# INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

## COURSE CONTENT

| COMMUNICATION SYSTEMS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **IV Semester: ECE** | | | | | | | | |
| **Course Code** | **Category** | **Hours / Week** | | | **Credits** | **Maximum Marks** | | |
| **AECD10** | **Core** | **L** | **T** | **P** | **C** | **CIA** | **SEE** | **Total** |
| | | 3 | - | - | 3 | 40 | 60 | 100 |
| **Contact Classes: 48** | **Tutorial Classes: Nil** | **Practical Classes: Nil** | | | | **Total Classes: 48** | | |
| **Prerequisite: Signals and Stochastic Process** | | | | | | | | |

### I. COURSE OVERVIEW:
Communications emphasize on generation, transmission and reception of audio, video, and telephony signals. The course is intended to understand various analog and pulse modulation schemes. Further, its emphasis the knowledge on various digital modulation techniques and linear block codes. Communication system principles are used for real world applications of radio and TV broadcasting systems.

### II. COURSES OBJECTIVES:
**The students will try to learn**

I. The need of modulation, generation and detection techniques of analog and pulse modulation systems.
II. Familiarize with digital systems like Pulse code modulation (PCM), Differential pulse code modulation(DPCM), Delta modulation (DM) and Adaptive DM.
III. The applications of spread spectrum techniques in secured digital communication systems.

### III. COURSE OUTCOMES:
**At the end of the course students should be able to:**

CO 1 Outline the basic concepts of communication system, need of modulation and fundamental elements to realize amplitude modulation systems
CO 2 Interpret the generation and detection techniques of frequency modulated waves used for audio signal transmission systems.
CO 3 Illustrate the concept of pulse modulation schemes, demodulation, sampling, quantization and coding for obtaining of digital data.
CO 4 Analyze digital pass band communication schemes (ASK, PSK, FSK) using modulation and demodulation process.
CO 5 Identify the importance of spread spectrum techniques for secured digital communication systems.
CO 6 Build the block codes for error detection and error correction in noisy environment.

### IV. COURSE CONTENT:

**MODULE - I: AMPLITUDE MODULATION (10)**
Need for modulation, Amplitude Modulation - Time and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves - Switching modulator, Detection of AM Waves - Envelope detector, DSBSC modulation - time and frequency domain description, Generation of DSBSC Waves - Balanced Modulators, Coherent detection of DSB-SC Modulated waves, COSTAS Loop, SSB modulation - time and frequency domain description, frequency discrimination and Phase discrimination methods for generating SSB, Demodulation of SSB Waves, principle of Vestigial side band modulation.

**MODULE –II: ANGLE MODULATION (09)**
Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave -Generation of FM Signal

Armstrong Method, Detection of FM Signal: Balanced slope detector, Phase locked loop, Comparison of FM and AM., Concept of Pre-emphasis and de-emphasis.

**MODULE –III: ANALOG AND DIGITAL PULSE MODULTAIONS (10)**

**Pulse Modulation:** Types of Pulse modulation- Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM), Comparison of FDM and TDM. Pulse Code Modulation: Elements of digital communications, pulse code modulation (PCM) generation and reconstruction, quantization noise, uniform, and non-uniform quantization and companding, Differential pulse code modulation (DPCM), Delta modulation (DM) and Adaptive DM.

**Digital Modulation:** Amplitude shift keying (ASK)- Modulator, Coherent ASK Detector, Frequency shift keying (FSK)- Modulator, Non-Coherent FSK Detector, Binary phase shift keying (BPSK)- Modulator, Detector, Principles of QPSK, Differential PSK, Probability of Error for ASK, FSK, PSK.

**MODULE –IV: BASE BAND TRANSMISSION AND PULSE SHAPIN (09)**

Base Band Transmission: Requirements of a line encoding format, Various line encoding formats: Unipolar, Polar, Bipolar; Scrambling techniques: BZ8S, HDB3, computation of power spectral densities of various line encoding formats. Pulse Shaping: Inter symbol interference; pulse shaping to reduce ISI, Eye diagrams for ASK, PSK, FSK, Cross Talk

**MODULE –V: SOURCE CODING AND ERROR CONTROL CODES (10)**

**Source coding:** Fixed length and variable length Source Coding Schemes, Huffman coding, Shannon fano coding, Channel coding theorem Hartley Shannon law.

**Linear Block Codes:** Introduction to error control coding, Matrix description of linear block codes, error detection and error correction capabilities of linear block codes, hamming code, Binary cyclic code's algebraic structure, encoding, syndrome calculation and decoding.

## V. TEXT BOOKS:


1. Simon Haykin, "Analog and Digital Communications", John Wiley, 2005.
2. Wayne Tomasi, "Electronics Communication Systems-Fundamentals through Advanced", 5th edition, 2009.
3. K. Sam Shanmugam, "Digital and Analog Communication Systems", John Wiley & Sons, 2nd edition, 2005.


## VI. REFERENCE BOOKS:


1. B.P.Lathi, "Modern Analog and Digital Communication", Oxford reprint, 3rd edition, 2004.
2. Singh, Sapre, "Communication Systems Analog and Digital," TMH, 2nd edition, 2004.
3. Herbert Taub, Donald L Schilling, Goutam Saha "Principles of Communication Systems ", McGraw-Hill,3rd edition, 2007.


## VII. ELECTRONICS RESOURCES:

1. NPTEL :: Electronics and Communication: Principles of Digital Communications
2. NPTEL :: Electronics and Communication- NOC: Introduction to Digital Communication
3. NPTEL :: Electronics and Communication - NOC: Modern digital communication techniques
4. NPTEL :: Electronics and Communication: Digital Communications

## VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Definition and terminology
4. Tech-talk topics
5. Assignments
6. Model question paper - I
7. Model question paper - II
8. Lecture notes

9. Early learning readiness videos (ELRV)
10. Power point presentations