Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 40985

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

Fourth/Fifth/Sixth Semester

Electronics and Communication Engineering

EC 3491 — COMMUNICATION SYSTEMS

(Common to Computer and Communication Engineering/Electronics and Instrumentation Engineering/Electronics and Telecommunication Engineering/Instrumentation and Control Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is the need for modulation?

2. What is the limitation of a Square Law Demodulator for amplitude demodulation?

3. Define Sampling Theorem.

4. What is PAM?

5. What is Pulse code modulation?

6. Define Hamming distance.

7. Define QAM.

8. How does the convolution code differ from block codes?

9. What is inter-symbol interference?

10. What is coherent detection?

PART B — (5 × 13 = 65 marks)

11. (a) An AM signal is given by the following expression:

$$s(t) = [20 + 12\cos(\pi 10^4 t) + 16\cos(2\pi 10^4 t)] . \cos(2\pi 10^6 t)$$

Find the following:

(i) modulation index, (2)

(ii) bandwidth, (2)

(iii) total power, (2)

(iv) sideband power, and (2)

(v) modulation efficiency. Also, plot its spectrum. (5)

Or

(b) A sinusoidal carrier of 20 volts, 5 MHz is frequency modulated by a message signal of 10 volts, 25 kHz, with a frequency sensitivity of 12.5 kHz/volt.

(i) Find the maximum frequency deviation, modulation index, bandwidth, and normalized power. (8)

(ii) What happens to the above parameters if the message signal amplitude is doubled? (5)

12. (a) Determine the Nyquist sampling rate for the signal given below :

$$x(t) = \frac{\sin(200\pi t) \cdot \sin c(900t)}{\pi t}$$

Or

(b) What is pre-emphasis and de-emphasis? Why are these required? Explain in detail.

13. (a) Draw and explain the DPCM transmitter and receiver system.

Or

(b) Explain in detail slope overload and granular error in delta modulation and how these errors can be reduced.

14. (a) Draw and explain the BPSK transmitter and receiver system.

Or

(b) Draw and explain the DPSK transmitter and receiver system.

15. (a) A source is transmitting 2 possible symbols of binary 1 and 0. When symbol 1 is transmitted, the signal voltage at the input of the threshold comparator can take any value between 0 volts and 1 volt with equal probability. When symbol 0 is transmitted, the signal voltage varies between –0.25 volts and 0.25 volts with equal probability. Determine the average probability of error, assuming a threshold voltage of 0.2 volts.

Or

(b) A message signal band limited to 15kHz is transmitted through the channel after the DSB-SC modulation scheme. The double-sided noise PSD is given by 10^{-10} W/Hz. Find the transmitted power required to get a signal-to-noise ratio of 40 dB at the output. Assuming the channel loss of 50 dB.

PART C — ($1 \times 15 = 15$ marks)

16. (a) Ten sinusoidal message signals, each bandlimited to 5 kHz, are multiplexed using TDM. The sampling rate is chosen 50% more than the Nyquist rate. The maximum quantization error should be at most 2% of the peak amplitude of the message signal. The number of synchronization bits is considered to be 5. Determine the transmission bit rate for the given system.

Or

(b) A message signal of $5\cos(2\pi 10^5 t)$ is given to 512 level PCM system. The resulting digital signal is transmitted through free space by using binary signaling technique. Find the transmission bandwidth if modulation technique is

(i) ASK,

(ii) PSK and

(iii) FSK with $f_h = 2$ MHz and $f_L = 1$ MHz. (5+5+5)