

CBCS SCHEME

18EC53

Fifth Semester B.E. Degree Examination, Dec.2024/Jan.2025

Principles of Communication Systems

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Explain the generation of amplitude modulated (AM) waves using switching modulator. (08 Marks)
- b. With a neat block diagram, explain the working of COSTAS receiver used for demodulation of DSB-SC singles. (07 Marks)
- c. An audio signal $10 \sin 1000 \pi t$ volts is used to amplitude modulate a carrier signal $75 \sin (2\pi \times 10^6)t$. Assume modulation index as 0.5. Find :
 - i) Side band frequencies
 - ii) Amplitude of each side band
 - iii) The bandwidth required
 - iv) The total power delivered to a load of 100Ω . (05 Marks)

OR

- 2 a. With a neat block diagram and equations, explain the generation and demodulation of VSB signals. (08 Marks)
- b. Fig.Q2(b) shows the block of an AM system with $s(t) = AC[1 + K_a m(t)]\cos(2\pi f_c t)$ and $|K_a m(t)| < 1$ for all t . If $m(t)$ is a band limited signal in the interval $(-w < f < w)$ and $f_c > 2w$ show that $m(t)$ can be obtained from the square rooter output.

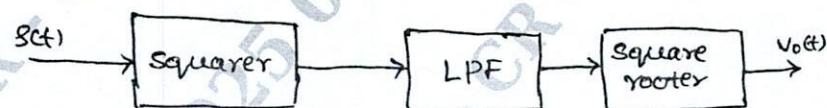


Fig.Q2(b)

- c. Explain in detail the scheme of FDM. (05 Marks)

Module-2

- 3 a. Derive the equation of FM wave and list the properties of angle modulated waves. (07 Marks)
- b. Obtain the time domain expression of NBFM wave plot its spectrum and compare with AM using phasor diagrams. (08 Marks)
- c. An angle modulated wave is defined by the equation :
 $s(t) = 10 \cos[2\pi \times 10^6 t + 5 \sin(2000\pi t) + 10 \sin(3000\pi t)]$
 determine the following :
 - i) Power in the modulated signal across a standard 1Ω resistor
 - ii) Frequency deviation
 - iii) The deviation ratio
 - iv) Phase deviation
 - v) Transmission bandwidth. (05 Marks)

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OR

- 4 a. With a neat block diagram and necessary equations explain the demodulation of FM waves using non-linear model of phase locked loop (PLL). (08 Marks)
- b. Draw the block diagram of super heterodyne receiver from AM reception and explain the functions of each block. (06 Marks)
- c. An FM signal $s(t) = A_c \cos \left[2\pi f_c t + 2\pi k_f \int_0^t m(t) dt \right]$ is applied to a system consisting of RC high pass filter and envelope detector shown in Fig.Q4(c). Assume $R \ll X_C$ and envelope detector does not load the filter, determine the envelope detector output assuming $k_f |m(t)| < f_c$ for all t . Comment on the output.

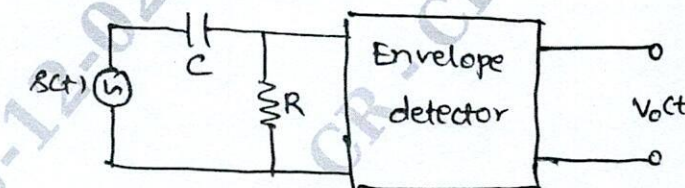


Fig.Q4(c)

(06 Marks)

Module-3

- 5 a. Explain thermal noise and white noise. (06 Marks)
- b. Define noise equivalent bandwidth and derive the expression for the same. (08 Marks)
- c. An amplifier operating over a frequency 2 range of 450 to 460 KHz is having an input resistance of $10 K\Omega$. If the temperature is $15^\circ C$. Find :
 - i) rms noise voltage at the input of the amplifier
 - ii) the amplifier noise power
 - iii) the power spectral density. (06 Marks)

OR

- 6 a. Starting from fundamentals, derive the expression for Figure of Merit (FOM) of an AM receiver operating on single tone modulation. (10 Marks)
- b. Discuss the noise in FM receivers and obtain the expression for Figure of Merit (FOM) for FM receiver. (10 Marks)

Module-4

- 7 a. Mention the advantages of digitalizing analogy signals. (04 Marks)
- b. With relevant equations, state and explain sampling theorem for low pass signals and derive the interpolation formula. (10 Marks)
- c. With a neat block diagram, explain the generation of Pulse Position Modulation (PPM) signals. (06 Marks)

OR

- 8 a. Mention the few applications of pulse amplitude modulation (PAM). (04 Marks)
- b. Consider the signal $x(t) = 5 \cos(2000\pi t) + 10 \cos(6000\pi t)$
 - i) What is the Nyquist rate and Nyquist interval
 - ii) Assume if the signal is sampled at frequency $f_s = 5000$ Hz ; what is the resulting signal
 - iii) Draw the spectrum of the sampled signal for $f_s = 5000$ Hz. (10 Marks)
- c. With a neat block diagram, explain Time Division Multiplexing Technique(TDM). (06 Marks)

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Module-5

- 9 a. A PCM system uses uniform quantizer followed by a N bit encoder. Show that rms signal to quantization noise is approximately given by $[SNR]_{dB} = (4.8 + 6N)dB$. (08 Marks)
- b. Explain the generation and reconstruction of PCM signal. (06 Marks)
- c. A TV Signal with a bandwidth of 4.2MHz is transmitted using binary PCM. The number of representation levels are 512 calculate :
- i) Code word length
- ii) Final bit rate
- iii) Transmission band width. (06 Marks)

OR

- 10 a. For the bit sequence 10011101 draw unipolar NRZ, polar NRZ, unipolar RZ, bipolar RZ and Manchester encoding formats. (08 Marks)
- b. Explain Delta modulation with relevant equations and waveforms. (06 Marks)
- c. With a neat block diagram, explain the working of linear predictive vocoder. (06 Marks)

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