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Question Paper Code : 82344

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

Fourth Semester

Computer and Communication Engineering

EC 3491 — COMMUNICATION SYSTEMS

(Common to: Electronics and Communication Engineering/Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define modulation and state its need in communication systems.
2. Differentiate between DSB and SSB modulation.
3. Define Gaussian noise and mention its properties.
4. Define aliasing and state how it can be avoided.
5. Give the significance of delta modulation.
6. Mention any two differences between PCM and DM.
7. Define bit error rate (BER).
8. Write the expression for the power spectral density (PSD) of BPSK.
9. Define inter-symbol interference.
10. Give any two applications of optimum detection theory.

PART B — (5 × 13 = 65 marks)

11. (a) Derive the expression for the power of an amplitude modulated signal and draw its spectrum.

Or

(b) Explain the generation of SSB signal using the Phase Shift Method with a neat block diagram.

12. (a) Derive the expression for noise power in FM systems and explain the threshold effect.

Or

(b) A band-limited signal of 4 kHz is sampled at 1.5 times its Nyquist rate. Illustrate the effect of aliasing using sketches. Suggest a method to remove aliasing.

13. (a) Explain the working of Delta Modulation with suitable waveforms and discuss slope overload and granular noise.

Or

(b) Construct a (7,4) Hamming code for the message 1011 and show how it can correct a single bit error.

14. (a) With a neat block diagram, explain the generation and detection of QPSK signals. Also sketch the constellation diagram.

Or

(b) Compare coherent and non-coherent BFSK systems in terms of BER. For a given E_b / N_o =10 dB, calculate the BER for coherent BPSK and BFSK systems.

15. (a) Derive the expression for probability of error for coherent binary communication over an AWGN channel.

Or

(b) A binary digital system transmits at a data rate of 1 Mbps over a band-limited channel with noise power spectral density $N_0/2 = 10^{-9}$ W/Hz and signal power $P_S = 10^{-3}$ W. Calculate the probability of bit error assuming BPSK modulation.

PART C — (1 × 15 = 15 marks)

16. (a) Design a complete digital communication system to transmit voice signals over a noisy channel. Your design should include:

(i) Suitable sampling and quantizations scheme (7)

(ii) Coding and modulation techniques (8)

Justify your choices with calculations, diagrams, and expected BER performance.

Or

(b) A satellite communication system uses QPSK modulation over a channel having a bandwidth of 10 MHz and SNR of 20 dB.

(i) Estimate the maximum achievable data rate using Shannon's capacity theorem. (5)

(ii) Calculate the BER of the system if $E_b / N_0 = 10$ dB. (5)

(iii) Suggest possible methods to improve system performance without increasing bandwidth. (5)