53 (EC 502) DGCM

2017

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)* Discuss the operation of a binary PCM. 8

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

(c) What is quantization error in a binary PCM ? 4

Contd.

2. *(a)* Discuss the operation of a DPCM circuit. 7

(b) Prove that a first order predictor circuit in a DPCM is a unit-delay block. 3

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

3. *(a)* A microwave link is used for transmitting binary data at the rate of 1*Mbps*. Assuming the PSD (two-sided) 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 (*Pe*) is not to exceed 10^{-4}, when *(i)* coherent BPSK and *(ii)* coherent BFSK are used. Given inverse complementary error function of 2×10^{-4} to be 2·629. 5+5

(b) Discuss the coherent detection of ASK bandpass signals and hence calculate the minimum error probability for such scheme. 5+5

4. (a) Calculate the power spectra for a binary FSK (BFSK) signal and hence discuss the result. 10

(b) If a signal is given by $x(t) = \wedge(t-1)$; where $\wedge(t)$ is a triangular function, calculate the transfer function of the filter matched to this signal. 10

5. (a) For a lossless channel; show that $H(x|y) = 0$, where the symbols have their usual meaning. 10

(b) A binary memoryless source produces the binary symbols 0 and 1 with probabilities 'p' and '1–p' respectively. Calculate the entropy of this source and hence sketch the variation of the entropy with the probability 'p'. 8+2

6. *(a)* A source is producing sequences of independent symbols A, B, C, D and E with the following probabilities :

$$A = \frac{1}{12}; \quad B = \frac{1}{6}; \quad C = \frac{1}{12}; \quad D = \frac{1}{6};$$

$$E = \frac{1}{12}.$$ 8+7

(i) Device an unambiguous binary code for these symbols.

(ii) Compute the coding efficiency of your code.

(b) Why PSK signals cannot be detected by non-coherent techniques ? 5
