Q. P. Code: 37491

(3 Hours)

[Total Marks:80]

N. B.: 1) Question No. **1** is **compulsory**.
    2) Attempt **any three** questions out of the remaining five questions.
    3) Assume suitable data wherever necessary.

1. Answer the following (any four):   20
   a) State and explain central limit theorem.
   b) Show that the mean of the sum of random variables is the sum of the means of the random variables.
   c) Consider the five messages given by the probabilities ½, ¼, 1/8, 1/16, 1/16. Calculate average information and information rate if r=1messages per second.
   d) The binary data 1101101011 is applied to the input of a duo-binary system with a pre-coder. Draw the duo-binary encoder and construct the encoder output.
   e) For the binary sequence 1011001101 draw the following line codes: i) NRZ, ii)RZ, iii)AMI, iv)RB, v) bi-phase M.

2. a) A discrete memory less source has an alphabet of five symbols with their probabilities a shown below: 12

Symbol	S1	S2	S3	S4	S5
Probability	0.19	0.22	0.10	0.38	0.11

   i) Construct Huffman code for each symbol and determine the following parameters:
       Entropy, Average code word length, code efficiency and code redundancy.
   ii) Determine the above parameters for Shannon-Fano code.

   b) Discuss the causes of ISI and ways to overcome it. Also state and explain the Nyquist condition for zero ISI.   8

3. a) The generator vectors for a convolutional encoder with code rate 1/3 are g1=111, g2=101 and g3=110.   10

   i) Draw the encoder diagram and determine the code word for the input vector (11010)
   ii) Draw trellis diagram and state diagram.

   b) A (7, 4) cyclic code is generated using the polynomial $g(x)=(1+x+x^3)$. Find the code word if the data word is i) 0011, ii) 0100(MSB) by long division method. Draw the encoder and generate the code word for the same data tracing the path through the encoder.   10

4. a) What is spread spectrum modulation? Explain FHSS giving appropriate diagrams   10

   b) With a neat diagram, explain the working of the Integrate and Dump receiver. Derive the expression for its probability of error.   10

8ACEEF88C199C56EB11FF9BC16589432

5. a) Draw the signal constellation for 16-QASK and hence find its Euclidean 10 distance. Compare it with the Euclidean distance of 16-QPSK.

b) For the bit sequence 101010011010 draw the MSK waveform. 5

c) If the direct sequence spread spectrum system has the following parameters: 5
   Data sequence bit duration, T_b=6.125ms,
   PN chip duration, T_c= 1.5μs,
   The probability of error is less than 10^{-5}; (E_b/N_0=10)
   Then calculate the Processing gain and Jamming Margin.

6. Write short notes on:
   a) Expression for PSD of NRZ data 5
   b) Eye pattern and its significance 5
   c) Significance of AWGN channel 5
   d) Desirable properties of line code 5

****

8ACEEF88C199C56EB11FF9BC16589432