Code: 13A04404 **R13**

B.Tech II Year II Semester (R13) Regular & Supplementary Examinations May/June 2016

ANALOG COMMUNICATION SYSTEMS

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

PART - A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Justify that AM is a linear modulation system.

(b) A super heterodyne radio receiver with an IF of 460 kHz is tuned to a station operating at 1200 kHz. Determine the associated image frequency.

(c) Draw the phasor diagram of narrowband frequency modulation.

(d) State Carson's rule for determining the bandwidth for an FM wave.

(e) What is white noise? Sketch the PSD.

(f) Define and explain the term 'noise equivalent bandwidth' of a filter.

(g) What is meant by aperture effect? How can it be reduced?

(h) How is PDM wave converted into PPM system?

(i) Differentiate between the terms information and the entropy.

(j) A communication system consists of six messages with probabilities 1/8, 1/8, 1/8, 1/8, 1/4 and 1/4 respectively. Determine the entropy of the system.

PART - B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

2 (a) Derive from rudiments the time-domain expression of a single tone AM signal and sketch its spectrum showing the bandwidth requirements.

(b) Explain with sketch the phase discrimination method of SSB generation.

OR

3 (a) Discuss the effect of frequency and phase error in demodulation of DSB-SC wave synchronous detector.

(b) With the help of the block diagram explain the principle of FDM and mention its applications.

UNIT - II

4 (a) Explain fully the difference between frequency and phase modulation, beginning with the definition of each type and the meaning of the modulation index in each case.

(b) An angle modulation signal has the form $V(t) = 100\cos(2\pi f_c t + 4\sin 200\pi t)$, where $f_c = 10\,MHz$. Determine: (i) Average transmitted power. (ii) Peak phase deviation. (iii) Peak frequency deviation. (iv) Is this FM or a PM signal.

OR

5 (a) Explain the working of a ratio detector for FM.

(b) Explain the reactance modulator method of generation of WBFM. Why is it necessary to use AFC in this method of generation?

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UNIT - III

6 (a) a $10\ K\Omega$ and a $20\ K\Omega$ resistor are both at room temperature of $27°C$. For a 100 KHz bandwidth, determine the r.m.s value of the thermal noise voltage across (i) Each one of them. (ii) Their series combination. (iii) Their parallel combination.

(b) The available output noise power from an amplifier is 80 nW, the available power gain of the amplifier being 40 dB and the equivalent noise bandwidth being 25 MHz. Calculate the noise figure, assuming T_0 to be $27°C$.

OR

7 (a) Derive an expression for the destination SNR of a DSB-SC system in terms of that of a base band system.

(b) Derive an expression for SNR at the destination for an FM system. Compare this with that of PM system.

UNIT - IV

8 (a) Establish the principles of flat top sampling with neat schematics. Hence explain the phenomenon of aperture effect and equalization.

(b) Show that a PAM signal can be expressed as the convolution of an instantaneously sampled signal, and a rectangular pulse p(t) of the form:

$$p(t) = \begin{cases} 1, & |t| \leq \frac{\tau}{2} \\ 0, & elsewhere \end{cases}$$

OR

9 (a) Explain the generation and demodulation of PDM signals with suitable diagrams.

(b) Explain why a single channel PPM system requires the transmission of synchronization signal, where as a single channel PAM or PDM system does not.

UNIT - V

10 (a) Show that the entropy is maximum when all the symbols of a discrete memoryless source are equiprobable.

(b) State and prove channel capacity theorem.

OR

11 Consider an alphabet of a discrete memory-less source having seven sources symbols with their respective probabilities as given below.

$$[S_k] = [S_0 \quad S_1 \quad S_2 \quad S_3 \quad S_4 \quad S_5 \quad S_6]$$
$$[P_k] = [0.40 \quad 0.20 \quad 0.12 \quad 0.08 \quad 0.08 \quad 0.08 \quad 0.04]$$

Suppose there are 3 numbers of symbols in an encoding alphabet.

(a) Create a Shannon-Fano source code-word for each symbol. Compute the respective length of the code-words for each of the given source symbols.

(b) Determine the average code-word length.

(c) Determine the entropy of the specified discrete memory less source.

(d) Determine the coding efficiency.

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