CBCS SCHEME

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15EC45

Fourth Semester B.E. Degree Examination, Jan./Feb. 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. With relevant equations and waveforms, explain downward frequency translation. **(05 Marks)**

b. With necessary equations and waveforms, explain quadrature carrier multiplexing. **(07 Marks)**

c. Explain the working of Envelope detector. **(04 Marks)**

OR

2 a. With necessary equations, waveforms and circuit diagram, explain the operation of switching modulator. **(08 Marks)**

b. In a SSB – SC system, USB of the message signal is transmitted. The local carrier at the receiver has no frequency error, but a phase error of θ radians. Discuss the effect of phase error on the demodulated signal. **(04 Marks)**

c. Explain USB modulation. **(04 Marks)**

Module-2

3 a. An angle modulated signal is represented by
$s(t) = 10 \cos [2\pi \times 10^6 t + 5 \sin (2000\pi t) + 10 \sin (3000\pi t)]$ volts. Find the following :
i) The power in the modulated signal ii) The frequency deviation Δf
iii) The deviation ratio D iv) The phase deviation $\Delta\theta$.
v) The approximate transmission bandwidth B_T. **(05 Marks)**

b. With the help of a neat block diagram and equation, explain FM stereo multiplexing. **(05 Marks)**

c. Explain Generation of FM waves using direct method. **(06 Marks)**

OR

4 a. With necessary equations, explain non linear and linear model of PLL for FM demodulation. **(12 Marks)**

b. Explain the capture effect in FM. **(04 Marks)**

Module-3

5 a. Define Mean, Correlation and Covariance functions. **(06 Marks)**

b. Derive the relation between Noise figure and Equivalent Noise temperature. **(07 Marks)**

c. Show that the total volume under the surface of joint PDF is always equal to unity. **(03 Marks)**

OR

6 a. A random variable has a probability density function :

$$f_X(x) = \begin{cases} \frac{5}{4}(1-x^4) & ; \quad 0 \le x \le 1 \\ 0 & ; \quad \text{elsewhere} \end{cases}$$

Find i) E[X] ii) E[4X + 2] iii) $E[X^2]$. **(04 Marks)**

b. What is Thermal Noise? Explain. List any three properties of thermal noise voltage. (08 Marks)

c. Explain the following :
i) Function of a random variable ii) Moments about the origin. (04 Marks)

Module-4

7 a. Obtain the figure of merit of a Noisy DSBSC receiver. (10 Marks)
b. Explain the Pre – emphasis and De - emphasis. (06 Marks)

OR

8 a. With a neat block diagram and relevant equations, explain Noisy receiver model. (06 Marks)
b. The PSD of a noise at the front – end of the receiver is 0.5×10^{-3} watts/Hz. The modulating wave m(t) is sinusoidal, with a carrier power of 80 kilowatts and a sideband power of 10 kilowatts per sideband. The message bandwidth is 5KHz. Assume the use of an envelope detector in the receiver. Determine output SNR of the system. By how many decibels is this system inferior to a DSBSC system? (06 Marks)
c. Explain the FM Threshold effect. (04 Marks)

Module-5

9 a. Derive the expression for Signal – to – quantization Noise Ratio (SNR) and show that for uniform quantization, each bit in the code word of a PCM system contributes 6dB to SNR. (10 Marks)
b. Six independent message sources of bandwidths, w, w, 2w, 2w, 3w and 3w hertz are to be transmitted on TDM. Set up a scheme to accomplish this requirement, with each message signal sampled at its Nyquist rate. Also determine the minimum transmission bandwidth of the signal g(t). (06 Marks)

OR

10 a. With a neat block diagram, explain Time – division Multiplexing. (06 Marks)
b. What is Flat – top sampling? Derive the expression for the flat – top sampled signal. (10 Marks)

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