CBCS SCHEME

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15EC45

Fourth Semester B.E. Degree Examination, July/August 2022
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. Derive an expression for time domain description of an AM wave with neat waveforms. **(07 Marks)**

b. Explain the method of obtaining practical synchronous receiving system with DSBSC modulated wave using COSTAS LOOP. **(06 Marks)**

c. A 400W carrier is modulated on a depth of 75%, calculate the total power in the modulated wave for the following form of AM.
i) Double Side Band with Full Carrier (DSBFC)
ii) Double Side Band with Suppressed Carrier (DSBSC)
iii) Single Side Band suppressed carrier (SSB). **(03 Marks)**

OR

2 a. Explain the generation of DSB-SC modulated waves using ring modulator. **(07 Marks)**

b. With a relevant block diagram, explain the working of FDM system. **(05 Marks)**

c. What is the significance of single side band modulation? Give the frequency domain description of the same. **(04 Marks)**

Module-2

3 a. Derive the equation for single tone FM wave. Define modulation index, maximum deviation of a frequency modulated signal. **(05 Marks)**

b. With a neat diagram, explain FM demodulation using balanced slope detector. **(06 Marks)**

c. A single tone FM signal is given by $s(t) = 10\sin[16\pi \times 10^6 t + 20\sin 2\pi \times 10^3 t]$ volts. Determine: i) Modulation index ii) Modulation frequency iii) Frequency deviation iv) Carrier frequency v) Power of FM signal across 100Ω resistor. **(05 Marks)**

OR

4 a. Explain generation of frequency modulated signal using direct method. **(05 Marks)**

b. Explain the non linear model of Phase Lock Loop (PLL). **(06 Marks)**

c. With relevant block diagram, explain FM stereo multiplexing and demultiplexing. **(05 Marks)**

Module-3

5 a. Define mean and covariance function with respect to stationary random process. **(04 Marks)**

b. Define PDF. Explain its important properties. **(06 Marks)**

c. Prove the following two properties of the auto correlation function $R_x(\tau)$ of a random process x(t).
i) If x(t) contains a d.c component equal to A, then $R_x(\tau)$ will contain a constant component equal to A^2.
ii) If x(t) contains a sinusoidal component then $R_x(\tau)$ will also contain a sinusoidal component of the same frequency. **(06 Marks)**

OR

6 a. Define white noise. Plot Power Spectral Density (PSD) and autocorrelation function of white noise. **(06 Marks)**

b. Define noise equivalent band width. Derive the expression for the same. **(06 Marks)**

c. Let x be a continuous random variable having a uniform probability distribution defined in the range $2 \leq x \leq 4$. Let $y = 3x + 2$. Find mean m_x and m_y. **(04 Marks)**

Module-4

7 a. Prove that the figure of merit of a DSB-SC system is unity. **(08 Marks)**

b. Explain pre-emphasis and de-emphasis in frequency modulation. **(08 Marks)**

OR

8 a. Show that the figure of merit of a noisy FM receiver for single tone modulation is $3/2\ \beta^2$. **(08 Marks)**

b. Find the figure of merit in AM when depth of modulation is i) 100% ii) 60% iii) 25% **(03 Marks)**

c. Write a short note on FM threshold reduction. **(05 Marks)**

Module-5

9 a. With necessary diagram, explain the generation and reconstruction of Pulse Code Modulation (PCM). **(06 Marks)**

b. Explain the sampling theorem for low pass signals. Derive the equation for sampled signal in the frequency domain and sketch the spectrum. **(07 Marks)**

c. What are the advantages of digital signals over analog? **(03 Marks)**

OR

10 a. With neat diagram, explain the generation of Pulse-Position Modulation (PPM). **(06 Marks)**

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

c. Show that the signal-to-noise ratio of an uniform quantizer is equal to 1.8 + 6N. **(04 Marks)**

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