (MCA)			Year/ Semester:	II/III	
Course Name	Cloud Infrastructure & Services	Course Code:	MCAE0304 T	Type:	Theory	
Credits	04			Total Sessions Hours:	60 Hours	
Evaluation Spread	Internal Continuous Assessment:	30 Marks		End Term Exam:	70 Marks	
☐ Core	☐ Major	☐ Minor	☐ Elective	☐ Co-curricular	☐ Vocational	
Course Objectives	1. To introduce the fundamental concepts, architecture, and service models of cloud computing 2. To develop a deep understanding of virtualization technologies 3. To explore various cloud storage mechanisms, platforms, and distributed processing frameworks 4. To examine cloud service management, security issues, legal compliance, and emerging trends					
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:						
Course Outcome (CO)	Attributes					
CO1	Describe cloud computing architecture and service models.					
CO2	Explain virtualization and its role in cloud infrastructure.					
CO3	Analyze cloud storage solutions and major cloud platforms.					
CO4	Discuss cloud security concerns, SLAs, and future trends in cloud computing.					
Pedagogy	Interactive, discussion-bases, student-centered, presentation.					
Internal Evaluation Mode	Mid-term Examination: 12 Marks Attendance: 04 Marks Quiz Test: 04 Marks Assignment: 05 Marks Presentation: 05 Marks					
Session Details	Topic				Ho urs	Mapped CO
Unit 1	Introduction to Cloud Computing and Architecture: Evolution of Computing Models: Cluster, Grid, Utility, and Cloud Computing. Characteristics of Cloud Computing, Service Models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS). Deployment Models: Public, Private, Hybrid, Community. Benefits, Limitations, and Use Cases of Cloud Computing, Cloud Reference Architecture (NIST Model)				15	CO1
Unit 2	Virtualization and Data Center Infrastructure: Concept and Benefits of Virtualization, Virtualization levels, Types of virtualization in cloud computing: Application Virtualization, Network Virtualization, Desktop Virtualization, Storage Virtualization, and Data Virtualization. Virtual Machines (VMs): Creation, Management, and Live Migration Hypervisors: Introduction, Types: Type 1 and Type 2 Data Centers: Components, Design Considerations, Disaster Recovery.				16	CO2

Unit 3	Cloud Storage and their types. Storage System in the Cloud: Object Storage, File and Block Storage. Amazon Web Services: Introduction, Fundamental concepts of AWS. Google Cloud Platform (GCP): Introduction, Use Cases of Google Cloud Platform. Compute Services: Google Compute Engine(GCE), Google App Engine(GAE), Google Kubernetes Engine (GKE), Cloud Functions, Cloud Run. Cloud Storage: Objects & Buckets. Cloud Datastore: Introduction, Create a Cloud Datastore Database, Query Cloud Datastore. Cloud Networking: Virtual Private Cloud (VPC), Subnets, Firewall rules, Load balancers, VPNs.	14	CO3
Unit 4	Cloud Management, Security & Emerging Trends: Cloud Resource Management: Monitoring, Autoscaling, Load Balancing, SLA (Service Level Agreements) and QoS (Quality of Service). Security Challenges in Cloud: Confidentiality, Integrity, Availability (CIA Triad), Identity and Access Management (IAM), Security Threats and Risk Management. Legal and Compliance Issues in Cloud. Emerging Trends: Edge and Fog Computing, Serverless Computing (FaaS), Containerization (Docker Basics), Cloud Interoperability and Standards (e.g., NIST, IEEE).	15	CO4

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	2					1	1		
CO2	2	3	3	1	1	3	2	2	2	1	1	1
CO3	3	2	2	3	1	2		1	1	3	1	1
CO4	2	3	3	2		3	1		2	3	1	

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books	- Rajkumar Buyya et al. – Mastering Cloud Computing - Barrie Sosinsky – Cloud Computing Bible
Reference Books	1. Velte, Velte & Elsenpeter – Cloud Computing: A Practical Approach 2. Krutz & Vines – Cloud Security: A Comprehensive Guide
e-Learning	https://nptel.ac.in/courses/106105167 https://books.google.co.in/books?id=5pIzngEACAAJ

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	Section A: Contains 05 MCQs/Fill in the blanks/One Word Answer/ True-False type of questions. Each question carries 01 Marks . Section B: Contains 02 descriptive questions and each question carries 2 marks. Section C: Contains 04 descriptive questions out of which 03 questions are to be attempted. Each question carries 05 Marks . <i>50% of the marks obtained in the mid semester examination will be added to the internal assessment.</i>
Quiz Test	04	Contains 04 descriptive questions . Each question carries 01 Mark .
Assignment	05	Assignment to be made on topics and instruction given by subject teacher
Presentation	05	Presentation to be made on topics and instruction given by subject teacher
Attendance	04	As per policy
Total Marks	30	