CBCS SCHEME

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15EC45

Fourth Semester B.E. Degree Examination, June/July 2023
Principles of Communication Systems

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Describe the generation of an AM wave using switching modulator. Draw neat sketches and give relevant mathematical analysis and draw frequency spectrums to substantiate your answer. **(06 Marks)**

b. Explain the operation of envelope detector with neat diagrams and waveforms. Bring out the significance of RC time constant of the circuit in detection of the message signal without distortion. **(05 Marks)**

c. A sinusoidal carrier voltage is amplitude modulated as,
$v_c = [1000 + 700 \cos 6000\pi t] \cos 2000k\pi t$
Determine the following:
i) Unmodulated carrier voltage
ii) Modulating voltage
iii) Modulation index
iv) LSB and USB frequencies
v) Bandwidth of operation. **(05 Marks)**

OR

2 a. With a neat sketch and analysis, explain the generation of a DSB-SC wave using ring modulator. **(06 Marks)**

b. Explain the method of obtaining a practical synchronous receiving system with DSB – SC modulated wave using costas loop. **(06 Marks)**

c. Consider the message signal, $m(t) = 20\cos(2\pi t)$ volts and a carrier signal, $c(t) = 50 \cos(100\pi t)$ volts.
i) Sketch to scale, the resulting AM wave and determine modulation index.
ii) Determine the power delivered across a load of 10Ω due to transmission of this AM wave. **(04 Marks)**

Module-2

3 a. Explain the following terms associated with FM systems,
i) Maximum frequency deviation
ii) Carrier swing
iii) NBFM and WBFM
iv) Carson's rule. **(05 Marks)**

b. A Frequency Modulated (FW) wave is represented by the voltage waveform,
$v = 12 \sin(6 \times 10^8 t + 5 \sin 1250t)$.
i) Determine the carrier and modulating frequencies.
ii) Modulation index.
iii) Maximum frequency deviation.
iv) Carrier swing.
v) Transmission bandwidth.
vi) Power dissipated in 10Ω resistor. **(06 Marks)**

c. Show that the spectrum of an FM wave contains infinite number of sidebands. **(05 Marks)**

OR

4 a. With a neat schematic and frequency response, explain the operation of balanced frequency discriminator for demodulation of FM wave. **(06 Marks)**

b. Discuss 'Non-Linear Effects' in FM systems. **(04 Marks)**

c. With relevant block diagrams, explain FM stereo multiplexing used in FM radio broadcasting. **(06 Marks)**

Module-3

5 a. Define and explain Mean, Correlation and Covariance of a Random Process. **(06 Marks)**

b. Define 'Auto-Correlation' function of the random process x(t). Explain the properties of Auto-Correlation functions **(06 Marks)**

c. Compare Auto-correlation and cross-correlation functions. **(04 Marks)**

OR

6 a. Explain the following types of Noise that affect communication systems and give their mathematical expressions.
i) Short Noise ii) Thermal Noise iii) White Noise **(08 Marks)**

b. Explain 'Noise Equivalent Bandwidth'. Derive an expression for the same. **(08 Marks)**

Module-4

7 a. Show that the Figure – of – Merit (FOM) of DSB – SC system is unity. **(08 Marks)**

b. With relevant diagrams, explain the concepts of Pre-Emphasis and De-Emphasis in FM systems. **(08 Marks)**

OR

8 a. Derive the expression for Figure – of – Merit (FOM) of SSB Receivers. **(10 Marks)**

b. Write explanatory note on 'Capture Effect' in FM systems. **(06 Marks)**

Module-5

9 a. State 'Sampling Theorem' for band-limited signals. Explain the sampling process. **(06 Marks)**

b. With a neat block diagram, explain the process of Time-Division Multiplexing (TDM). **(06 Marks)**

c. Twelve different message signals, each with a bandwidth of 10KHz, are to be multiplexed and transmitted. Determine the minimum bandwidth required for the two methods, if the multiplexing modulation method used is : i) FDM, SSB ii) TDM, PAM. **(04 Marks)**

OR

10 a. With neat diagrams, explain the process of generation and reconstruction of PCM signal. **(06 Marks)**

b. Explain 'Quantization' process used in PCM. **(05 Marks)**

c. With neat diagrams and waveforms, the generation of PPM waves. **(05 Marks)**

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