

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech (ECE)/SEM-5/EC-502/2010-11**

**2010-11**

**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 any ten of the following :

10 × 1 = 10

- i) Adaptive delta modulation is preferred over delta modulation as
  - a) it gives better noise performance
  - b) it uses lesser bits for encoding the signal
  - c) it does not suffer from slope overload and threshold effects
  - d) it has simpler circuitry.
- ii) A rectangular pulse of duration  $T$  is applied to matched filter. The output of the filter is a
  - a) Rectangular pulse of duration  $T$
  - b) Rectangular pulse of duration  $2T$
  - c) Triangular pulse
  - d) Sine function.

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- iii) The compander in a digital communication system serves to
- a) equalise the SNR for both weak and strong PAM signals
  - b) increase amplification of the signals
  - c) improve A/D conversion
  - d) improve multiplexing.
- iv) Entropy is basically a measure of
- a) Rate of information
  - b) Average information
  - c) Probability of information
  - d) Channel capacity for transmission of information.
- v) The bit rate of a digital communication system is 34 Mb/s. The modulation scheme is QPSK. The baud rate is
- a) 68 Mbps
  - b) 34 Mbps
  - c) 17 Mbps
  - d) 8.5 Mbps.
- vi) The use of non-uniform quantization leads to
- a) reduction of transmission bandwidth
  - b) increase in maximum SNR
  - c) increase in SNR for low level signal
  - d) simplification of quantization process.

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- vii) The Nyquist sampling rate for the signals  $s(t) = 10 \cos(50\pi t) \cos^2(150\pi t)$  when  $t$  is in seconds is
- a) 150 samples/second    b) 200 samples/second  
c) 300 samples/second    d) 350 samples/second.
- viii) The entropy of an message source generating four messages with probabilities 0.5, 0.25, 0.125 and 0.125 is
- a) 1.0 bit/message    b) 1.75 bit/message  
c) 3.32 bit/message    d) 5.93 bit/message.
- ix) Coherent demodulation of FSK signal can be effected using
- a) correlation receiver  
b) bandpass filters and envelope detector  
c) matched filter  
d) discriminator detection.
- x) If the number of bits per sample in a PCM system is increased from  $n$  to  $n + 1$ , the improvement in signal-to-quantisation noise ratio will be
- a) 3 dB    b) 6 dB  
c)  $2n$  dB    d)  $n$  dB.

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- xi) A PAM signal can be detected by using
- a) an ADC
  - b) an integrator
  - c) a bandpass filter
  - d) a highpass filter.
- xii) The probabilities of the five possible outcomes of an experiment are  $\frac{1}{2}$ ,  $\frac{1}{4}$ ,  $\frac{1}{8}$ ,  $\frac{1}{16}$  and  $\frac{1}{16}$  respectively. The source entropy is
- a) 1.578 bits/symbol
  - b) 1.5 bits/symbol
  - c) 1.978 bits/symbol
  - d) 1.875 bits/symbol.

**GROUP - B**

**( Short Answer Type Questions )**

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

2. Explain the implication of Inter-Symbol Interference (ISI) in digital communication. What is Nyquist criterion for zero ISI ?
3. a) What is Aliasing ?  
b) What is the function of anti-aliasing filter for the generation of PAM signal ? 2 + 3
4. What is coherent detection technique ? Describe ASK demodulation through coherent detection. 2 + 3
5. a) Why is DPSK scheme of carrier modulation used ?  
b) Compare the bandwidths of QPSK and BPSK. 2 + 3
6. What is companding ? Why is companding needed in digital communication ? 2 + 3

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**GROUP - C****( Long Answer Type Questions )**Answer any *three* of the following.  $3 \times 15 = 45$ 

7. a) With neat block diagram. Explain the generation & detection of the BFSK signal. 6
- b) Define line coding. Write the properties of line coding. 1 + 4
- c) A BPSK modulator has the carrier frequency 70 MHz and input bit rate is 10 Mbps. Determine the maximum and minimum frequencies of the modulated signal. 4
8. a) With neat block diagram, explain the generation & reception of Delta Modulation (DM). 6
- b) What are the limitations of DM ? How these can be solved ? 3 + 2
- c) For a sinusoidal signal (  $A \cos \omega t$  ), find the condition for no slope overload, if step size is  $\Delta$  & sampling period is  $T_s$ . 4
9. a) List the advantages and disadvantages of DPSK technique. 2 + 2
- b) With suitable block diagram, explain the working principle of QPSK transmitter and receiver. Sketch its state space diagram. 4 + 4 + 1
- c) What are the drawbacks of MSK technique ? 2

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10. a) What do you mean by information source and a discrete memoryless source. 2 + 2

b) With suitable expression explain Entropy of a communication system. 6

c) The probabilities of the five possible outcomes of an experiment are given as  $P(x_1) = \frac{1}{2}$ ,  $P(x_2) = \frac{1}{4}$ ,  $P(x_3) = \frac{1}{8}$ ,  $P(x_4) = \frac{1}{16}$  and  $P(x_5) = \frac{1}{16}$ . Determine the entropy and information rate if there are 16 outcomes per second. 5

11. a) A DMS  $X$  has five symbols with respective probabilities 0.2, 0.15, 0.05, 0.1 and 0.5. Construct a Huffman code and calculate the code efficiency. 8

b) The parity check matrix of a particular ( 7, 4 ) linear block code is expressed as

$$[H] = \begin{bmatrix} 1110100 \\ 1101010 \\ 1011001 \end{bmatrix}$$

i) Obtain the generator matrix

ii) List all the code vectors. 7

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12. Write short notes on any *three* of the following : 3 × 5

- a) Matched filter
  - b) Shannon-Fano Algorithm
  - c) Regenerative Repeater
  - d) Linear Block code
  - e) Eye pattern.
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