



CBCS SCHEME

21EC44

Fourth Semester B.E. Degree Examination, June/July 2023 Communication Theory

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 time domain and frequency domain analysis of AM wave for a single modulating signal with neat diagrams and necessary equations. (10 Marks)
- b. Explain the operation of envelope detector with neat diagrams and waveforms. Also mention the significance of RC-time constant. (05 Marks)
- c. An audio frequency signal $10\sin 2\pi(500)t$ is used to amplitude modulate a carrier of $50\sin 2\pi(10^5)t$. Assume modulation index = 0.2. Determine sideband frequencies, amplitude of each side band, bandwidth required, Efficiency of AM wave. (05 Marks)

OR

- 2 a. With relevant diagrams, explain the operation of the quadrature carrier multiplexing transmitter and receiver schemes. (07 Marks)
- b. Explain the concept of FDM with neat block diagram. (06 Marks)
- c. A carrier wave $4\sin(2\pi * 500 * 10^3 t)$ volts is amplitude modulated by an audio wave $[0.2\sin 3(2\pi * 500t) + 0.1\sin 5(2\pi * 500t)]$ volts. Determine upper and lower sidebands and sketch the complete spectrum of the modulated wave. Estimate the total power in the sideband ($R = 1 \Omega$). (07 Marks)

Module-2

- 3 a. Define the following :
 - (i) Instantaneous frequency
 - (ii) Maximum frequency deviation
 - (iii) Modulation index. (06 Marks)
- b. Explain the generation of narrow band FM wave with neat block diagram, necessary equations and phasor diagrams. (08 Marks)
- c. When a 50.4 MHz carrier is frequency modulated by a sinusoidal AF modulating signal, the highest frequency reached is 50.405 MHz. Calculate
 - (i) The frequency deviation produced.
 - (ii) Carrier swing of the wave.
 - (iii) Lowest frequency reached. (06 Marks)

OR

- 4 a. Explain the demodulation of FM signal using the nonlinear and linear model of PLL with neat diagrams and equations. (10 Marks)
- b. Explain the FM stereo multiplexer and demultiplexer operation with neat diagrams. (08 Marks)
- c. An FM wave is defined by $s(t) = 10\cos[2 + \sin 6\pi t]$. Find the instantaneous frequency of $s(t)$. (02 Marks)

Module-3

- 5 a. Write short notes on :
- Thermal noise
 - Shot noise.
 - White noise.
- (06 Marks)
- b. Derive the noise equivalent bandwidth equation $B = \frac{1}{4CR}$ Hz for low pass filter. (08 Marks)
- c. Three $5\text{ K}\Omega$ resistors are connected in series. For room temperature ($KT = 4 \times 10^{-21}$) and an effective noise bandwidth of 1 MHz, determine
- The noise voltage appearing across each resistor.
 - The noise voltage appearing across the series combination.
 - What is the rms noise voltage which appears across same three resistors connected in parallel under the same conditions? (06 Marks)

OR

- 6 a. Show the figure of merit for DSBSC system is unity. (08 Marks)
- b. Obtain the expression for FOM of AM receivers using envelope detector. (08 Marks)
- c. An AM receiver operating with a sinusoidal wave of 80% modulation has an output signal to noise ratio of 30 dB. Calculate the corresponding channel S/N ratio. (04 Marks)

Module-4

- 7 a. What are the advantages of digitizing the analog sources? (06 Marks)
- b. State and explain the sampling theorem for the band limited signal. Also explain the under sampling, over sampling and Nyquist rate with neat diagram. (14 Marks)

OR

- 8 a. Explain the pulse amplitude modulation with neat diagram and equations. (08 Marks)
- b. Explain the Time Division Multiplexing (TDM) with neat block diagram. (08 Marks)
- c. An analog signal is expressed by the equation, $x(t) = \frac{1}{2\pi} \cos(4000\pi t) \cos(1000\pi t)$. Calculate the nyquist rate and nyquist interval for this signal. (04 Marks)

Module-5

- 9 a. Explain the construction and regeneration of PCM signal. (10 Marks)
- b. Explain the different line codes. To transmit a bit sequence 01101001 draw the resulting waveforms using,
- Unipolar NRZ
 - Polar NRZ.
 - Unipolar RZ
 - Bipolar RZ
 - Manchester
- (10 Marks)

OR

- 10 a. Explain the concept and operation of delta modulation in detail. (10 Marks)
- b. Explain quantization process with neat diagrams. Also explain the types of quantizer with neat diagrams. (06 Marks)
- c. Write a short note on Vocoder. (04 Marks)
