

International Islamic University Chittagong
Department of Electrical and Electronic Engineering
B. Sc. Engineering in EEE

Special Semester End Exam, Autumn 2022

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

Course Outcomes (COs), Program Outcomes (POs) and Bloom's Levels (BL) of the Questions			
CO	CO Statements	PO	BL
CO1	Reflect a basic understanding of analogue and digital communication, Noise, modulation and Multiplexing technique	POa	C1,C2
CO2	Apply the understating to Solve the problems of analogue and digital communication problem.	POb	C3,C4
CO3	Use necessary learning skills in different types of analogue and digital communication system design	POc	C3,C4,C5,C6

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 a PLL FM Demodulator. What is Capture range? | 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) Design the encoding process for a PCM system. | CO2 | C6 | 5 |
| 2. b) Design instantaneous sampling and natural sampling; depict the results of these samplings. | CO2 | C5 | 5 |

Or

- | | | | |
|--|------------|-----------|---|
| 2. a) Write down the Carson's rule. Depict the spectral analysis of 1% bandwidth and Carson's rule. | CO2 | C6 | 5 |
| 2. b) A 100 KHz carrier wave is frequency modulated with 3-KHz 3 V-peak sinusoid .if the modulator has a sensitivity of 2 KHz/V, Assuming the modulated signal is a cosine, determine i) the approximate signal bandwidth using Carson's rule ii) the expression as a function of time for the FM signal for a cosine carrier of 5 V peak. | CO2 | C5 | 5 |

Part B

[Answer the questions from the followings]

- | | | | |
|--|------------|-----------|---|
| 3. a) Show the process of generating BPSK signal using Balanced modulator Circuit. | CO2 | C4 | 5 |
| 3. b) Show the step by step process of phasor diagram and constellation diagram of a QPSK signal. | CO2 | C4 | 5 |
| 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 |

- | | | | | |
|-------|---|-----|----|---|
| b) | Design a chip code and show its functionality for a CDMA based Satellite system. | CO3 | C4 | 5 |
| 5. a) | Define WDM, multiplexing. Design WDM Multiplexing and de-multiplexing of a 10 laser optical sources system. | CO1 | C1 | 5 |
| 5. b) | Design a basic FDMA frame for satellite communication. Depict how unique word correlator works. | CO2 | C6 | 5 |
- OR
- | | | | | |
|-------|--|-----|----|---|
| 5. a) | Design the receiver for a QPSK system. | CO1 | C1 | 5 |
| 5. b) | For a Binary Phase Shift Keying (BPSK) modulator with an input data rate (f_b) equal to 10 Mbps and a carrier frequency of 70 MHz, determine the minimum Nyquist bandwidth (f_N) and the baud. | CO2 | C6 | 5 |

International Islamic University Chittagong
Department of Electrical and Electronic Engineering

Final Examination -Autumn-2018

Program: B.Sc. Engg. (EEE)

Course Code: EEE-3601

Course Title: Communication theory

Time: 2 hours 30 minutes

Full Marks: 50

Part A

[Answer any two questions from the followings; figures in the right margin indicate full marks.]

- 1(a). Explain the following terms i) Percent modulation ii) 1% bandwidth 2
- 1(b). How frequency modulated wave can be obtained by using phase modulator. Derive the equation of Narrow Band FM. 4
- 1(c). An angle modulated signal with carrier frequency $\omega_c = 2\pi 10^5$ is described by the equation $V(t) = 10 \cos (\omega_c t + 5 \sin 3000t + 10 \sin 2000\pi t)$ 4
 - a. Find the power of the modulated signal.
 - b. Find the frequency deviation.
 - c. Find the phase deviation
 - d. Estimate the bandwidth of $V(t)$.
- 2(a). Design the encoding process for a PCM system. 5
- 2(b). Design simultaneous sampling and natural sampling; depict the results of these sampling. 5
- 3(a). Derive the expression for the signal to quantization noise ratio for PCM system that employs linear quantization technique. Assume that input to the PCM system is a sinusoidal signal. 5
- 3(b). Write down the steps of Pulse Code Modulation (PCM) generation? 3
- 3(c). Design a sample and hold circuit. 2

Part B

[Answer any three questions from the followings; figures in the right margin indicate full marks.]

- 4(a). Write down the types of Digital modulation technique. 1
- 4(b). For a Binary Phase Shift Keying (BPSK) modulator with an input data rate (f_b) equal to 10 Mbps and a carrier frequency of 70 MHz, determine the minimum bandwidth. 5
- 4(c). Depict the constellation diagram of a QPSK and QAM modulation system.
- 5(a). Classify the communication satellite according to its orbit. Contrast the advantages and disadvantages of geosynchronous satellites. 5
- 5(b). What are the factors that limit the number of sub-channels provided within a satellite channel via FDMA? Also, briefly discuss about the satellite link performance factors. 5
- 6(a). Design a basic TDMA frame for satellite communication. 4
- 6(b). Make a comparison between Time-Division Multiple-Access (TDMA) and Frequency-Division Multiple Access (FDMA). 1
- 6(c). Design a WDM, multiplexing and de-multiplexing system with 10 lesser sources. 5
- 7(a). What are the common multiple access technologies? Write a very short description about CDMA. Also, differentiate between multiplexing and multiple access technologies. 5
- 7(b). Four data channels (digital), each transmitting at 1Mbps, use a satellite channel of 1 MHz. Design an appropriate configuration using FDM. 3
- 7(c). Prove that the minimum bandwidth required for BPSK is equal to the input bit rate. 2

International Islamic University Chittagong
Department of Electrical and Electronic Engineering

Final Examination Spring-2019

Course Code: EEE 3601

Time: 2 hours 30 minutes

Program: B.Sc. Engg. (EEE)

Course Title: Communication Theory

Full Marks: 50

Part A

[Answer any two questions from the followings; figures in the right margin indicate full marks.]

- 1(a). What are the advantages of FM over AM? Write some applications of frequency modulation. CO2 02
- 1(b). Explain the relationship between FM and PM waves. Sketch the FM and PM waves for the digital modulating signal $m(t)$ shown in Fig. 1(b). The constants k_f and k_p are $2\pi 10^5$ and $\pi/2$, respectively, and $f_c = 100$ MHz. CO3 04

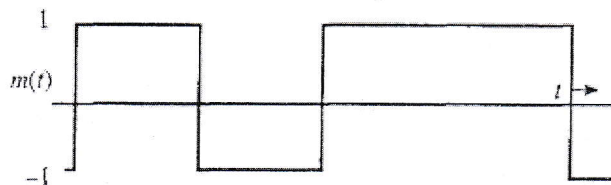


Fig. 1: for question 1(b)

- 1(c). An angle modulated signal with carrier frequency $\omega_c = 2\pi 10^5$ is described by the equation $V(t) = 10 \cos(\omega_c t + 5 \sin 3000t + 10 \sin 2000\pi t)$ CO3 04
- Find the power of the modulated signal.
 - Find the frequency deviation.
 - Find the phase deviation
 - Estimate the bandwidth of $V(t)$.
- 2(a). Design the encoding process for a PCM system. CO3 C 5
- 2(b). Design instantaneous sampling and natural sampling; depict the results of these samplings. CO3 E,C 5
- 3(a). State the sampling theorem. CO1 R,E 2
- 3(b). Design a sample and hold circuit. CO2 An,E 3
- 3(c). What are the problems associated with delta modulation? How the problem of slope overload distortion can be solved by adaptive delta modulation? Explain. CO2 05

Part B

[Answer any three questions from the followings; figures in the right margin indicate full marks.]

- 4(a). Design an Amplitude Shift Keying (ASK) system. CO1 R,U 3
- 4(b). For a Binary Phase Shift Keying (BPSK) modulator with an input data rate (f_b) equal to 10 Mbps and a carrier frequency of 70 MHz, determine the minimum Nyquist bandwidth (f_N) and the baud. CO2 Ap,E 4
- 4(c). Depict the constellation diagram of a QPSK system. CO2 C 3

- | | | | |
|-------|--|-----|--------|
| 5(a). | Classify the communication satellite according to its orbit. Contrast the advantages and disadvantages of geosynchronous satellites. | CO1 | 05 |
| 5(b). | What are the factors that limit the number of sub-channels provided within a satellite channel via FDMA? Also, briefly discuss about the satellite link performance factors. | CO1 | 05 |
| 6(a). | Discuss about the multilevel multiplexing. Make a comparison between TDM and FDM. | CO4 | 05 |
| 6(b). | We have four sources, each creating 250 characters per second. If the interleaved unit is a character and 1 synchronization bit is added to each frame, find | CO4 | 05 |
| | (a) the data rate of each source, | | |
| | (b) the duration each character in each source, | | |
| | (c) frame rate | | |
| | (d) the duration of each frame, | | |
| | (e) the number of bits in each frame and | | |
| | (f) the data rate of the link. | | |
| 7(a). | Show the receiving technique for a QPSK system. | CO3 | Ap,E 5 |
| 7(b). | What is Minimum shift-keying(MSK)? What are the advantages of MSK . | CO2 | U,R 3 |
| 7(c). | Write down the difference between Bit rate and baud rate? | CO1 | U,R 2 |

CO1 Reflect a basic understanding of analogue and digital communication
CO2 Understand the application of modulation technique.
CO3 Solve the problems of difernet modulation.
CO4 Demonstrate basic proficiency in multiplexing techniques.

International Islamic University Chittagong
Department of Electrical and Electronic Engineering

Final Examination Spring-2018

Course Code: **EEE-3601**

Time: 2 hours 30 minutes

Program: B.Sc. Engg. (EEE)

Course Title: **Communication Theory**

Full Marks: 50

Use separate script for each part. Figures in the right margin indicate full marks.

Part-A

[Answer any two questions from the followings]

- | | |
|---|---|
| 1(a). Depict the spectral analysis of 1% bandwidth and Carson's rule. | 4 |
| 1(b). Design a FM modulator and non Coherent FM Demodulator. | 4 |
| 1(c). Write down the required power and bandwidth of angel modulation. | 2 |
| | |
| 2(a). State the sampling theorem and Nyquist criterion. | 4 |
| 2(b). Explain the companding effect with figure. | 2 |
| 2(c). Comparison among different types of pulse modulation with appropriate figures. | 4 |
| | |
| 3(a). Design a Pulse code modulation (PCM) System. | 4 |
| 3(b). A 100 MHz sinusoidal carrier is frequency modulated with a 3-KHz, 3-V peak sinusoid. If the modulator has a sensitivity of 2KHz/V, determine" | 4 |
| (i) The amplitude of the frequency deviation of the carrier, | |
| (ii) The modulation index, | |
| (iii) The approximate signal bandwidth using Carson's rule, | |
| (iv) The expression as a function of time for the FM signal for a cosine carrier of 5 V peak. Assume the modulating signal is a cosine. | |
| 3(c). Draw the different line codes. | 2 |

Part- B

[Answer any three questions from the followings]

- | | |
|--|---|
| 4(a). Design an Amplitude Shift Keying (ASK) system. | 3 |
| 4(b). Write down the types of Digital modulation technique. | 2 |
| 4(c). For a Binary Phase Shift Keying (BPSK) modulator with an input data rate (f_b) equal to 10 Mbps and a carrier frequency of 70 MHz, determine the minimum Nyquist bandwidth (f_N) and the baud. | 5 |
| | |
| 5(a). What are the types of satellite based on altitude? | 1 |
| 5(b). Describe the encoding and decoding process for a synchronous Code-Division Multiple Access (CDMA) system if the Sender0 has code (1,-1) and data (1,0,1,1), and Sender1 has code(1,1) and data(0,0,1,1). | 5 |
| 5(c). Design a chip code and show its functionality for a CDMA based Satellite system. | 4 |

- 6(a). Define spread spectrum multiplexing. 2
- 6(b). Make a comparison between Time-Division Multiple-Access (TDMA) and Frequency-Division Multiple Access (FDMA). 3
- 6(c). Design a WDM, multiplexing and de-multiplexing system with 10 lesser sources. 5
- 7(a). Depict the constellation diagram of a QPSK and QAM modulation system. 4
- 7(b). For a binary FSK modulator with space, rest, and mark frequencies of 60, 70, and 80 MHz, respectively and an input bit rate of 20 Mbps, determine the output baud and the minimum required bandwidth. 2
- 7(c). Design a basic TDMA frame for satellite communication. 4

International Islamic University Chittagong

Department of Electrical and Electronic Engineering

B. Sc. Engineering in EEE

Final Exam, Autumn 2021

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

Course Outcomes (COs) of the Questions	
<i>Upon the successful completion of the course, students will be able to</i>	
CO1	Reflect a basic understanding of analogue and digital communication, noise, modulation and multiplexing technique
CO2	Apply the understating to Solve the problems of analogue and digital communication problem.
CO3	Use necessary learning skills in different types of analogue and digital communication system design

Bloom's Levels of the Questions						
Letter Symbols	R	U	App	An	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Part A

[Answer the questions from the followings]

1. a) Design a PLL FM Demodulator. Explain the relationship between FM and PM. CO3 App, E 5
1. b) An FM wave is given by $s(t) = 20 \sin(6 \times 10^8 t + 7 \sin 1250t)$. Determine, CO2 E 5
 - i) The carrier and modulating frequencies, the modulation index, and maximum deviation.
 - ii) Power dissipated by this FM wave in a 100Ω resistor.
2. a) What is quantization noise? Write briefly about signal to quantization error ratio. CO3 U 5
2. b) Write down the steps of Pulse Code Modulation (PCM) generation? Design a sample and hold circuit. CO3 App 5

Or,

2. a) Design the encoding process for a PCM system. CO3 U 5
2. b) Explain a DPCM system with the expressions and block diagram. Show that SNR of DPCM is better than that of PCM. CO1 App 5

Part B

[Answer the questions from the followings]

3. a) Design an amplitude Shift Keying (ASK) system. Show receiving technique for a QPSK system. CO1 R 4

- | | | | | |
|-------|---|-----|------|---------|
| 3. b) | What is MSK? Show the details of a Binary Phase Shift keying (BPSK) modulator including input data rate, carrier frequency and minimum Nyquist bandwidth. | CO2 | E | 6 |
| 4. a) | Based on altitude What type of satellite is Bangabandhu Satellite-1.? | CO1 | U, R | 2 |
| 4. b) | Design a chip code and show its functionality for a CDMA based Satellite system. Design a FDMA, SPADE earth station transmitter | CO3 | C | 4+
4 |
| 5. a) | Define CDM. Discuss the basic concepts of WDM and list the advantages and disadvantages of WDM. | CO1 | App | 5 |
| 5. b) | Describe the operations of time division multiplexing (TDM) and compare its advantages and disadvantages over frequency division multiplexing (FDM). | CO2 | U, E | 5 |

Or,

- | | | | | |
|-------|---|-----|------|---|
| 5. a) | Define multiplexing? Discuss about the multilevel multiplexing. | CO1 | App | 5 |
| 5. b) | Describe the operation of a CDMA multiplexing system. Make a comparison between Time-Division Multiple-Access (TDMA) and Frequency-Division Multiple Access (FDMA). | CO2 | U, E | 5 |