Ref: Ex/ET/PC/B/T/313/2024(S)

Bachelor of Electronics and Telecommunication Engineering Examination, 2024
(Third Year, First Semester, Supple)

Subject: Digital Communication Systems

Time: Three hours **Full Marks: 100**

Answer must be written at one place for each attempted question
Answer must be brief and precise

Module I CO1 Marks: 10

Q.1 Answer all the following questions:

(a) Write two important advantages of digital communication over analog communication with explanation. 03

(b) Draw a basic elemental communication system block diagram you have learnt in analog communication and then modify the block diagram for digital communication. 03

(c) What is the basic difference between amplifier and repeater? 02

(d) Write 3 fundamental mechanisms used for multiple access technology in digital communication. 02

Module II CO2+ CO3 Marks: 20+10

Answer one question from Q2 and Q3 and answer Q4:

Q.2. CO2

(a) Write sampling theorem that would be employed in digital communication for signal sampling. Explain the phenomena that will occur if any signal is under sampled. 05

(b) Take a sinusoidal signal of amplitude 4 volts and frequency 1 KHz. Then Generate a PAM (Pulse Amplitude modulated) signal for this with natural sampling. You need to mention the sampling frequency for the generated PAM signal.05

(c) Now explain the process of generation of the PCM (Pulse code Modulation) of this signal into 3-bit code word. 05

(d) Define and write expression for quantization error. 05

Q.3. CO2

(a) Draw a delta modulation circuitfor transmitter and receiver sides. 05

(b) Explain the basic principle of designing delta modulation and write the most significant advantage of delta over pulse code modulation. 05

(c) Now by drawing show the two types of errors occur in delta modulation.

(d) The input to a linear delta modulator is a sinusoidal signal whose frequency can vary from 200 Hz to 4000 Hz. The input is sampled at eight times the Nyquist rate. The peak amplitude of the sinusoidal signal is 1 Volt. Determine the value of the step size to avoid slope overload when the input signal frequency is 800 Hz. 06

Q.4 CO3

(a) A base band signal transmission for 101100101 streamswould require using line coding techniques of types NRZ unipolar and NRZ polar methods. Draw the modulated signal generated in two cases. Explain the advantages for unipolar and polar cases. 06

(b) Now convert the generated line code when Manchester code will be used. Point out the advantages for Manchester code for which it is mostly used. 04

Module III CO4 +CO5 Marks: 20+20

Answer both Q.5 and Q.6

Q.5(a) Define orthogonal and orthonormal signals. 05

(b) A set of mutually orthogonal signal s_1 (t), s_2 (t), ...s_N (t) as expressed

$$s(t) = \sum_{n=1}^{N} c_n s_n(t) \quad t_1 \le t \le t_2$$

Define and express c_n for the expression given. What is the range of value for c_n. 05

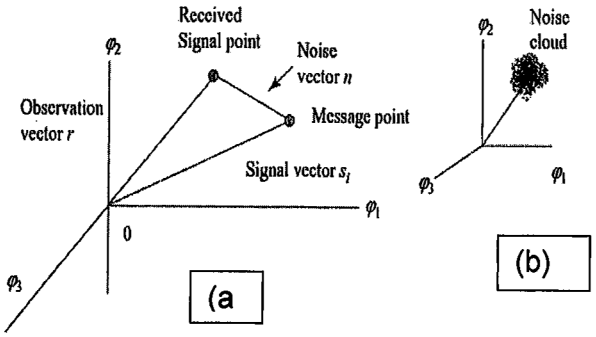
(c) Geometric representation of the M transmitted signals is expressed as,

$$s_i(t) = \sum_{j=1}^{N} s_{ij}\, \varphi_j(t),$$

N<=M

What is s_{ij} and ϕ_j mean here. Draw the signal space diagram for i=1,2 and j= 1,2. 05

(d) The picture below is the Geometric representation of transmitted signal in very noisy environments. Explain the significance of the two pictures (a) and (b). 05



Q.6 (a) Explain the binary phase shift modulation technique for digital transmission by expressing symbols $s_1(t)$ and $s_2(t)$. Write generation and detection methods. Draw constellation diagram. 10

(b) How is error probability determined for BPSK transmission. Find the expression for error probability P_e. 10

Module IV CO6 Marks 20

Q. 7. (a) The city B weather status is coded as given below, what is the average code length.

Now City C weather condition is giving in second table, what will be the average code-length? Differentiate the two cases and draw conclusion on source coding for information transmission.

City B Weather Status

Weather	Code	Probability
Sunny	00	1/4
Rainy	01	1/4
Cloudy	10	1/4
Foggy	11	1/4

City C Weather Status

Weather	Code	Probability
Sunny	1110	1/8
Rainy	110	1/8
Cloudy	10	1/4
Smoggy	0	1/2

(b). Consider a discrete memoryless source with a source alphabet $A = \{S_0, S_1, S_2\}$ and the respective probabilities $p_0 = ¼$, $p_1 = ¼$ and $p_2 = ½$. Find the entropy of the source. 05

(c) Describe the Binary Memoryless Channel and find the expression for its entropy. 05