



# TEERTHANKER MAHAVEER UNIVERSITY

(Established under Govt. of U.P. Act No. 30, 2008)

Delhi Road, Moradabad (U.P.)

## Ph.D. PROGRAMME

### SYLLABUS FOR DISCIPLINE-SPECIFIC COURSE IN

### COMPUTER APPLICATIONS

Course Code:	ADVANCED RESEARCH TRENDS IN COMPUTER APPLICATIONS	L	T	P	C
PDS240178		0	0	0	4
Objectives:					
CO1	Comprehensive understanding of cloud computing and distributed architectures, technologies, and protocols.				
CO2	Apply fundamental software engineering principles and methodologies to real-world projects.				
CO3	Apply data science principles, preprocessing, statistical analysis, regression modeling, and data visualization for analytics.				
CO4	Understand and apply principles of decentralized computing to process data at the network edge, improving efficiency and reducing latency.				
CO5	Understand AI fundamentals, problem-solving, logic, learning methods, neural networks, and practical applications.				
Course Content:					
Unit 1:	<b>Cloud Computing:</b> Introduction to Cloud Computing: Overview of cloud computing, historical evolution, Core Principles: Parallel and distributed computing models, cloud characteristics, Model differences between public, private, and hybrid clouds. Cloud Security Challenges: Data integrity, confidentiality, availability, potential vulnerabilities, Identity and Access Management (IAM), zero trust architecture, and virtual machine security. <b>Edge and Fog Computing:</b> Integration of cloud systems with edge devices and the evolving fog computing paradigm. <b>AI and Cloud Optimization:</b> Application of machine learning for auto-scaling, anomaly detection, and predictive resource management				
Unit 2:	<b>Software Engineering:</b> Definition of software product and process, Software Process and lifecycle models, Software Requirements Analysis & Specification (including SRS format), ER Diagram, Dataflow Model, Software architecture, Modular Design, Cohesion and Coupling, Overview of Testing Process, Functional & Structural Testing, Testing Activities like Unit, Integration & System Testing, Concept of Software Maintenance, Reverse Engineering, Software re-engineering, Software versions and change control process, Documentation.				
Unit 3:	<b>Data Science:</b> Data Science Life Cycle, Data Science Roles, Data Science Applications in Various Fields, Data Security Issues, Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization, Data Storage, and management, Data preparation with Sandbox for analytics, Types of Data Analytics, Descriptive Statistics, Mean, Standard Deviation, Skewness, and Kurtosis,				

	Box Plots, Pivot Table, Heat Map , Correlation Statistics , ANOVA , Exploratory Data Analytics, Confidence (statistical) intervals; variances and correlations, Simple and Linear Regression , Polynomial Regression and Pipelines , data visualization, Data types, Data encoding , mapping variables, Conventional data visualization tools, Techniques for visual data representations, Types of data visualization.
<b>Unit 4:</b>	<p><b>Edge Computing &amp; IoT:</b> Introduction to Edge Computing and its Architectures, Roles and Functions of Edge Communication Technologies, Distributed systems and edge computing core concepts, Edge computing and its application.</p> <p>IoT Architecture, IoT and Edge Security, Physical and hardware security, Shell security, Collaborative and Integrated Edge Security Architecture, Applications of Edge Networks in Internet of things, Introduction to IoT Edge platforms such as Azure IoT hub and AWS IoT platform,</p>
<b>Unit 5:</b>	<p><b>Intelligent System:</b> Introduction to Artificial Intelligence (AI): AI Problems and Foundations, Intelligent Agents and Environments, The Structure of Intelligent Agents; Search Algorithms and Problem Solving: Uninformed Search Strategies, Informed Search Strategies; Logic and Reasoning in AI: First-Order Logic (FOL) and Predicate Logic, Inference in First-Order Logic, Logic Programming and Knowledge Representation; Learning: Inductive, Explanation-Based and reinforcement learning; Knowledge Representation and Reasoning Under Uncertainty, Statistical Learning Methods, Machine Learning Algorithms; Neural Networks and Deep Learning: Introduction to Artificial Neural Networks (ANN), Advanced Neural Networks, Neural Network Design and Training; Cognitive system, Practical application of Machine learning</p>
<b>Text Books:</b>	<ol style="list-style-type: none"> <li>1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.</li> <li>2. R. Pressman, “Software Engineering”, 7th Edition, 2002, McGraw-Hill.</li> <li>3. Jie Cao, Quan Zhang, Weisong Shi, “Edge Computing: A Primer” Springerlink in Science</li> <li>4. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer</li> <li>5. S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, Second Edition, Pearson Education</li> </ol>
<b>Reference Books:</b>	<ol style="list-style-type: none"> <li>1. Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.</li> <li>2. Software Engineering, Yogesh Singh, New Age Publications, Delhi.</li> <li>3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big Data Analytics”, EMC Education Series, John Wiley.</li> </ol>
<b>Additional Electronic Reference Material: (if any)</b>	