

**M.TECH/ECE/1<sup>ST</sup> SEM/ECEN 5101/2016**  
**ADVANCED DIGITAL COMMUNICATION**  
**(ECEN 5101)**

**Time Allotted : 3 hrs**

**Full Marks : 70**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one 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) Total probability of any random variable between the limits  $-\alpha$  to  $+\alpha$  is  
(a) infinite                      (b) zero                      (c) one                      (d) a fraction.
  - (ii) The binomial coefficient in binomial distribution is given by  
(a)  $\frac{n!}{k!(n-k)!}$                       (b)  $\frac{n!}{(n-k)!}$   
(c)  $\frac{n!}{k!}$                       (d)  $\frac{1}{n!(n-k)!}$
  - (iii) Delta modulation is considered as  
(a) carrier modulation                      (b) amplitude modulation  
(c) phase modulation                      (d) 1 bit PCM.
  - (iv) In QASK signal carrier signal parameter that changes with the symbol level is  
(a) frequency only                      (b) amplitude only  
(c) amplitude and frequency                      (d) amplitude and phase.
  - (v) Decision region in signal space is used for finding  
(a) inter symbol interference                      (b) minimum error probability  
(c) bandwidth efficiency                      (d) code rate.
  - (vi) For uniform quantization r m s quantization noise is proportional to  
(a) s                      (b) s<sup>2</sup>                      (c) 1/ s<sup>2</sup>                      (d) 1/s.  
where s is the quantization step size

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- (vii) For converting white noise to colored noise the filter necessary is  
(a) bandpass                      (b) bandstop  
(c) highpass                      (d) lowpass.
- (viii) The access technique necessary for accessing communication resources at contiguous frequency bands is known as  
(a) TDMA                      (b) SDMA  
(c) FDMA                      (d) CDMA.
- (ix) In eye pattern minimum eye opening indicates  
(a) ISI maximum                      (b) ISI minimum  
(c) minimum timing jitter                      (d) maximum timing jitter.
- (x) The abbreviation for ADPCM stands for  
(a) Auxiliary Different Phase Code Module  
(b) Adaptive Diplexing Pulse Code Modulation  
(c) Adaptive Differential Pulse Code Modulation  
(d) Asymmetric Diverse Pulse Code Modulation.

**Group – B**

2. (a) Explain with block diagram the principle of delta modulation operation considering both modulator and demodulator. Justify the statement 'Delta Modulation is 1 bit PCM'.  
(b) How do the quantization noise and slope overload noise arise in Delta Modulation? Show graphically the interdependence of both types of noises on step size. Prove that maximum signal amplitude necessary to avoid slope overload in delta modulation is  $a_f$ , where a is the step size and  $f_s$  is the sampling frequency. **8 + 4 = 12**
3. (a) What is called Inter Symbol interference (ISI)? Draw the transfer characteristic of a Nyquist filter and establish the condition of zero ISI.  
(b) What do you understand by TDM hierarchy? Describe ATT system of Digital hierarchy. What will be the output bit rate of T1 Carrier system? **6 + 6 = 12**

**Group – C**

4. (a) Draw the modulated waveforms for OOK, QPSK and BFSK. Draw the signal constellation diagram for BPSK, QPSK and 16 PSK signals. Distinguish between 16 QPSK and 16 QAM signals.

- (b) Explain with block diagram the principle of operation of QPSK modulator and demodulator.

**6 + 6 = 12**

5. (a) What is known as narrow band noise?  
Write an expression for Rayleigh Probability function for composite signal that is digital message signal in presence of narrowband noise.

- (b) Write a note on OFDM signal.

**6 + 6 = 12**

**Group - D**

6. (a) Introduce OFDM signal and explain its properties. Describe with block diagram the method of generation and detection of OFDM signal.

- (b) State several applications of OFDM signals in modern communication systems.

**9 + 3 = 12**

7. (a) What is the difference between multiplexing and multiple access? Explain and mention the application of each of the following access techniques.

(i) CDMA (ii) FDMA (iii) TDMA.

- (b) Describe the essential features of spread spectrum modulation. Explain the principle of operation of a PN sequence generator. Explain its role in the generation of DSSS signal.

**6 + 6 = 12**

**Group - E**

8. (a) Introduce the concept of decision region for Optimum Detection of signal in presence of noise.

- (b) Draw the block diagram of a M ary optimum receiver using correlators. What is the function of a correlator? What way is it useful for optimum detection?

**3 + 9 = 12**

9. What do you understand by matched filtering? Why is it important in a Digital Communication system? Derive the expression for signal to noise ratio at the output of a matched filter and discuss it's significance.

**12**