Reg. No. :

Question Paper Code : X20449

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Fifth Semester
Electronics and Communication Engineering
EC 6501 – DIGITAL COMMUNICATION
(Regulations 2013)
(Common to PTEC6501 – Digital Communication for B.E. (Part-Time) – Fourth Semester)
(Regulations 2014)
(Electronics and Communication Engineering)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. State sampling theorem for band-limited signals and the filter to avoid aliasing.

2. Write the two fold effects of Quantization Process.

3. What is Adaptive Delta Modulation ?

4. What is prediction filtering ?

5. Draw the NRZ-M and Biphase-M baseband encoding forms for the data [1 0 1 1 0 0 0 1 1].

6. Write down the decision rule for detecting the original input sequence $\{b_k\}$ from the output binary sequence $\{c_k\}$ of a pre-coded Duo-Binary scheme.

7. Distinguish coherent vs non coherent digital modulation techniques.

8. Draw a block diagram of a coherent BFSK receiver.

9. What is the need of channel coding ?

10. What are the different methods of describing the structure of a convolutional code ?

PART – B **(5×13=65 Marks)**

11. a) Derive the signal to Quantization noise ratio in PCM system.

(OR)

b) Explain in detail about Delta modulation transmitter and receiver. A sinusoidal signal $X(t) = a_0 \cdot \cos(2\pi f_0 t)$ is applied to a delta modulator that operates with a sampling Period, T_s and step size, $\Delta = 2\delta$.

i) Find the expression for amplitude, a_0 to avoid slope overload distortion. **(3)**

ii) Compute the maximum permissible value of the output signal power. **(3)**

iii) Compute the variation of Quantization noise in delta modulation. **(3)**

iv) Find the maximum value of output signal to noise ratio. **(4)**

12. a) With neat diagram, explain the adaptive delta modulation and demodulation system in detail.

(OR)

b) Explain the operation of DPCM encoder and decoder with neat block diagrams.

13. a) i) Derive Nyquist criterion for distortionless transmission. **(7)**

ii) Using related figure, discuss the role of Eye pattern in baseband transmission. **(6)**

(OR)

b) i) Derive the power spectral density of NRZ unipolar format. **(6)**

ii) Discuss about correlative coding. **(7)**

14. a) Illustrate the transmitter, receiver and signal space diagram of Quadrature Phase Shift Keying and describe how it reproduces the original sequence with the minimum probability of symbol error with neat sketch. **(13)**

(OR)

b) Illustrate the transmitter, receiver and the generation of the non coherent version of PSK with neat sketch. **(13)**

15. a) i) Describe the cyclic codes with the linear and cyclic property. Also represent the cyclic property of a code word in polynomial notation. **(8)**

ii) List the different types of errors detected by CRC code. **(5)**

(OR)

b) i) Describe how the errors are corrected using Hamming code with an example. **(9)**

ii) The code vector [1110010] is sent, the received vector is [1100010]. Calculate the syndrome. **(4)**

PART – C **(1×15=15 Marks)**

16. a) One experiment has four mutually exclusive outcomes A_i, i = 1, 2, 3, 4 and a second experiment has a three mutually exclusive outcomes B_j, j = 1, 2, 3. The joint probabilities $P(A_i, B_j)$ are;

$P(A_1, B_1) = 0.10$; $P(A_1, B_2) = 0.08$; $P(A_1, B_3) = 0.13$;

$P(A_2, B_1) = 0.05$; $P(A_2, B_2) = 0.03$; $P(A_2, B_3) = 0.09$;

$P(A_3, B_1) = 0.05$; $P(A_3, B_2) = 0.12$; $P(A_3, B_3) = 0.14$;

$P(A_4, B_1) = 0.11$; $P(A_4, B_2) = 0.04$; $P(A_4, B_3) = 0.06$;

i) Determine the probabilities $P(A_i)$, i = 1, 2, 3, 4 and $P(B_j)$, j = 1, 2, 3. **(7)**

ii) Suppose we observe the outcomes A_i, i = 1, 2, 3, 4 of experiment, A. Determine the Mutual information, $I(B_j; A_i)$ for j = 1, 2, 3 and i = 1, 2, 3, 4 in bits. Also determine the average mutual information, I(B : A). **(8)**

(OR)

b) Consider a random variable $x \in \{-3, -1, +1, +3\}$ with apriori probabilities $P_x(\pm 3) = 0.1$ and $P_x(\pm 1) = 0.4$. Given an observation of the random variable y = x + n; where n is a zero mean Gaussian random variable with variance, σ^2 independent of x. Deduce the decision threshold, y of the MAP detector. Now suppose $\sigma^2 = 0.25$ and y = 2.1, what is the decision ?