

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)

- 1 Answer the following: (10 X 02 = 20 Marks)
- Justify that AM is a linear modulation system.
 - 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.
 - Draw the phasor diagram of narrowband frequency modulation.
 - State Carson's rule for determining the bandwidth for an FM wave.
 - What is white noise? Sketch the PSD.
 - Define and explain the term 'noise equivalent bandwidth' of a filter.
 - What is meant by aperture effect? How can it be reduced?
 - How is PDM wave converted into PPM system?
 - Differentiate between the terms information and the entropy.
 - 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

- Derive from rudiments the time-domain expression of a single tone AM signal and sketch its spectrum showing the bandwidth requirements.
 - Explain with sketch the phase discrimination method of SSB generation.
- OR
- Discuss the effect of frequency and phase error in demodulation of DSB-SC wave synchronous detector.
 - With the help of the block diagram explain the principle of FDM and mention its applications.

UNIT - II

- 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.
 - 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
- Explain the working of a ratio detector for FM.
 - 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 $10\text{ K}\Omega$ and a $20\text{ K}\Omega$ 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:

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

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.

$$[S_k] = [S_0 \ S_1 \ S_2 \ S_3 \ S_4 \ S_5 \ S_6]$$

$$[P_k] = [0.40 \ 0.20 \ 0.12 \ 0.08 \ 0.08 \ 0.08 \ 0.04]$$

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.
