

Digital Communication

Lib

- N.B.** (1) Question No.1 is **compulsory**.
 (2) Attempt any **four** questions out of remaining **six** questions.
 (3) Assume **suitable** data wherever **required** but justify the **same**.

1. Answer the following questions (any **four**) :— 20
 - (a) State and explain Shannon's theorem on channel capacity.
 - (b) Explain the Nyquist's criterion for distortionless baseband transmission.
 - (c) Compare linear block codes, cyclic codes and convolutional codes by giving their advantages and disadvantages.
 - (d) MSK has lower intersymbol interference compared to QPSK. Justify.
 - (e) In eye Pattern noise is not related to opening or closing of eye. Is that true ?
 - (f) What is processing gain and Jamming Margin in spread spectrum system ?
 A slow FH/MFSK system transmits 4 bits per MFSK symbol and 5 symbols per hop. Calculate the processing gain of the system.

2. (a) Consider Fine Message given by the probabilities :— 10

$$M = m_1, m_2, m_3, m_4, m_5$$

$$P = \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{16}$$
 - (i) Calculate H (Entropy).
 - (ii) Use the Shannon-Fano algorithm to develop an efficient code and, for that code, calculate the average number of bits / message. Compare with H.
- (b) Explain the necessity of line codes for data transmission. State different types of line codes. Derive and plot the power spectral demity of NRZ signal. 10

3. (a) Does channel bandwidth requirement reduces by a factor of four in QPSK compared to BFSK ? 5
- (b) How does phase of carrier vary for message {1 1 0 1 0 1 1} in — 5
 - (i) BPSK
 - (ii) DPSK
 - (iii) DEPSK system, also show decoded output.
- (c) What is duobinary signalling ? What is the need of precoder ? Construct the coder output and corresponding decoder output with precoder. Also differentiate between duobinary and modified duobinary coding scheme. 10

4. (a) A Binary Sequence $b(t) = 1 0 1 0 0 0 1 1 0$ is applied to digital communication system — 10
 - (i) Sketch the scheme of offset QPSK modulation and demodulation
 - (ii) Find the transmitted phase sequence and sketch the transmitted waveform
 - (iii) Draw the signal space representation of 4-Ary and 8-Ary PSK.
- (b) Distinguish between :— 10
 - (i) Matched filter and correlator
 - (ii) MPSK and MFSK

5. (a) Sketch the encoder and syndrom calculator for the generator polynomial $g(x) = 1 + x^2 + x^3$ and obtain the syndrom for the received code word $R = 1001011$ and generate corrected message from the Received Code Word. 10
- (b) A rate $1/3$, $K = 3$ convolutional encoder can be described by the impulse response of the path given by $g_1 = 110$, $g_2 = 101$, $g_3 = 111$. 10
- Draw the block diagram of encoder
 - Draw the Trellis and state diagram of encoder
 - If the received signal at the decoder for the fine message bit is —

$$y = 010 \quad 110 \quad 100 \quad 101 \quad 110$$
Trace the decision on a Trell's and find out message bit sequence.
6. (a) Derive the transfer function, $H(f)$ for an optimum filter, when a optimum filter can be called as matched filter? 10
- (b) Prove that for the 16-ary QASK digital modulation technique, the Euclidian distance is given by $d = 2\sqrt{0.4E_b}$ 10
 Where E_b = normalized energy per bit, also write the advantage and application of QASK.
7. (a) With the help of neat block diagram explain DS-SSS. How chip duration is related to measurement accuracy in ranging by DS spread spectrum? 10
- (b) Write short notes on any **two** of the following :— 10
- Equalizers
 - 8-ary FSK
 - P-N sequence generator.