MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

(Formerly West Bengal University of Technology)

Syllabus of B. Sc. in Information Technology

(Effective from 2023–24 Academic Sessions)

Semester: V

Name of the Course:

- **Computer Networking** **Course Code: BSCITM501**
- **Computer Networking Lab** **Course Code: BSCITM591**

Contact Hours: 3L +2P

Credits: 5

Course Objective:

- The course aims to introduce students to the fundamental concepts and principles of computer networking, covering the OSI and TCP/IP models, different types of networks (LAN, MAN, WAN), and various network topologies.
- It aims to develop the student's ability to analyze data transmission techniques and understand the factors affecting data transmission.
- The course also emphasizes the implementation of network layers, including Data Link, Network, Transport, and Application layers, and their respective protocols.
- Furthermore, it aims to provide knowledge of network security mechanisms, such as encryption, firewalls, and securing data in transit.
- The course focuses on equipping students with practical knowledge of networking tools and troubleshooting techniques, enabling them to configure and optimize network devices like routers, switches, and hubs.

Course Outcomes:

Course Outcome (CO)	Mapped Module(s)
CO1: Understand the basics of communication systems, analog and digital signals, data transmission, and switching concepts.	Module 1, Module 2
CO2: Explain the structure of computer networks, OSI and TCP/IP models, transmission media, and performance measures.	Module 1, Module 2
CO3: Apply data link layer mechanisms including framing, error control, and flow control protocols.	Module 3
CO4: Analyze medium access sublayer protocols and channel access mechanisms like ALOHA, CSMA, FDMA, TDMA, and CDMA.	Module 4
CO5: Evaluate network and transport layer functionalities such as addressing, routing, congestion control, and protocol operations (IPv4, IPv6, TCP, UDP).	Module 5, Module 6
CO6: Demonstrate knowledge of application layer protocols and network security techniques including cryptography and firewalls.	Module 7

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

(Formerly West Bengal University of Technology)

Syllabus of B. Sc. in Information Technology

(Effective from 2023–24 Academic Sessions)

Semester: V

Contents:

Module 1: Introduction

Introduction to communication systems, Data, signal and Transmission: Analog and Digital, Transmission modes, components, Transmission Impairments, Performance criteria of a communication system. Goals of computer Network, Networks: Classification, Components and Topology, categories of network [LAN, MAN, WAN]; Internet: brief history, internet today; Protocols and standards; OSI and TCP/IP model.

Module 2: Physical Layer

Overview of data [analog & digital], signal [analog & digital], Modulation-Analog and Digital, transmission media [guided & unguided]; Switching-Circuit, message, packet, data rate limit, data performance measure- bandwidth, throughput, latency. Multiplexing-FDM, TDM, WDM

Module 3: Data Link Layer

Types of errors, framing [character and bit stuffing], error detection & correction methods; CRC, Flow control; ARQ, piggybacking, stop and wait ARQ, Go back n

Module 4: Medium Access Sublayer

Point to point protocol, FDDI, token bus, token ring; Reservation, polling, concentration; Multiple access protocols: ALOHA, CSMA-CA, CSMA-CD, FDMA, TDMA, CDMA; Ethernet.

Module 5: Network Layer

Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing: Internet address, classful address, classless address, routing techniques, static vs. dynamic routing, Protocols: IPv4, IPV6. Transition mechanism, address mapping-ARP, RARP; ICMP

Module 6: Transport Layer

Process to process delivery; UDP; TCP; Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, Quality of services [QoS].

Module 7: Application Layer

DNS, SMTP, FTP, HTTP & WWW; Security: Cryptography [Public, Private Key based], Digital Signature, Firewalls [technology & applications].

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

(Formerly West Bengal University of Technology)

Syllabus of B. Sc. in Information Technology

(Effective from 2023–24 Academic Sessions)

Semester: V

Module No.	Content	Total Hours	% of Questions	CO Covered	Bloom's Level	Remarks (if any)
Module 1	Introduction to Communication Systems, Networks, OSI & TCP/IP Models	8	14%	CO1, CO2	Remember, Understand	Foundational concepts
Module 2	Physical Layer: Signals, Transmission Media, Circuit Switching, Telephone Network	10	16%	CO1, CO2	Remember, Understand	Real-world communication media
Module 3	Data Link Layer: Framing, Error Control, Stop-and-Wait ARQ	8	14%	CO3	Understand, Apply	Communication reliability
Module 4	Medium Access Sublayer: Protocols (ALOHA, CSMA, FDMA, etc.)	8	14%	CO4	Understand, Analyze	Protocol analysis focus
Module 5	Network Layer: Devices, Addressing, Routing, IP & IPv6	8	14%	CO5	Understand, Apply, Analyze	Routing logic and IP models
Module 6	Transport Layer: UDP, TCP, QoS, Congestion Control Algorithms	6	14%	CO5	Understand, Apply, Analyze	Connection control focus
Module 7	Application Layer: DNS, FTP, HTTP, WWW, Cryptography, Firewalls	6	14%	CO6	Understand, Apply, Evaluate	Internet application and security

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

(Formerly West Bengal University of Technology)

Syllabus of B. Sc. in Information Technology

(Effective from 2023–24 Academic Sessions)

Semester: V

Practical

Computer Networking Lab
Course Code: BSCITM591

Credit: 2

Course Objective:

- The lab course is designed to provide students with hands-on networking skills, including the configuration, installation, and maintenance of networking hardware and software.
- It focuses on the practical application of networking protocols like TCP/IP, ARP, DNS, and others through various lab exercises.
- The lab course also aims to give students experience with network devices such as switches, routers, and network interface cards (NICs), as well as simulating network communication using tools like Packet Tracer and Wireshark.
- Students will learn to troubleshoot common networking problems and configure devices for optimal performance while experimenting with different network topologies.
- Additionally, the lab emphasizes network security configuration, such as setting up firewalls, encryption, and securing communication channels.

Suggestive List of Practical:

1. **Study of different types of network cables** (Coaxial, Twisted Pair, Fiber Optic) and connectors.
2. **Crimping of straight-through and cross-over cables** using RJ-45 connectors.
3. **Setting up a LAN using switches and hubs** and verifying connectivity using ping and ipconfig.
4. **Installing and configuring NICs** and testing driver/software installation.
5. **Configuring IP addresses manually and using DHCP** on a small peer-to-peer network.
6. **Studying internetworking devices** – Switches, Routers, Gateways, Bridges, Hubs – their setup and functioning.
7. **Basic router configuration** using console cable (e.g., setting hostname, IP, enabling interfaces).
8. **Configure a wireless access point and test connectivity** on different devices.
9. **Implementing static and dynamic routing** on small network simulators or real routers (if available).
10. **Observing and measuring network signal degradation** using basic network analyzers or cable testers.
11. **Demonstrating stop-and-wait ARQ protocol** using simple hardware simulators.
12. **Demonstrate error detection using CRC hardware simulation** (or simple kits with bit patterns).
13. **Simulation of network topologies** (star, bus, ring, mesh) using Cisco Packet Tracer or GNS3.

14. **Simulation of ALOHA and CSMA protocols** using Java/C/Python or available online tools.
15. **Analysis of packets using Wireshark** – inspecting ARP, ICMP, TCP, and HTTP.
16. **Setup of a basic web server and file transfer (FTP) service** on local host.
17. **DNS configuration and resolution testing** (using nslookup, dig, or local BIND server setup).
18. **Configure and test firewall rules** using Windows/Linux firewall settings.
19. **Simulating congestion control techniques** (Leaky Bucket and Token Bucket) using custom code or simulation tools.
20. **Simulating cryptographic algorithms** (Caesar, RSA, or Diffie-Hellman) using Python or Java.

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
B. A. Forouzan	Data Communications and Networking	5th Edition, ISBN: 978-0073376226	TMH (McGraw-Hill Education)
A. S. Tanenbaum	Computer Networks	5th Edition, ISBN: 978-0132126953	Pearson Education/PHI
W. Stallings	Cryptography and Network Security	10th Edition, ISBN: 978-0134444284	Pearson Education/PHI

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

(Formerly West Bengal University of Technology)

Syllabus of B. Sc. in Information Technology

(Effective from 2023–24 Academic Sessions)

Semester: V

Paper Name: Data Warehousing and Mining

Paper Code: BSCITM502
Contact Hours: 5L
Credits: 5

Aim of the Paper:

The aim of this course is to provide students with a comprehensive understanding of **data warehousing concepts and data mining techniques**, enabling them to effectively store, manage, retrieve, and analyze large volumes of data. The course equips learners with the foundational knowledge and practical skills required to apply data mining methods such as **association rule mining, classification, clustering, and web mining** to extract meaningful patterns and insights. It also emphasizes the **application of these techniques in real-world domains**, preparing students to support data-driven decision-making in business, scientific, and technological environments.

Course Objectives:

1. To introduce students to the **mathematical and theoretical foundations** underlying data warehousing and data mining tools and techniques.
2. To enable students to **understand, design, and implement classical models and algorithms** used in data warehousing and mining processes.
3. To provide insight into **pattern discovery methods** through association rule mining, classification, and clustering, and to explore their applicability in knowledge discovery.
4. To develop the ability to **apply data mining techniques to real-world domains** such as social media, scientific research, and environmental data analysis.
5. To equip students with the skills to **evaluate and select appropriate data mining algorithms** for practical problem-solving and decision support.

Course Outcomes (CO):

CO No.	Course Outcome Description	Bloom's Taxonomy Level	Mapped Modules
CO1	Understand the functionality of various data mining and data warehousing components.	*Knowledge, Understand*	Module 1, Module 2
CO2	Appreciate the strengths and limitations of various data mining and warehousing models and techniques.	*Apply, Create*	Module 1, Module 3, 5
CO3	Explain various data analysis techniques including association, classification, clustering, and web mining.	*Analyze*	Module 3, Module 4, 5, 6
CO4	Describe different methodologies used in data mining and data warehousing from design to implementation.	*Analyze*	Module 1, Module 2, 6
CO5	Compare and evaluate different data warehousing architectures and mining models used in real-world applications.	*Evaluate*	Module 1, Module 2, 4
CO6	Develop knowledge discovery strategies using clustering, classification, and association mining suited to specific business or research problems.	*Apply, Analyze, Create*	Module 3, Module 4, 5

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

(Formerly West Bengal University of Technology)

Syllabus of B. Sc. in Information Technology

(Effective from 2023–24 Academic Sessions)

Semester: V

Module 1: Data Warehouse (10 Hours)

What Is a Data Warehouse? The need for a Separate Data Warehouse. Data Warehouse Models: Enterprise Warehouse, Data Mart and Virtual Warehouse. Differences between Operational Database Systems and Data Warehouses. Data Warehouse Modeling: Data Cube, Conceptual Modeling of Data Warehouse. Concept Hierarchies, Measures: Their Categorization and Computation. OLAP Operations, Operations in the Multidimensional Data Model (OLEP). Data Warehouse Design and Usage, From Online Analytical Processing to Multidimensional Data Mining. Data Warehouse Implementation.

Module 2: Introduction to Data Mining (10 Hours)

What is Data Mining? Process of Knowledge Discovery. Types of Repositories, Data Mining Functionalities, Methods of presenting Derived Model. Data Mining Tasks, Data Mining Trends, Data Mining Issues.

Module 3: Association and Correlation Analysis (8 Hours)

Basic Concepts, how does Association Rule Learning work? The Apriori Algorithm: Basics. FP Growth Algorithm, Applications of Association Rule Learning.

Module 4: Clustering Algorithms and Cluster Analysis (10 Hours)

Unsupervised Learning basic idea. Clustering Algorithms: K-Means Clustering, K-Medoids clustering (PAM), Hierarchical Clustering, Graph-Based Clustering. Cluster Analysis basics, Cluster Evaluation. Outlier Detection and Analysis.

Module 5: Classification (10 Hours)

Supervised Learning: Classification, Issues regarding Classification, Types of Classifiers: Binary Classification, Multiclass Classification. Classification Approaches: Bayesian Classification - Naïve Bayes, Association based Classification, Rule-Based Classifier.

Module 6: Web Mining (7 Hours)

Web Mining, Mining the web page layout structure. Mining web link structure, mining multimedia data on the web. Automatic classification of web documents and web usage mining. Distributed Data Mining.

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

(Formerly West Bengal University of Technology)

Syllabus of B. Sc. in Information Technology

(Effective from 2023–24 Academic Sessions)

Semester: V

List of Books-

Text book:

Sl. No.	Author(s)	Title of the Book	Edition / ISBN	Publisher
1	Jiawei Han, Micheline Kamber, Jian Pei	*Data Mining: Concepts and Techniques*	3rd Edition, ISBN: 9780123814791	Morgan Kaufmann / Elsevier
2	Alex Berson, Stephen J. Smith	*Data Warehousing, Data Mining & OLAP*	ISBN: 9780070587410	Tata McGraw-Hill
3	Paulraj Ponniah	*Data Warehousing Fundamentals for IT Professionals*	2nd Edition, ISBN: 9788126520675	Wiley India
5	Arun K. Pujari	*Data Mining Techniques*	4th Edition, ISBN: 9788126568318	Universities Press (India)
6	S. Anitha and S. Kannan	*Data Warehousing and Mining*	ISBN: 9789351198395	S. Chand Publishing