Pokhara University
Faculty of Science and Technology

Course Code: CMP 335(3 Credit)	Full Marks: 100
Course Title: Data Communication (3-0-2)	Pass Mark: 45
Nature of the Course: Theory and Practical	Total Lectures: 45 hours
Level: Bachelor/ Year: III/ Semester: VI	Program: BE

1. Course Description:

Data Communication is a fundamental aspect of computer engineering and networking. This course provides students with a comprehensive understanding of the principles, protocols, and technologies used to transmit data between computers, devices, and networks. It explores the theoretical and practical aspects of data communication.

2. General Objectives:

a) To acquire the knowledge and concept of Data Communication.
b) To recognize the requirements of digital devices to exchange data.
c) To realize the basics of switching and networking.

3. Methods of Instructions:

- Lecture, and practical.

4. Course Contents

Unit 1: **Introduction** (2 hrs)

- Evolution of Data Communication systems
- Analog and Digital Data Transmission, Data Communication Terminology
- Standards Organizations, Applications

Unit 2: **Data Transmission** (3 hrs)

- Data Transmission Techniques - Parallel Transmission, Serial Transmission (Synchronous, Asynchronous and Isochronous Communication), Modes of Data Transmission
- Line Configuration, Bit Rate/ Baud rate, Transmission Channel, Data Rate Limits - Shannon Capacity Theorem and Nyquist Bit Rate, RS-232C (DTE-DCE, DTE-DTE)

Unit 3: **Signals and Systems** (6 hrs)

- Signals and their classification: Periodic and non-periodic signals; Deterministic and Random signals; Energy and Power signals; Continuous and Discrete time signals
- Basic Elementary Signals - Unit Step Signal, Ramp Signal, Impulse Signal, Sinusoidal Signal, Signum Signal
- System - Continuous and Discrete time system
- Basic system properties: Linearity, Causality, Stability, Static & Dynamic, and Time Invariance, Introduction to LTI System

Unit 4: **Overview of Data Communication Networking and Protocols** (4 hrs)

- Network Types, Topology
- OSI layers and Functions, TCP/IP layer, Local Area Networks (LAN) Architecture, LLC/MAC & Routing
- IEEE Standards, Ethernet (Aloha, CSMA), Wide Area Networks (WAN): X.25, Frame Relay, ATM

Unit 5: **Transmission Media** (5 hrs)

- Electromagnetic Spectrum for Telecommunication
- Type of Propagation
- Guided Transmission Media: Twisted Pair Cable, Coaxial Cable, Optical Fiber, Characteristics of Unguided Communication Bands, Antennas
- Unguided Transmission Media: Terrestrial Microwave, Satellite Communication, VSAT, and Cellular Telephony

Unit 6: **Impairments, Error handling and Compression Techniques** (6 hrs)

- Attenuation & Distortion, Delay Distortion, Noise & Types, interference, crosstalk
- Types of error & its Detection and Correction Methods
- Data Compression, Lossless Compression - Run Length Coding, Dictionary Coding and Huffman Coding
- Lossy Compression - Predictive Coding and Transform Coding

Unit 7: **Data Link Control and Protocol** (5 hrs)

- Framing
- Flow Control: Stop - & - Wait, Sliding Window, Error Control: Automatic Repeat Request (ARQ), Stop-and Wait ARQ, Sliding Window (ARQ)
- HDLC protocol
- Point-to-Point protocol

Unit 8: **Multiplexing & Switching** (5 hrs)

- Multiplexing types and Application
- Multiplexing Vs Non-Multiplexing
- The Telephone System: Analog services and its Hierarchy
- Digital services and Hierarchy Circuit Switching, Packet Switching, Message Switching, and Private Branch Exchange

Unit 9: **Data Encoding & Modulation** (9 hrs)

- Line coding – Unipolar, Polar and Bipolar signaling.
- Digital Modulation Techniques - Amplitude, Frequency, and Phase Shift Keying.
- Analog to Digital Conversion - Pulse Code and Delta Modulation.
- Analog Modulation Techniques -Amplitude, Frequency, and Phase Modulation
- Multilevel Modulation-QPSK, QAM
- Introduction to Modem

5. List of Tutorials	
SN	
1.	X
2.	x
3.	x

6. List of Practicals	
SN	
1.	Signal Analysis using MATLAB (Maximum 3 Labs)
2.	Implementation of Error Detection Techniques.
3.	Simulated simple PCM coder that converts samples into a digital code
4.	Amplitude Modulation and Demodulation
5.	Frequency Modulation and Demodulation
6.	Simulated Error Control Coding Techniques

7. Evaluation System and Students' Responsibilities

Evaluation System

The internal evaluation of a student may consist of assignments, attendance, term-exams, lab reports and projects etc. The tabular presentation of the internal evaluation is as follows:

Internal Evaluation	Weight	Marks	External Evaluation	Marks
Theory		**30**	**Semester End**	**50**
Attendance &Class Participation	10%			
Assignments	20%			
Presentations/Quizzes	10%			
Internal Assessment	60%			
Practical		**20**		
Attendance &Class Participation	10%			
Lab Report/Project Report	20%			
Practical Exam/Project Work	40%			
Viva	30%			