

[5253] - 522
T.E. (E & TC)
DIGITAL COMMUNICATION
(2015 Pattern)

Time : 2 ½ Hours]

[Max. Marks :70

Instructions to the candidates:

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) What is delta - sigma modulator? Draw its block diagram, what are its advantages? [7]
- b) What is time division multiplexing? Explain how allocation of time slots in TDM depends on bit rate. [7]
- c) What is a strictly stationary process? Explain . [6]

OR

- Q2)** a) A binary channel with 36 kbps bit rate is available for PCM voice transmission Find. [6]
- i) Number of quantization levels.
 - ii) Number of bits per sample.
 - iii) Sampling frequency.
- The voice signal is band limited to 3.4 kHz
- b) What is bit synchronisation? Explain any one bit synchroniser. [7]
- c) If a white Gaussian noise is passed through a ideal low pass filter find the autocorrelation function of the filtered noise. Assume passband amplitude response of filter $H(f) = 1$ and cutoff frequency W Hz. [7]

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Q3) a) Explain likelihood ratio test (LRT). [6]

b) A received binary signal has amplitude $\pm 2V$ and bit duration is T_b . The signal is corrupted by AWGN having power spectral density 10^{-4} volt²/Hz. If the signal is processed by integrate & dump filter, what will be required value of T_b so that error probability is less than or equal to 10^{-4} . Given $Q(3.71) \approx 10^{-4}$ [7]

c) State any one property of matched filter. [3]

OR

Q4) a) Derive the expression for signal - to - noise ratio of integrate - and - dump filter. [8]

b) Find impulse response of matched filter whose input is given by [6]

$$g(t) = A \sin\left(\frac{2\pi t}{T}\right); 0 \leq t \leq T$$

$$= 0 \quad ; \text{ otherwise}$$

c) Draw the block diagram of correlation receiver for binary digital input signal. [2]

Q5) a) Explain the band - pass transmission model (Both transmitter & receiver) [6]

b) Binary data is transmitted using PSK at a rate 2 Mbps over RF link having bandwidth 2MHz, find signal power required at the receiver input so that error probability is not more than 10^{-4} . Given noise PSD

$$\frac{N_0}{2} = 10^{-10} \text{ Watt/ Hz and } Q(3.71) = 10^{-4} \quad [6]$$

c) Explain QPSK signal generation. [6]

OR

Q6) a) Explain M-ary PSK transmitter & receiver. [6]

- b) Binary data is transmitted using M-ary PSK at a rate 2 Mbps over RF link having bandwidth 2MHz find signal power required at the receiver input so that bit error probability is less than 10^{-5} .

Given $M = 16$ and Noise PSD $\frac{N_o}{2} = 10^{-8}$ Watt / Hz $\text{erf}(3.1) = 0.99996$ [8]

- c) Explain coherent binary FSK signal generation. [4]

Q7) a) Draw the block diagram of spread spectrum digital communication and explain the various blocks. [8]

- b) State and explain properties of PN sequence. [6]

- c) What are advantages of FHSS. [2]

OR

Q8) a) Draw the block diagram of FHSS transmitter and receiver and explain the various blocks. [8]

- b) The DSSS communication system has message bit duration $(T_b) = 4.095$ ms and chip duration $(T_c) = 1$ μ sec. with $\frac{E_b}{N_o} = 10$ for average error probability less than 10^{-5} . Calculate processing gain & Jamming margin. [6]

- c) What are disadvantages of DSSS. [2]

