53 (EC 502) DGCM

2014

DIGITAL COMMUNICATION

Paper : EC 502

Full Marks : 100

Pass Marks : 30

Time : Three hours

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

*Answer **any five** questions.*

1. *(a)* Describe different common steps of a digital communication system with neat block diagram. 10

   (b) Define quantization noise and show that for uniform quantization, average quantization noise power is $= \frac{\Delta^2}{12}$ where Δ is the step height. From this expression can we relate SNR and no. of bits/sample ? 10

2. What is meant by DPCM ? Compare it with general PCM. Draw block diagram of DPCM Transmitter and Receiver and explain its working in detail. 20

3. *(a)* Consider the following analog signal

$$\rho_m(t) = 2\cos(100\pi t) + 3\sin(3000\pi t) + 5\cos(600\pi t)$$

(i) What is the Nyquist rate for this signal ?

(ii) Determine the sampled signal if sampling is done at 2000 *samples/sec.* 8

(b) Draw the block diagram for coherent detection of FSK and describe how it works. 12

4. *(a)* Define Entropy and give it's mathematical formula. 5

(b) A Discrete Memoryless Source emits one out of four symbols S_0, S_1, S_2 and S_3. If $P(S_0) = 2P(S_1) = 4P(S_2) = 8 \cdot P(S_3)$. Find out the entropy of the source. 7

(c) Show the digital formats of the following data stream 10101110

(i) ON-OFF signalling

(ii) NRZ signalling

(iii) Bipolar return to zero signalling

(iv) Manchester coding. 8

5. (a) What is meant by Mutual Information of two sources ? What are the properties of Mutual Information ? 8

(b) Show that Mutual Information is symmetric i.e. $H(X)-H(X/Y)=H(Y)-H(Y/X)$ 7

(c) Write the mathematical statement of Shanon's theorem for channel capacity. Calculate the channel capacity for a $10MHz$ channel when it is corrupted by $40dB$ noise. 5

6. (a) What is Linear block code ? State the methods how to generate Generator matrix and parity matrix. 10

(b) What is an optimum filter ? Show that in a noisy environment, in a receiver the SNR is optimized when the filter has impulse response

$$h(t) = S(T - t)$$

where $S(t)$ is the input signal, T is the sampling period and $h(t)$ is impulse response of the matched filter. 10

7. Write short notes : ***(Any two)*** 2×10

(i) Companding

(ii) Delta Modulation

(iii) Cyclic code

(iv) Huffman Coding.
