

- N.B. :** (1) Question No. 1 is **compulsory**.  
 (2) Solve any **four** questions out of remaining **six** questions.  
 (3) **Figures** to the **right** indicate **full** marks.  
 (4) Make **suitable** assumptions where **necessary**.

1. Attempt any **four** of the following :- 20
- What is the need of modulation in communication ?
  - What is companding ?
  - Explain bandwidth efficiency and power efficiency of AM, FM and PM.
  - Discuss the importance of Euclidian distance in ASK, FSK and PSK methods.
  - Explain FDM.
2. (a) A modulating signal  $10 \sin (2\pi \times 10^3 t)$  is used to modulate a carrier signal  $20 \sin (2\pi \times 10^4 t)$ . Find the modulation index, percentage modulation, frequencies of the sideband components and their amplitudes. What is the BW of the modulated signal ? Draw the spectrum of the AM wave. 10
- (b) Explain in detail superheterodyne AM receiver with the waveforms at various points. 10
3. (a) State and prove sampling theorem for low pass signal. 10
- (b) For the bit sequence  $b(t) = 1 1 0 1 0 0 1 0$ . Draw the following lien coding waveforms. 10
- NRZ - L
  - AMI
  - Manchester
  - URZ
  - Polar RZ.
4. (a) Explain QPSK transmitter and receiver. Draw signal sapce representation... 10
- (b) Compare PCM, DM, and ADM. 10
5. (a) Explain the following :- 10
- Information
  - Information Rate
  - Entropy
  - Channel capacity.

An analog signal is bandlimited to 4 kHz. It is sampled at the Nyquist rate and the samples are quantized into 4 levels. The quantization levels  $Q_1, Q_2, Q_3$  and  $Q_4$  are independent messages and have the probabilities  $P_1 = P_2 = \frac{1}{8}, P_3 = P_4 = \frac{3}{8}$ .

Find the information rate of the source.

(b) Explain the concept of image frequency and double spotting. **10**

6. (a) For a (7, 4) linear block code, the generator matrix is given by **10**

$$G = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$$

(i) Find all code vectors

(ii) Explain the procedure for error correction using syndrome vector. Give example.

(b) Compare ASK, FSK and PSK techniques. **10**

7. Write short notes on any **four** :- **20**

- (a) Shannon's Theorem
  - (b) Diode Detector
  - (c) Thermal Noise
  - (d) Pre-emphasis and De-emphasis
  - (e) Ring Modulator.
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