COURSE CONTENT

ANALOG AND DIGITAL COMMUNICATIONS								
IV Semester: ECE								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
2540407	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**40**	**60**	**100**
Contact Classes: 40	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:40**		
Prerequisites: Knowledge on Signals and Fourier Transforms.								

Course Overview:

This course introduces the fundamental concepts and techniques of Analog and Digital Communication systems**.** It covers amplitude and angle modulation, transmitters and receivers, detection and estimation of signals, digital modulation schemes, and information theory with coding techniques. The course emphasizes both theoretical analysis and practical applications, preparing students to design, analyze, and optimize modern communication systems.

Course Objectives:

The students will try to learn

- About principles of analog communication including AM, FM, and PM, along with their generation and detection techniques.
- Design and operation of transmitters and receivers, and evaluate their performance under noise conditions
- Detection and estimation of signals in noise, including matched filter and correlation receiver concepts
- Digital modulation techniques such as PCM, DM, BPSK, QPSK, QAM, and M-ary modulation methods
- Information theory and coding to measure channel capacity, optimize bandwidth efficiency, and minimize errors

Course Outcomes:

After successful completion of the course, students shall be able to

- Design and analyze various Analog and digital Modulation and Demodulation techniques
- Understand the effect of noise present in continuous wave Modulation techniques
- Understand the concept of Super heterodyne Receiver and Pulse Modulation Techniques
- Analyze and design the various coding techniques and Base band Transmission
- Analyze linear block codes and cyclic codes for error detection and correction in communication channels

Module – I: Amplitude Modulation and Angle Modulation **9L**

Amplitude Modulation Need for modulation, Amplitude Modulation: Time and frequency domain description, Generation – Square Law modulator, Detection - Envelope detector, DSB-SC Modulation: Generation – Balanced Modulator, Detection- Synchronous detector, SSB Modulation: Time and frequency domain description, Generation – Phase discrimination Method and Demodulation - coherent detection, Introduction to Vestigial side band modulation. Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis, Carson's Rule, Generation of FM Waves- Armstrong Method, Detection of FM Waves- Phase locked loop, Comparison of

FM and AM.

Module – II: Transmitters & Receivers **6L**

Classification of Transmitters, AM Transmitters, FM Transmitters, AM Receiver - Super heterodyne receiver, FM Receivers, Comparison of AM and FM Receiver. Noise analysis in AM, DSB, SSB and FM Modulation System, Pre- emphasis, and de-emphasis Pulse Modulation: Types of Pulse modulation- PAM, PWM and PPM, Comparison of FDM and TDM.

Module – III: Detection and Estimation **9L**

Model of Digital Communication Systems, Detection of Known Signals in Noise, Probability of error, Optimum Receivers Using Coherent Detection: Matched filter Receiver and its Properties, Correlation receiver, Requirements of a line encoding format, various line encoding formats- Unipolar, Polar, Bipolar, Inter symbol interference, Nyquist's criterion, Correlation coding: Duobinary signaling, Eye pattern.

Module – IV: Digital Modulation Techniques **9L**

PCM Generation and Reconstruction, Quantization Noise, Uniform Quantization, DPCM, DM and Adaptive DM, Noise in PCM and DM. Digital Modulation formats- binary modulation techniques: BASK, BPSK, BFSK, and DPSK, M-ary modulation techniques: QPSK and QAM, Comparison of modulation techniques: power spectra, bandwidth and efficiency, constellation diagrams.

Module – V: Information Theory and Coding Techniques **7L**

Information theory: Entropy, Information rate, Mutual information, Channel capacity of discrete channel, Shannon-Hartley law; Trade-off between bandwidth and SNR. Source coding - Huffman coding, Shannon Fano coding, Channel coding - Linear block codes and cyclic codes.

TEXT BOOKS:

1. Electronics Communication Systems-Fundamentals through Advanced-Wayne Tomasi, 5th Edition, PHI, 2009.
2. Digital and Analog Communication System – K. Sam Shanmugam, Wiley, 2019.

REFERENCES:

1. Electronic Communications – Dennis Roddy and John Coolean, 4th Edition, PEA, 2004.
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH, 2004.
3. Communication System - Simon Haykin and Michael Moher, Wiley, 5th edition, 2022.

REFERENCE LINKS:

1. **https://www.youtube.com/watch?v=qhjj6WG7Rgc&list=PLwjK_iyK4LLArUHRm3SvPLT0XWlVhpl4h**
2. **https://www.youtube.com/watch?v=mHvV_Tv8HDQ&list=PLwjK_iyK4LLArUHRm3SvPLT0XWlVhpl4h&index=2**
3. **https://www.youtube.com/watch?v=E4E1GftPD1M&list=PLwjK_iyK4LLArUHRm3SvPLT0XWlVhpl4h&index=3**
4. **https://www.youtube.com/watch?v=RFOGJB564Kk&list=PLwjK_iyK4LLArUHRm3SvPLT0XWlVhpl4h&index=4**
5. **https://www.youtube.com/watch?v=CcM4Q66dLtU&list=PLwjK_iyK4LLArUHRm3SvPLT0XWlVhpl4h&index=5**

MATERIALS ONLINE:

1. Course template

2. Tutorial question bank
3. Tech Talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper–I
8. Model question paper–II
9. Lecture notes
10. Drshya Siksha Sangrah Videos(DSSV)