SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES
(AUTONOMOUS)

QUESTION BANK

Year / Semester: III B.Tech VI Semester **Regulation: R23**

Subject and Code: Analog and Digital Communications-23ECE241T

SYLLABUS

UNIT – I : Continuous Wave Modulation

Introduction: The communication Process, Communication Channels, Baseband and Passband Signals, Analog vs Digital Communications, Need for the modulation.

Amplitude Modulation (AM): AM and its modifications – DSB, SSB, VSB. Frequency Translation, Frequency Division Multiplexing (FDM).

Angle Modulation: Frequency Modulation (FM), Phase Modulation, PLL, Nonlinear Effects in FM, Super heterodyne Receivers.

UNIT – II: Noise and Pulse Modulation

Introduction to Noise: Types of Noise, Receiver Model, Noise in AM, DSB, SSB, and FM Receivers, Pre-Emphasis and De-emphasis in FM.

Introduction to Pulse Modulation: The Sampling Process, PAM, TDM, Bandwidth-Noise Trade off, Quantization process, PCM, Noise considerations in PCM systems, Delta Modulation, DPCM, Coding speech at low bit rates.

UNIT – III: Baseband Pulse Transmission

Introduction, Matched Filter, Properties of Matched Filter, Error rate due to noise, Inter Symbol Interference (ISI), Nyquist Criterion for distortion less baseband binary transmission, Correlative level coding, Baseband M-ary PAM transmission, QAM, MAP and ML decoding, Equalization, Eye pattern.

UNIT – IV: Digital Passband Transmission

Introduction, Passband Transmission Model, Gram-Schmidt Orthogonalization Procedure, Geometric Interpretation of Signals, Response of bank of correlators in noise, Correlation receiver, Probability of Error, Detection of Signals with unknown phase.

UNIT – V: Digital Modulation Schemes

Coherent Digital Modulation Schemes – ASK, BPSK, BFSK, QPSK, Non-coherent BFSK, and DPSK. M- ary Modulation Techniques, Power Spectra, Bandwidth Efficiency, Timing and Frequency synchronization.

Information theory: Entropy, Mutual Information and Channel capacity theorem.

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Max Marks: 10

S.No.	CO	Questions	BT
Unit I: CONTINUOUS WAVE MODULATION			
1	1	Explain the functional description of communication system in detail with neat sketch.	L2
2	1	Differentiate Baseband and Pass band signals.	L4
3	1	List the differences between Analog and Digital Communications.	L1
4	1	Define Amplitude modulation, derive general expression for AM wave, and calculate power distribution and percentage of Efficiency with graphical representation of AM wave.	L3
5	1	An Audio frequency signal 10sin $2\pi 500t$ is used to amplitude modulated a carrier of 50 sin $2\pi * 10^5\ t$. Assume modulation index = 0.2. Find (a) Side band frequency (b) Amplitude of each side band (c) bandwidth required (d) Total power delivered to the load of 600Ω.	L3
6	1	Discuss in detail about Generation and Detection of DSB-SC signal.	L2
7	1	Find the percentage of power saving when carrier is suppressed in AM signal. Assume Modulation index = 1.	L3
8	1	Discuss in detail the classification of Angle Modulation.	L2
9	1	Evaluate the effectiveness of PLL-FM Demodulator in terms of noise performance and stability.	L5
10	1	Design a Superheterodyne FM receiver and justify the choice of intermediate frequency and filter stages.	L6

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S.No.	CO	Questions	BT
Unit II: NOISE AND PULSE MODULATION			
1	2	List the different types of noise in communication systems.	L1
2	2	Discuss the Effects of Noise on AM, DSB-SC, SSB-SC and FM receivers.	L4
3	2	Discuss the concept of Pre-Emphasis and De-Emphasis in FM systems. Why are they important.	L2
4	2	Define Nyquist rate and Describe the Sampling process	L2
5	2	Describe the Quantization process and its types.	L2
6	2	Illustrate the generation and detection of PAM signals with suitable waveforms.	L3
7	2	Explain the working of pulse code modulation (PCM) and role of quantization and noise in PCM systems.	L2
8	2	Discuss with a block diagram of Time Division Multiplexing.	L3
9	2	Design a Delta Modulation (DM) system with the transmitter and receiver block diagrams.	L6
10	2	Evaluate the performance of Differential Pulse Code Modulation (DPCM) at the transmitter and receiver	L5
11	2	Differentiate PCM, DM, DPCM	L4

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S.No.	CO	Questions	BT
Unit III: BASE BAND PULSE TRANSMISSION			
1	3	State the definition of a Matched Filter with neat sketch .	L1
2	3	State and prove the properties of matched filter	L3
3	3	Discuss Inter Symbol Interference with neat block diagram.	L2
4	3	Analyze how the Nyquist criterion eliminates Inter Symbol Interference (ISI) and examine the conditions required for zero ISI.	L4
5	3	Explain the working operation of Quadrature Amplitude Modulation.	L2
6	3	Evaluate the performance of a Pulse Amplitude Modulator (PAM) for baseband M-ary transmission.	L5
7	3	Explain MAP and ML decoding strategies.	L2
8	3	Explain the interpretation of an Eye Pattern in digital communication systems.	L2
9	3	Compare correlative level coding and Nyquist pulse shaping in terms of bandwidth efficiency and ISI control.	L4
10	3	Derive the probability of error for a binary communication system in the presence of noise.	L3

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S.No.	CO	Questions	BT
Unit IV: DIGITAL PASSBAND TRANSMISSION			
1	4	List the blocks in the functional model of a passband transmission system.	L1
2	4	Apply the Gram–Schmidt orthogonalization procedure to obtain orthonormal basis functions for a given set of signals.	L3
3	4	Derive response bank of correlators in noise.	L3
4	4	Analyze the working of a correlation receiver with two subsystems.	L4
5	4	Explain the detection of signals with unknown phase in digital communication systems	L2
6	4	Design a receiver structure suitable for detection of signals with unknown phase and justify your design choice.	L6
7	4	Apply the Gram–Schmidt procedure to obtain orthonormal basis functions for a given set of signals.	L3
8	4	Explain the passband transmission model with a suitable block diagram.	L2
9	4	Discuss the response of a bank of correlators in the presence of noise.	L2
10	4	Derive the probability of error for binary signaling in an AWGN channel.	L3

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S.No.	CO	Questions	BT
Unit V: DIGITAL MODULATION SCHEMES			
1	5	List the basic characteristics of ASK, BPSK, BFSK, and QPSK modulation schemes.	L1
2	5	Compare the performance of ASK, BPSK, BFSK, and QPSK modulation schemes in terms of bandwidth and noise immunity.	L4
3	5	Explain the generation and detection of Coherent QPSK with signal space diagram.	L2
4	5	Discuss M-ary modulation techniques and analyze the tradeoff between bandwidth and error performance.	L4
5	5	Evaluate the performance of Non-Coherent DPSK generation and detection technique with neat block diagram.	L5
6	5	Construct a coherent modulation receiver incorporating timing and frequency synchronization mechanisms,	L2
7	5	Define mutual information and explain the channel capacity theorem.	L2
8	5	Explain Entropy and its properties.	L2
9	5	The source is transmitted message A,B,C,D,E,F with corresponding probabilities 1/2, 1/4, 1/8, 1/10, 1/12, 1/14. Find the entropy , code length and efficiency.	L3
10	5	Apply the entropy procedure for the following messages taken m=2, where probabilities are 0.3, 0.25, 0.15, 0.12, 0.10, 0.08.	L3

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Textbooks:

1. Simon Haykin, "Communication Systems", JohnWiley& Sons, 4th Edition, 2004.
2. B. P. Lathi, Zhi Ding " Modern Digital and Analog Communication Systems", Oxford press, 2011.

References:

1. Sam Shanmugam, "Digital and Analog Communication Systems",JohnWiley& Sons, 1999.
2. Bernard Sklar, F. J. harris"Digial Communications: Fundamentals andApplications", Pearson Publications, 2020.
3. Taub and Schilling, " Principles of Communication Systems", Tata McGraw Hill, 2007.

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Note: L1-Remembering, L2-Understanding, L3-Applying, L4-Analyzing, L5-Evaluating, and L6-Creating

Instruction to Faculty Members:

The Six Levels of Bloom's Taxonomy:

1. **Remembering:** Retrieving, recognizing, and recalling relevant knowledge from long-term memory (e.g., list, define, name, locate).
2. **Understanding:** Constructing meaning, explaining ideas, or concepts (e.g., summarize, interpret, classify, compare).
3. **Applying:** Using information in new situations or implementing procedures to solve problems (e.g., solve, use, demonstrate, implement).
4. **Analyzing:** Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure (e.g., contrast, categorize, distinguish, diagram).
5. **Evaluating:** Making judgments based on criteria and standards through checking and critiquing (e.g., judge, critique, justify, defend, argue).
6. **Creating:** Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure (e.g., design, construct, develop, formulate).

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