International Islamic University Chittagong

Department of Electrical and Electronic Engineering

B. Sc. Engineering in EEE

Semester End Exam, Spring 2024

Course Code: **EEE 3601** Course Title: **Communication Theory**

Time: 2 hours 30 minutes Full Marks: 50

(i) The figures in the right-hand margin indicate full marks

(ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

| CO | CO Statements | PO |
|---|---|---|
| CO1 | Reflect a basic understanding of analogue and digital communication, Noise, modulation and Multiplexing technique. | PO1 |
| CO2 | Apply the understating to Solve the problems of analogue and digital communication problem. | PO2 |
| CO3 | Use necessary learning skills in different types of analogue and digital communication system design. | PO3 |

| Bloom's Levels (BL) of the Questions | | | | | | |
|---|---|---|---|---|---|---|
| Letter Symbols | C1 | C2 | C3 | C4 | C5 | C6 |
| Meaning | Remember | Understand | Apply | Analyze | Evaluate | Create |

## Part A
**[Answer the questions from the followings]**

| | | | | | |
|---|---|---|---|---|---|
| 1. | a) | Design FM modulator and Demodulator. | CO3 | C3 | 5 |
| 1. | b) | Show the relationship between FM and PM. Find the required power and bandwidth for FM modulator. | CO2 | C3, C4 | 5 |
| 2. | a) | A PCM system multiplexes 20 band limited voice channel (300-3400Hz). 15 of them are multiplexed and uses a 256 level quantizer, if the signal is sampled at 8KHz what will be the bandwidth of binary encoded signal? | CO2 | C6 | 5 |
| 2. | b) | Evaluate the spectrum of sampling theorem. Write down some applications of sampling theorem. | CO2 | C5 | 5 |
| | | **Or,** | | | |
| 2. | a) | Design an Armstrong indirect FM or PCM modulator to generate an FM or PPM signal with carrier frequency 97.3 MHz and $\Delta f = 10.24$ kHz. A NBFM generator of $fc_1 = 20$ kHz and $\Delta f = 5$ Hz is available. Only frequency doublers can be used as multipliers. Additionally, a local oscillator (LO) with adjustable frequency between 400 and 500 kHz is readily available for frequency mixing. | CO2 | C6 | 5 |
| 2. | b) | Describe the generation of PCM, DM and DPCM signals. | CO2 | C5 | 5 |

## Part B
**[Answer the questions from the followings]**

| | | | | | |
|---|---|---|---|---|---|
| 3. | a) | Demonstrate ASK, FSK and PSK signal assuming a bit sequence 110011. | CO3 | C4 | 5 |
| 3. | b) | For a BPSK modulator with a carrier frequency of 70 MHz and an input bit rate of 10 Mbps, determine the maximum and minimum upper and lower side | CO3 | C6 | 5 |

| | | | | | |
|---|---|---|---|---|---|
| | | frequencies, draw the output spectrum, determine the minimum Nyquist bandwidth, and calculate the baud. | | | |
| 4. | a) | Based on altitude, what type of satellite is Bangabandhu Satellite-1.? How can you correlate the parameters of Bangabandhu Satellite-1 based on the knowledge you have gathered in this course? | CO2 | C3 | 5 |
| 4. | b) | Design a chip code and show its functionality for a CDMA based Satellite system. Design a FDMA earth station transmitter. | CO3 | C4 | 5 |
| 5. | a) | Design a basic TDMA frame for satellite communication. Depict how unique word correlator works. | CO2 | C3 | 5 |
| 5. | b) | Define WDM, multiplexing. Design WDM Multiplexing and de-multiplexing of a 10 laser optical sources system. | CO3 | C6 | 5 |
| | | **Or,** | | | |
| 5. | a) | Illustrate different types of satellite orbits. Discuss the disadvantages of Low Earth Orbit (LEO). | CO1 | C1 | 5 |
| 5. | b) | Describe frequency bands of the satellite communication. Design the expression of elevation angle of a satellite. | CO2 | C6 | 5 |