53 (EC 502) DGCM

2019

DIGITAL COMMUNICATION

Paper : EC 502

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* What is quantisation error in a binary PCM? 4

   (b) Discuss the operation of a binary PCM. 8

   (c) Show that the 'signal-quantisation ratio' in a binary PCM is given by $SNR\big|_Q = 1{\cdot}8 + 6 \times n$; where '$n$' is the number of bits in a code-word. 8

2. *(a)* Prove that the destination *SNR* for a linear delta modulator circuit (only for granular noise) is given by $\left(\frac{S}{N}\right)_D \leq \left(\frac{3}{8\pi^2}\right) \times \left(\frac{f_s}{W}\right)^3$; where 'f_s' is the sampling frequency and 'W' is the LPF bandwidth. 10

(b) Discuss the operation of a DPCM circuit. 10

3. *(a)* Discuss the coherent detection of ASK bandpass signal and hence calculate the minimum error probability (P_e). 10

(b) A microwave link is used for transmitting binary data at the rate of $1Mbps$. Assuming the two-sided PSD of the noise at the input of the receiver to be $10^{-10} W/Hz$, find the average carrier power required to be maintained if the error probability is not to exceed 10^{-4}; when *(i)* coherent BPSK and *(ii)* coherent BFSK are used. Given value of inverse complementary error function of 2×10^{-4} to be 2·629. 10

4. *(a)* Discuss the method for the generation of BFSK (coherent) modulated signal. 5

(b) Calculate the power spectra for a binary BFSK signal and hence comment on the result. 15

5. *(a)* Consider a telegraph source having two symbols : dot and dash. The dot duration is $0{\cdot}2 sec$ and the dash duration is 3 times the dot duration. The probability of the dot's occurring is twice that of the dash and the time between the symbols is $0{\cdot}2 sec$. Calculate the information rate of the telegraph source. 10

(b) A DMS 'S' has an alphabet $\{s_0, s_1\}$ with probabilities $p(s_0) \equiv p_0 = \frac{1}{4}$ and $p(s_1) \equiv p_1 = \frac{3}{4}$. Find the entropies of the source 'S' and that for the extended source S^3. 10

Contd.

6. Write short notes on ***any two*** from the following : 10+10

(a) Line coding in digital communication system

(b) Bandwidth-power trade-off in PCM

(c) Error probability with matched filter for polar signaling

(d) Discrete Memoryless Channel (DMC).