

**CS/B.TECH/EE/ODD SEM/SEM-7/EE-705C/2016-17**



**MAULANA ABUL KALAM AZAD UNIVERSITY OF  
TECHNOLOGY, WEST BENGAL**

**Paper Code : EE-705C**

**DIGITAL COMMUNICATION**

*Time Allotted : 3 Hours*

*Full Marks : 70*

*The figures 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 the following :

10 × 1 = 10

i) 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.

ii) If the baud rate is 400 for a QPSK signal, the bit rate is

- a) 100                      b) 400
- c) 800                      d) 1600.

7/70416

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**CS/B.TECH/EE/ODD SEM/SEM-7/EE-705C/2016-17**

iii) In a delta modulation system, the granular noise occurs when the modulating signal

- a) increases rapidly
- b) changes within the step size
- c) decrease rapidly
- d) has high frequency component.

iv) For BPSK system, the bit error probability is given by

- a)  $\frac{1}{2} \operatorname{erfc} \left( \sqrt{\frac{E_b}{2N_o}} \right)$
- b)  $\frac{1}{2} \operatorname{erfc} \left( \frac{1}{2} \sqrt{\frac{E_b}{2N_o}} \right)$
- c)  $\frac{1}{2} \operatorname{erfc} \left( \sqrt{\frac{E_b}{N_o}} \right)$
- d)  $\frac{1}{2} \operatorname{erfc} \left( \frac{1}{2} \sqrt{\frac{E_b}{N_o}} \right)$ .

v) In which modulation technique redundant bits should be reduced ?

- a) ADM                      b) DPCM
- c) PCM                      d) none of these.

7/70416

2

- vi) A random process is defined as Ergodic, if
- all types of ensemble average are not changeable
  - all types of ensemble average are constant
  - all types of ensemble average are interchangeable
  - none of these.

vii) The Nyquist interval for  $m(t) = \left(\frac{\sin 200\pi t}{\pi t}\right)^2$  is

- 0.001 s
- 0.005 s
- 0.0025 s
- 0.00125 s.

viii) Auto correlation function of a random process is defined as

- $R(t_1, t_1) = E(X, Y) = \iint xyp(x, y) dx dy$
- $R(X, Y) = \iint x^2 y^2 p(x, y) dx dy$
- $R(t_1, t_1) = \iint x^2 y^2 p(x, y) dx dy$
- none of these.

- The power spectral density of white noise
  - varies as square root of frequency
  - varies as inverse of frequency
  - varies as square of frequency
  - is constant with frequency.
- Which of the digital modulation techniques is used for high speed telephone modem ?
  - QAM
  - GMSK
  - QPSK
  - GFSK.

### GROUP - B

#### ( Short Answer Type Questions )

Answer any *three* of the following.  $3 \times 5 = 15$

- Show that match filter receiver and a correlation receiver are equivalent of each other.
- For the input binary sequence 1100110011, sketch the waveforms of the following :
    - AMI
    - Manchester format
    - Unipolar NRZ.
  - Compare the power spectra of MSK and GMSK sequence.

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4. a) Why non-uniform quantization is needed ?  
b) Briefly discuss the A-Law and  $\mu$ -Law companding.  
2 + 3
5. What is conditional probability ? Explain. 1 + 4
6. State sampling theorem and explain its importance.  
What is Nyquist rate of sampling ?
7. State sampling theorem. A TV signal has a bandwidth of 4.5 MHz. Find out the sampling rate if the signal is to be sampled at a rate of 20% above Nyquist rate. 2 + 3

**GROUP – C**

**( Long Answer Type Questions )**

Answer any *three* of the following. 3 × 15 = 45

8. a) What do you mean by random process ?  
b) Explain auto correlation function of a random process and also explain the properties of auto correlation function.

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- c) What do you mean by probability density function ( PDF ) ? Deduce the relation between probability and PDF.
- d) A three digit message is transmitted over a noisy channel having a probability of error  $p ( E ) = 2/5$  per digit. Find out the probability of receiving a correct digit. 2 + 3 + 3 + 2 + 3 + 2
9. a) Explain with a suitable block diagram how an analog signal is converted into digital signal using PCM.  
b) Deduce the relation of signal to quantization noise.  
c) Prove that for  $n$  bit PCM the signal to quantization noise ratio for a sinusoidal modulation signal is  $1.76 + 6.02 n$ .  
d) What is the importance of regenerative repeaters in PCM ? 5 + 3 + 5 + 2

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10. a) With a neat diagram explain the generation and detection of BFSK signal.
- b) What are the disadvantages of BPSK and how they can be improved ?
- c) Why is DPSK scheme of carrier modulation used ? Compare the bandwidth and probability of error of QPSK, BPSK and BFSK. 7 + 4 + 4
11. a) With neat block diagram explain the generation and reception of data modulation.
- b) What are the disadvantages of delta modulation ? Explain with diagram.
- c) For a sinusoidal signal (  $A \cos \omega t$  ) find the condition for no slope overloaded if step size is  $\Delta$  and sampling period is  $T_s$ . 7 + 5 + 3
12. What do you mean by ISI ? How can overcome it ? What is the difference between MSK and QPSK modulation ? What is the significance of Adaptive delta modulation in digital communication system ? Explain briefly. Draw the eye diagram and define the significance in different regions. 5 + 3 + 4 + 3

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13. Write short notes on any *three* of the following : 3 × 5
- a) Zero forcing equalize
- b) EVM
- c) Regenerative repeater
- d) GMSK
- e) VSA.
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