Pokhara University
Faculty of Science and Technology

Course Code: CMP 344 (3 Credits) | Full marks: 100
Course title: **Computer Networks (3-1-2)** | Pass marks: 45
Nature of the course: Theory & Practical | Total periods: 45
Level: Bachelor | Program: BE

1. Course Description

This course is designed to familiarize the student with the basic taxonomy and terminology of the computer. It aims to provide an understanding about the operation of layer-wise network communication, various addressing mechanisms, routing algorithms, network management & security in the computer network and overview of server configuration for complete networking systems.

2. General Objectives

The course is designed with the following objectives:

- ➔ To acquaint the students with the computer networking concepts, including fundamental principles, terminology, and architecture.
- ➔ To make the students familiar with the various network models and protocols at different layers, understanding their roles, functions, and how they enable communication between devices.
- ➔ To expose the students to key concepts in network security, including strategies to protect data integrity, confidentiality, and availability, and to mitigate threats like hacking and data breaches.
- ➔ To equip the students with the practical skills to design, configure, manage, and troubleshoot networks, including the use of networking tools, hardware, and software.

3. Contents in Detail

Specific Objectives	**Contents**

● The student will be able to understand the computer networking concepts, including fundamental principles, terminology, and architecture.	**Unit I: Introduction to Computer Network (3 hrs)** 1.1 Definition, merits, Demerits 1.2 Network Models 1.2.1 PAN, LAN, Campus Area Network (CAN), MAN, Country Area Network (CAN*), WAN, GAN 1.2.2 Topological Models (star, bus, distributed bus, mesh, tree, hybrid, ring) 1.2.3 Client/Server, Peer-to-Peer 1.3 ISPs, NSPs Overview and Backbone of Networking 1.4 Recent Trends in Telecom Technologies: 2G/3G/4G/5G.
● Understand the layered approach to networking and the various network connecting devices	**Unit II: Reference Model (4 hrs)** 2.1 Protocols and Standards 2.2 Interfaces and Services 2.3 OSI Layers 2.4 TCP/IP Layers 2.5 Comparison between OSI and TCP/IP 2.6 Networking hardware: NIC, Hub, Repeater, Switches, Bridge, Router, Gateway
● Understand how the Physical Layer establishes the foundation for all subsequent layers of the networking model, ensuring that data can be physically transmitted between devices effectively and reliably. ● Alongside, students will learn about the various networking parameters	**Unit III: Physical Layer (4 hrs)** 3.1 Guided Media: Copper, Fiber cabling and its capacity standards 3.2 Unguided Media: Bluetooth, Wi-Fi/Wireless LAN, Satellite Communication Basics (Microwaves, Radio waves) 3.3 Circuit/packet/message switching 3.4 ISDN signaling and Architecture 3.5 Network Performance: Bandwidth, Throughput, Latency, Bandwidth-Delay Product, Jitter

• In this chapter the student will learn how the data link layer provides reliable data transfer across a physical network link by handling error detection, frame synchronization, and flow control between directly connected devices.	**Unit IV: Data Link Layer (8 hrs)** 4.1 LLC and MAC sub-layer overview 4.2 Physical (MAC) addressing overview 4.3 Framing 4.4 Flow Control (stop and wait, go-back-N, selective-repeat-request) 4.5 Error Control Mechanism 4.5.1 Error Detection: Parity Check, CRC 4.5.2 Error Correction: Hamming Code 4.6 Channel Access 4.6.1 ALOHA Systems 4.6.2 CSMA, CSMA/CD 4.7 802.3 Ethernet, Fast Ethernet, Gigabit Ethernet 4.8 802.4 Token Bus, 802.5 Token Ring 4.9 Virtual Circuit Switching: Frame Relay, ATM and X.25
• Gain a good understanding of Internet Layer Protocol for ensuring that data packets are correctly routed and delivered across networks, using IP addresses.	**Unit V: Network Layer Protocols and Addressing (8hrs)** 5.1 Logical Addressing 5.1.1 IPV4 addressing, subnetting, supernetting, CIDR, VLSM 5.1.2 IPV6 addressing overview 5.1.3 IPV4 and IPV6 header protocol format 5.1.4 IPV4 and IPV6 feature comparison 5.2 Routing Algorithm Overview 5.2.1 Classful and Classless Routing 5.2.2 Adaptive and non-adaptive Routing 5.2.3 Distance vector and Link-state routing 5.2.4 Interior and exterior routing 5.2.5 Unicast and multicast routing 5.2.6 Routing Algorithms: RIP, OSPF, BGP 5.3 NAT
• Understand the concept of transport layer protocol to ensure reliable and efficient data transfer between devices by managing end-to-end communication.	**Unit VI: Transport Layer and Protocols (4 hrs)** 6.1 Port addressing overview 6.2 Process to process delivery: multiplexing and demultiplexing 6.3 TCP services, features, segment headers, well known ports & Handshaking 6.4 UDP services, features, segment headers, well known ports 6.5 Concept of socket programming: TCP and UDP socket

• In this chapter, the students will learn the traffic shaping algorithms used in computer networks to control the amount and rate of data transmission, helping to manage congestion and ensure QOS.	**Unit VII: Congestion Control and Quality of Services (3 hrs)** 7.1 Congestion Control: Open Loop and Closed Loop 7.2 Traffic Shaping (Leaky bucket and Token bucket) 7.3 TCP Congestion Control
• Learn how the Application Server Protocols facilitates communication between the application server and client devices, ensuring the efficient, secure, and reliable delivery of application services.	**Unit VIII: Application Layer, Servers and Protocols (4 hrs)** 8.1 Domain addressing, DNS server and Queries 8.2 HTTP, FTP & proxy server overview 8.3 DHCP Principles 8.4 Email Server Protocols: SMTP, POP, IMAP
• Here the student will learn how to protect the network and its data from unauthorized access, attacks, and breaches - ensuring confidentiality, integrity, and availability of information.	**Unit IX: Network Management and Security (7 hrs)** 9.1 Introduction to Network Management 9.2 Principles of Cryptography (Symmetric Key: DES, Asymmetric key: RSA) 9.3 Key Exchange Protocols (Diffie-Hellman, Kerberos) 9.4 VPN 9.5 Overview of IP Security 9.6 Firewall, Digital Certificate 9.7 Next Generation Network (NGN)

Note: The figures in the parentheses indicate the approximate periods for the respective units.

4. Methods of Instruction

Lecture, Tutorials, Discussions and Assignments

5. List of Tutorials

The following tutorial activities of 15 hours per group of maximum 24 students should be conducted to cover all the required contents of this course.

S.N.	Tutorials
1	Error Detection and Correction Methods, Parity ,CRC and Hamming code
2	Subnetting
3	Leaky Bucket and Token Bucket/ Queuing Delay Numericals
4	RSA and cryptography Numerical

6. Practical Works

S.N.	Practical works
1	Network commands testing: ping-pong, netstat, nslookup, ipconfig/ifconfig, tracert/traceroute.
2	Setting up Client/Server network system in Microsoft and Linux environment
3	UTP CAT6 cabling: Straight and Cross wiring, testing and verification
4	Internet Packet header analysis using TCPDUMP/WIRESHARK
5	Router Configuration use of packet tracer or other simulator software
6	OSPF configuration and practices
7	VLAN And Router on stick method
8	Web, Proxy, FTP server configuration
9	Implementation of Router ACL, Proxy Firewall, IPTables
10	Case Study: Network Design Standards (eg: building network design with servers including NCR

7. Evaluation system and Students' Responsibilities

Evaluation System

In addition to the formal exam(s) conducted by the Office of the Controller of Examination of Pokhara University, the internal evaluation of a student may consist of class attendance, class participation, quizzes, assignments, presentations, written exams, etc. The tabular presentation of the evaluation system is as follows.

Internal Evaluation	Weight	Marks	External Evaluation	Marks
Theory		**30**	**Semester End Examination**	**50**
Class attendance and participation	10%			
Assignments	20%			
Quizzes/ presentations	10%			
Internal Term Exam	60%			
Practical		**20**		
Attendance and class participation	10%			
Lab Report/Project Work	20%			

Practical Exam/Project Work	40%			
Viva	30%			
Total Internal		**50**		
Full Marks = 50 +50 =100				

Students' Responsibilities:
Each student must secure at least 45% marks in the internal evaluation with 80% attendance in the class to appear in the Semester End Examination. Failing to obtain such a score will be given NOT QUALIFIED (NQ) and the student will not be eligible to appear in the End-Term examinations. Students are advised to attend all the classes and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course

8. Prescribed Books and References

Text Book

1. "Computer Networks", 4th Edition, A. S. Tanenbaum, Pearson Education.
2. "Data Communications and Networking", 5th Edition, Behrouz A. Forouzen, McGraw-Hills.

Reference Books

1. "Data & Computer Communications", 7th Edition, William Stallings, Pearson Education.
2. "Computer Networking: A Top-Down Approach", James F. Kurose, K.W. Rose, 6th Edition, Pearson Education.