

CS/B.Tech/Even/ECE/6th Sem/EC-601/2014

2014

Digital Communication

Time Alloted : 3 Hours

Full Marks : 70

The figure in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP - A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the following:

10x1=10

- i) Companding is used in PCM to
 - a) Reduce the probability of errors
 - b) Reduce quantization noise
 - c) To increase signal strength
 - d) Improve signal to noise ratio for low level input signals
- ii) To avoid aliasing, what is the nyquist rate of this signal $x(t) = 8\cos 100\pi t$?

a) 25 Hz	b) 50 Hz
c) 100 Hz	d) 200 Hz

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- iii) The probability density function (PDF) of the envelope of narrowband Gaussian noise is,

a) Poisson	b) Gaussian
c) Rayleigh	d) Rician
- iv) BPSK signal can be demodulated by using,
 - a) A low pass filter
 - b) A band pass filter
 - c) A high pass filter
 - d) None of these
- v) In a Delta Modulation system, the granular noise occurs when the modulating signal,
 - a) Increases rapidly
 - b) Changes within the step size
 - c) Decreases rapidly
 - d) Has high frequency component
- vi) The Nyquist interval for $m(t) = \left(\frac{\sin 200\pi t}{\pi t} \right)^2$ is

a) 0.001s	b) 0.005s
c) 0.0025s	d) 0.00125s
- vii) In a Digital Communication system employing Frequency Shift keying (FSK) the 0 and 1 bit are represented by sine waves of 10 KHz and 25 KHz respectively. These waveforms will be Orthogonal for bit interval of :

a) 45 μ S	(c) 50 μ S
b) 200 μ S	(d) 250 μ S
- viii) A Rectangular pulse of duration T is applied to matched filter. The output of filter is a

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- a) Rectangular Pulse of duration T
- b) Rectangular Pulse of duration 2T
- c) Triangular Pulse
- d) Impulse Function

ix) The PDF of a Gaussian Random variable X is given by

$$P_X(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

The probability of event $\{x=4\}$ is

- a) 1/2
- b) $\frac{1}{\sqrt{2\pi}}$
- c) 0
- d) 1/4

x) In Eye Pattern, as eye closes:

- a) ISI increases
- b) ISI decreases
- c) Timing jitter increases
- d) Timing jitter decreases

xi) A Random Process is defined as Ergodic, if.

- a) All types of Ensemble averages are not changeable
- b) All types of Ensemble averages are constant
- c) All types of Ensemble averages are interchangeable.

xii) The Bit Rate of a Digital Communication system is 34 Mbps. The modulation scheme is QPSK The baud rate of the system is:

- a) 68 Mbps
- b) 34 Mbps
- c) 17 Mbps
- d) 85 Mbps

GROUP - B
(Short Answer Type Questions)

Answer any *three* of the following. **3x5=15**

2. With the block diagram explain modulator and demodulator of a delta modulation system. **5**

3. Show that a matched filter receiver and a co-relation receiver are equivalent of each other. **5**

4. a) For the input binary sequence 1100110011, sketch the waveforms of in phase component of

- i) QPSK
- ii) Quadrature component of QPSK.
- iii) QPSK Signal

b) Compare the power spectra of MSK and GMSK sequence. **3+2**

5. Prove that $X = \sqrt{2/T} \sin 2\pi ft, Y = \sqrt{2/T} \cos 2\pi ft$ are set of orthonormal function

- 6. (a) Why non-uniform quantization is needed?
- (b) Briefly discuss the A-law and μ law companding.

(2+3)

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GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. 3x15=45

- 7. i) Justify why the term RANDOM VARIABLE is a misnomer.
 - ii) A joint PDF of 2RVs X and Y is given as

$$p_{xy}(x,y) = e^{-(x+y)} \text{ for } x \geq 0, y \geq 0.$$

$$= 0 \text{ otherwise}$$

Find P(X<1).
 - iii) A deterministic signal $x(t)=\cos(2\pi t)$ is passed through a differentiator.
 - a) Determine the autocorrelation $R_{xx}(\tau)$ and PSD, $S_{xx}(f)$ of the input signal.
 - b) Find the output PSD, $S_{yy}(f)$.
 - c) Find $R_{xy}(0)$ and $R_{xy}(1/4)$.

1+2+(2+2+2+2+2)=15
 - 8. i) Draw the block diagram for Regenerative Repeaters.
 - ii) Explain the function of Equalizer and Bit synchroniser in Regenerative Repeaters.
 - iii) Draw the block diagram of an Early late bit synchroniser and explain how it is useful to avoid ISI.

3+6+6=15
9. Prove that for a PCM system the SNR is $(1.76+6.02n)$ dB.

- ii) How nonlinear quantization can be used to improve SNR.
- iii) How DM is improved over PCM? Calculate the SNR for DM system.

5+4+6=15

- 10. a) Explain how slope overload distortion is minimized in adaptive delta modulation
- b) Draw and-explain the circuit diagram of a PN sequence generator for generating 15 bits PN sequences. Assuming the initial contents of the shift register stages to be all one. What is the output sequence obtained?
- c) The pulse rate in a delta modulator system is 5600 per sec. Find the minimum value of step-size which will avoid slope overload distortion for the signal:-

$$f(t)=5\cos(2\pi \times 100t)+2\cos(2\pi \times 200t)$$

5+6+4=15
- 11. a) With neat block diagram, explain the generation and detection of the BFSK signal.
- b) What are the advantages and disadvantages of DPSK?
- c) Mention four performance metrics for a good digital modulation scheme.
- d) How is BFSK scheme different from BPSK?

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$$8+3+2+2=15$$

12. Write short notes on any three of the following :

$$3 \times 5 = 15$$

- a) Zero forcing Equaliser
- b) PAM Modulator.
- c) Linear predictive Coding Technique
- d) Synchronous Time Division Multiplexing.
- e) Sampling and Zero-order-Hold Circuit

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