S.No	Paper Code	Subject	Hours/ Week	No of Credits	Max.Marks Internal assessment	Max. Marks University Exam	Total Marks
1.	C16	Aws For Cloud and Data Analytics	4	4	25	75	100
2.	C16P	Aws For Cloud and Data Analytics-Lab	2	2	-0-	50	50
3.	C17	Optimization For Machine Learning	4	4	25	75	100
4.	C17P	Optimization For Machine Learning-Lab	2	2	-0-	50	50
5.	C18	Distributed Computing, Simulation and Applications	4	4	25	75	100
6.	C18P	Distributed Computing, Simulation and Applications-Lab	2	2	-0-	50	50
7	C19	Data Science and Machine Learningwith R	4	4	25	75	100
8	C19P	Data Science and Machine Learningwith R-Lab	2	2	-0-	50	50
9	C20	Artificial Intelligence Concepts and Applications	4	4	25	75	100
10	C20P	Artificial Intelligence Concepts and Applications- Lab	2	2	-0-	50	50
Total			30	30	125	625	750

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C16 AWS FOR CLOUD AND DATA ANALYTICS.

UNIT – I

Introduction Definition of Cloud – Evolution of Cloud Computing – Benefits of Cloud Computing - Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

UNIT – II

Cloud Enabling Technologies Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures-Tools and mechanisms.

UNIT-III

Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery. Cloud Architecture & Services: Layered Cloud Architecture Design –Public, Private and Hybrid Clouds -Cloud computing models: laaS – PaaS – SaaS, cloud delivery models, cloud deployment models.

UNIT-IV

AWS & Networking Introduction to AWS, AWS Global infrastructure, Google cloud platform, network switches & virtual private cloud (VPC) , VPC and Subnets , IP addressing in AWS, AWS security groups, EC2 instance types. EC2 pricing models

UNIT-V

Cloud storage Cloud Storage –Advantages of Cloud Storage – Cloud Storage Providers – S3 (Simple Storage Service) - S3 Features. Security in cloud Software-as-a-Service Security – Security Governance – Virtual Machine Security-Security types: network level, host level, application level

TEXT BOOKS

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.

2) Overview of AWS : AWS whitepaper , copyright@aws,inc, and/or its affiliates. BY AWS.
3) Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security‖, CRC Press, 2017.

REFERENCE BOOKS

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing‖, Tata Mcgraw Hill, 2013.

2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach‖, Tata Mcgraw Hill, 2009.

3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)‖, O'Reilly, 2009.

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C17 OPTIMIZATION FOR MACHINE LEARNING

UNITI

Introduction to Operations Research, Origin and Development of OR, Definition of OR, Applications of OR, Models and their classifications, Advantages and Limitations of OR

UNIT-II

Linear programming problem (LPP), Formulation of LPP, Solution of LPP using graphical method and simplex method ($\leq$ inequality only).

UNIT-III

Transportation problem: Mathematical formulation, IBFS of transportation problem using northwest corner rule, least-cost rule and Vogel"s approximation method, Simple problems.

UNIT-IV

Assignment problem, definition, mathematical formulation of assignment problem, solution of transportation problem using Hungarian algorithm, unbalanced assignment problem, simple problems, difference between assignment and transportation problems

UNIT-V

Introduction – Definition – Terminology and Notations Principal Assumptions, Problems with N Jobs through Two Machines Problems with N Jobs through Three Machines

Text Book

1. Operations Research (2nd Edition) by S.Kalavathi, Vikas Publications Towers Pvt. Ltd.

Reference books

1. Operations Research by Kanthiswaroop, P.K.Gupta, Manmohan by Sultan Chand & Sons

2. Operations Research by Paneerselvam by Prentice Hall of India

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C18- DISTRIBUTED COMPUTING, SIMULATION AND APPLICATIONS

UNIT - I

Distributed Computing Concept: Definitions, The history of distributed computing, Different forms of computing, The strengths & weaknesses of distributed computing, Basics of operating systems, Network basics, Software engineering basics. Event synchronization, Timeouts and threading, Deadlocks, Data representation, Data marshalling, Event diagram and sequence diagram, IPv4 & IPv6, Connection – oriented versus connectionless IPC.

UNIT – II

Distributed Computing Paradigms: Paradigms and Abstraction, Message Passing, The Client-Server Paradigm, the Message System Paradigm, Remote Procedure Call Model, RMI, The Distributed Objects Paradigm, The Object space, The Mobile Agent Paradigm.

UNIT – III

The Socket API: The Socket metaphor in IPC, The Datagram Socket API, The Stream-Mode Socket API, Sockets with non-blocking I/O Operations, Secure Socket API. The client server paradigm issuers, connection- oriented and connectionless servers, Iterative server and concurrent server, stateful server and stateless server.

UNIT – IV

Distributed Objects: Remote Procedure Calls, Distributed Objected Systems, Remote Method Invocation, The Java RMI Architecture, The API for the Java RMI, RMI Security Manager, Comparison of RMI Remote Procedure Calls, Distributed Objected Systems, Remote Method Invocation, Comparison of RMI and Socket APIs.

UNIT – V

Group Communication: Uni-casting versus Multicasting, Multicast API, Connectionless versus

Connection-oriented Multicast, Reliable Multicasting versus Unreliable Multicasting, The Java Basic Multicast API.

Text Books

1. Liu M. L., "Distributed Computing: Principles and Application", Pearson Education, 2008.
2. Altiya H., Welch J., "Distributed Computing Fundamentals, Simulations and Advanced Topics", 2nd edition, Wiley – India Edition, 2006.

Reference Books

1. Distributed Systems: Principles and Paradigms Andrew S. Tanenbaum, Maarten Van Steen,
2016.
2. Distributed Computing: Fundamentals, Simulations and Advanced Topics" by Hagit Attiya and   Jennifer   Welch.

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UNIT I

Introduction to Data Sciences and Machine Learning, Machine Learning Algorithms, Extended Machine Learning Algorithms.

UNIT II

Introduction to R, More on Data Structures, Decision Control and Looping Statements.

UNIT III

Generating and Manipulating Data in R, Working with Data, Using dplyr () and tidyr () packages.

UNIT IV

Plotting graphs in R, Social Media Mining.

UNIT V

Implementing Machine Learning Algorithms, Implementing Extended Machine Learning Algorithms.

TEXT BOOK

1. Reema Thareja, "Data Science and Machine Learning in R", Mc Graw Hill 2021.

Reference books

1. Dr. Dhaval Maheta, "Data Analysis Using R: A Primer for Data Scientist", 2021.

2. Brett Lantz, "Machine Learning with R", third edition,Packt Publishing Limited.

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C20 – ARTIFICIAL INTELLIGENCE CONCEPTS AND APPLICATIONS

UNIT I

Foundations of Artificial Intelligence- Basics of Ai, Problem Solving Methods in Ai, Informed and Uninformed Search Strategies Knowledge Representation.

UNIT II

Basics of Machine Learning-Neural Networks and Applications, Fuzzy Logic and Applications, Statistical Machine Learning, Decision Processes and Reinforced Learning, Classification Problems in Machine Learning.

UNIT III

Applications of Ai- Game Playing, Text Analysis and Mining, Expert Systems and Applications

UNIT IV

Logic in Artificial Intelligence- First Order Logic, ProlongModern ArtificialIntelligence Languages and Tools.

UNIT V

Trends in Machine Larning- Concepts in Machine Learning, Advanced Topics in Machine Learning.

TEXT BOOK

1. LAVIKA GOEL "Artificial Intelligence: Concepts and Applications", Wiley,2021.

REFERENCE BOOKS

1. DEEPIKA M, VIJAY CUDDAPAH, AMITENDRA SRIVASTAVA,SRINIVAS MAHNKALI, "AI and ML POWRING THE AGETS OF AUTMATION" BPB PUBLICATION,