

Total No. of printed pages = 4

ECE 181503

Roll No. of candidate

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24/2/22 2021

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Arya Mahavidyalaya,
Kolkata-700017

B.Tech. 5th Semester End-Term Examination

DIGITAL COMMUNICATION

Full Marks – 70

Time – Three hours

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

Answer question No. 1 and any *four* from the rest.

1. Answer the following (MCQ/ Fill in the blanks) : (10 × 1 = 10)

- (i) The combination of a compressing and expanding is called _____
- (a) companding law
 - (b) A-law
 - (c) μ -law
 - (d) All of the above
- (ii) In a DM system, the granular noise occurs when the modulating signal
- (a) increases rapidly
 - (b) remains constant
 - (c) decreases rapidly
 - (d) vary rapidly
- (iii) In linear quantization, if number of bit is increased by one bit then the signal to noise ratio is improved by
- (a) 3 dB
 - (b) 1 dB
 - (c) 6 dB
 - (d) 1.8 dB

[Turn over

- (iv) For transmission of 4 kHz signal encoded by 8 bits, the required minimum bit rate is
- (a) 16 kHz
 - (b) 32 kHz
 - (c) 64 kHz
 - (d) 8 kHz
- (v) Power spectral density (PSD) of BPSK is similar to
- (a) DSB-SC
 - (b) DSB with carrier
 - (c) SSB
 - (d) DSB
- (vi) In line-coding, favourable power spectral density means
- (a) $PSD = 1$ at $f = 0$
 - (b) $PSD = 0$ at $f = 0$
 - (c) $PSD = 0$ at $f = 1$
 - (d) $PSD = 0$ at $f > 1$
- (vii) Detection scheme for FSK signal can be performed by
- (a) co-herent scheme
 - (b) non-coherent scheme
 - (c) both (a) and (b)
 - (d) none of the above
- (viii) In comparison to unipolar and polar line coding, the DC value of bipolar /AMI line coding is
- (a) more
 - (b) equal
 - (c) less
 - (d) moderate
- (ix) The capacity of Gaussian channel is
- (a) $C = 2B \log(1+S/N)$ bits/s
 - (b) $C = B^2 \log(1+S/N)$ bits/s
 - (c) $C = B \log(1+S/N)$ bits/s
 - (d) $C = B \log(1+S/N)^2$ bits/s

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(x) Any signal which is band limited is _____

- (a) amplitude limited
- (b) not time limited
- (c) time limited
- (d) Both (a) and (c)

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2. (a) Explain different types of sampling techniques with the help of waveforms and expressions. (10)

(b) Show that $(SNR)_{PCM} = (SNR)_{DM}$ of Delta modulation (DM)

Assume, Start up error = 0, Slope overloading error = low(0). (5)

3. (a) A sinusoidal signal with peak to peak voltage of 'V' sampled and thereafter linearly quantized into 'M' levels and in binary form. Find signal to noise ratio. (5)

(b) Derive a generalized expression with the help of Gram-Schmidt orthogonalisation procedure for a set of N energy signals represented by $S_1(t), S_2(t), S_3(t), \dots, S_N(t)$. (10)

4. (a) Find an output expression for distortionless baseband binary transmission by using Nyquist's criteria. (5)

(b) For what purpose matched filter is used? Find the frequency response of the matched filter to achieve maximum SNR at $t = t_m$. (10)

5. (a) What is source coding theorem? prove it. (10)

(b) Explain discrete memoryless channel. Why it is called discrete memoryless? (5)

6. (a) The probabilities of the five possible outcomes of an experiment are given as $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{16}$. Determine the Entropy and information rate if there are 16 outcomes per second. (5)

(b) Say, messages m_1 to m_8 have probabilities $\frac{1}{2}, \frac{1}{8}, \frac{1}{8}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{32}, \frac{1}{32}$. Find the coding efficiency and code redundancy using Shannon-fano coding. (5)

(c) Find out the probability of error expression for the scheme BPSK. (5)

7. Write short note for the following (any three)

(3 × 5 = 15)

- (a) Linear block codes
- (b) Automatic Repeat Request (ARQ)
- (c) Pulse code modulation (PCM)
- (d) Inter-symbol Interference (ISI)
- (e) Different keying techniques
- (f) Nyquist and raised cosine pulses

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