B.TECH/ECE/5TH SEM/ECEN 3105/2016

DIGITAL COMMUNICATION
(ECEN 3105)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i)   PAM signal can be demodulated using a
(a) low pass filter   (b) high pass filter
(c) bandpass filter   (d) none of these.

(ii)   Eye Pattern is used to study
(a) Intersymbol Interference   (b) Error Vector Magnitude
(c) Bit Error Rate   (d) Quantization Noise.

(iii) To avoid slope overload in delta modulation, the maximum value of signal amplitude will be (s = step size, f_s = sampling frequency, w = signal frequency)
(a) sf_s (b) w/s   (c) sf_s/w   (d) f_s/w.

(iv)   The spectral density of a real valued random process has
(a) an even symmetry   (b) an odd symmetry
(c) a conjugate symmetry   (d) no symmetry.

(v)   Alternate Mark Inversion (AMI) signalling is also known as
(a) Bipolar signalling   (b) Polar signalling
(c) Manchester signalling   (d) Unipolar signalling

(vi)   Which encoding method uses alternating positive and negative values for 1s?
(a) NRZ   (b) RZ   (c) Manchester   (d) AMI.

(vii) Which of the following condition holds for two statistically independent events A and B?
(a) P(AB)=P(A).P(B)   (b) P(A)=P(B)
(c) P(AB)=P(A)+P(B)   (d) None of these.

(viii) For encoding the binary data, differential encoding uses
(a) signal transitions   (b) signal frequency
(c) signal phase   (d) signal amplitude.

(ix)   Regenerative repeaters are used in
(a) digital communication
(b) wireless communication
(c) analog communication
(d) both analog and digital communication.

(x)   Spectral Density expresses
(a) average voltage as a function of frequency
(b) average current as a function of frequency
(c) average power in a waveform as a function of frequency
(d) none of these.

Group – B

2. (a)   What is the difference between natural sampling and flat top sampling?

   (b)   What is aperture effect?

   (c)   Why companding is used in PCM?

   (d)   A television signal having a B.W of 4.2 MHz is transmitted using binary PCM system. Given that the number of quantization level is 512. Determine (i) code word length (ii) transmission B.W. (iii) final bit rate (iv) output signal to quantization noise ratio.
                                   2 + 2 + 4 + (1 + 1 + 1 + 1) = 12

3. (a)   With a neat block diagram, explain the generation of Delta Modulation (DM).

   (b)   What are the limitations of DM? How can these be overcome?

   (c)   A DM system is designed to operate at 3 times the Nyquist rate for a signal with a 4 KHz Bandwidth. Determine the maximum amplitude of a 1 KHz input sinusoid for which the DM does not show slope-overload. Given that quantization step size is 200 mV.
                                   4 + (4 + 1) + 3 = 12

Group – C

4. (a) The CDF for a certain RV is given as:

$$F_X(x) = \begin{cases} 0 & -\infty < x \le 0 \\ kx^2 & 0 < x \le 10 \\ 100k & 10 < x < \infty \end{cases}$$

(i) Find the value of k.
(ii) Find the value of P(X≤5).
(iii) Find the value of P(5<X≤7).
(iv) Find the expression for PDF.

(b) Prove that the autocorrelation function of a WSS process has the maximum magnitude at zero time lag.

(c) What do you mean by a random process?

6 + 4 + 2 = 12

5. (a) Why pulse shaping is required in digital communication?

(b) Explain Nyquist criterion for zero ISI.

(c) Draw the block diagram of the zero forcing equalizer.

(d) A communication channel of bandwidth 75 KHz is required to transmit binary data at a rate of 0.1 Mbps using raised cosine pulses. Determine roll off factor.

3 + 3 + 3 + 3 = 12

Group – D

6. (a) Obtain an expression for the probability of error of an optimum filter.

(b) Derive an expression for the transfer function of an optimum filter.

(c) When is an optimum filter called a matched filter?

4 + 6 + 2 = 12

7. (a) 'In integrate and Dump type filter the integrater enhances the signal relative to the noise and this enhancement increases with bit duration (T)' - Justify the statement .

(b) Find the Transfer Function of an Optimum filter.

4 + 8 = 12

Group – E

8. (a) The bit rate for the digital system is 34 Mbps. For QPSK modulation scheme, what is the baud rate?

(b) For a bit sequence of 100110, draw the resulting waveform for QPSK modulation scheme.

(c) With suitable diagram, explain the working principle of QPSK transmitter. Draw its signal space diagram.

2 + 3 + (5+2) = 12

9. (a) What is the advantage of M-ary modulation technique?

(b) How, the problems faced in QPSK, are solved in MSK?

(c) Draw the signal space diagram of BFSK and BPSK.

4 + 4 + 4 = 12