

(03 hours)

QP Code: 31216
[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 if required, stating them clearly.

Q. 1 Answer the following questions: (any four) (20)

- (a) What is a random variable? Explain the moments of a random variable viz. Mean and Variance.
- (b) Why is MSK signal called as "shaped QPSK" signal? Justify with expressions and Waveforms.
- (c) Discuss source coding and channel coding in brief with example.
- (d) The binary data 1101101101 is applied to the input of duo-binary system with a pre-coder. Construct duo-binary coder with the corresponding output.
- (e) State and explain Shannon-Hartley theorem.

Q 2 (a) Show that for an input signal which is a sequence of rectangular positive and negative pulses, the integrator is the matched filter. Bring out properties of matched filter. (10)

(b) With the help of neat block diagram and waveform, explain how a message is transmitted in BFSK? What type of receiver is used for BFSK reception? Explain its working. (10)

Q.3 (a) A discrete memory less source has an alphabet of five symbols with the probabilities-

Symbol	S1	S2	S3	S4	S5
Probability	0.30	0.20	0.16	0.10	0.15

- (i) Construct Huffman code, find entropy and average length of the code.
- (ii) Calculate code efficiency and the redundancy of the code. (8)

(b) For $K=3$, code rate $=1/3$, of a Convolution Code encoder with generator Vectors given as $g_1=[101]$, $g_2=[110]$ and $g_3=[111]$, draw the encoder diagram.

- (i) draw its State diagram and Code tree.
- (ii) Use the Code tree to find the codeword for the msg 1011. (12)

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(2)

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Q.4 (a) With reference to 8-PSK, explain the following:

- (i) transmitter and receiver with a neat block diagram along with mathematical expression for transmitted signal
- (ii) sketch its PSD indicating the bandwidth
- (iii) draw its constellation diagram and find its Euclidian distance (5+3+2)

(b) Design a Feedback shift register encoder for a (8,4) cyclic code with generator Polynomial $g(x) = (1 + x + x^2 + x^3)$.

- (i) Find the codeword for the msg 1001, By tracing the path through the encoder.
- (ii) draw the syndrome calculator for the same and find the syndrome if the received codeword is 1101110 (5+5)

Q.5 (a) What is ISI ? How is it caused? Discuss the remedies to overcome ISI. state the Nyquist's Condition for zero ISI (Distortion less transmission) (10)

(b) Explain Direct sequence spread spectrum system. and Define anti-jamming characteristics of spread spectrum system.

If the direct sequence spread spectrum system has the following parameters.:

Data sequence bit duration $T_b = 6.125$ ms

PN chip duration $T_c = 1.5$ microseconds

The probability of error is less than 10^{-5} ($E_b/N_0 = 10$)

Then calculate Processing gain and Jamming margin. (5+5)

Q.6 (a) Draw the signal constellation diagram for 16-ary QASK (with $d=2a$) and for 16-PSK System. determine the Euclidian distance for the both systems and Compare. Which of them has better noise immunity? (10)

(b) write short notes on : any two (10)

- (i) Central Limit theorem
- (ii) Shannon-Fano coding with an example
- (iii) comparison of Offset QPSK and non-offset QPSK
- (iv) Linear Transversal Equalizer