# ANALOG COMMUNICATIONS

**IV Semester: ECE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AEC005 | Core | 3 | 1 | - | 4 | 30 | 70 | 100 |
| Contact Classes: 45 | Tutorial Classes: 15 | Practical Classes: Nil | | | | Total Classes: 60 | | |

## I. COURSE OVERVIEW:

Analog communications emphasizes on generation, transmission and reception of audio, video and telephony signals. The course covers representation of signals in time and frequency domain, need of modulation and an effect of noises on the performance of communication systems. Analog communi- cation system principles are used for real world applications of Radio and TV broadcasting systems.

## II. OBJECTIVES:

**The course should enable the students to:**

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| I | The skills for analyzing different type's signals in terms of their properties such asenergy, power, and correlation and apply for analysis of linear time invariant systems. |
| II | The generation and detection of Amplitude Modulation (AM), Frequency Modulation (FM), and Phase Modulation (PM) signals. |
| III | The performance of AM, FM, PM systems in terms of power, bandwidth andSNR (Signal-to-Noise Ratio). |
| IV | To establish a firm foundation for the understanding of telecommunication systems and evaluate analog communication system in terms of the complexity ofthe transmitters and receivers. |

## III. COURSE OUTCOMES:

**After successful completion of the course, students should be able to:**

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| CO 1 | **Interpret** the signals and different mathematical operations, convolution, correlation for analysis of response of LTI system. | Understand |
| CO 2 | **Illustrate** the basic principles, generation and detection techniques of amplitude modulations for video signal transmission systems. | Understand |
| CO 3 | **Outline** the generation and detection techniques of frequency modulated waves used for audio signal transmission systems | Understand |
| CO 4 | **Compare** bandwidth, power requirements, efficiency for AM and FM analog communication systems . | Analyze |
| CO 5 | **Make use of** the working principles of AM , FM receivers to measure selectivity, sensitivity, fidelity and signal to noise ratio. | Apply |
| CO 6 | **Demonstrate** the sampling and reconstruction of band limited signals using sampling techniques for digital signal transmission.. | Understand |

## IV. SYLLABUS:

| UNIT-I | SIGNAL ANALYSIS AND LTI SYSTEMS | Classes: 10 |
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Classification of signals and study of Fourier transforms for standard signals, definition of signal bandwidth; Systems: Definition of system, classification of systems based on properties, linear time invariant system , impulse, step, sinusoidal response of a linear time invariant system, transfer function of a linear time invariant system, distortion less transmission through a linear time invariant system; system bandwidth; Convolution and correlation of signals: Concept of convolution, graphical representation of convolution, properties of convolution; Cross correlation ,auto correlation functions and their properties, comparison between correlation and convolution.

| UNIT-II | AMPLITUDE AND DOUBLE SIDE BAND SUPPRESSED CARRIER MODULATION | Classes: 10 |
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Introduction to communication system, need for modulation, frequency division multiplexing; Amplitude modulation, definition; Time domain and frequency domain description, single tone modulation, power relations in amplitude modulation waves; Generation of amplitude modulation wave using ,square law and switching modulators; Detection of amplitude modulation waves using square law and envelope detectors; Double side band modulation: Double side band suppressed carrier time domain and frequency domain description; Generation of double side band suppressed carrier waves using balanced and ring modulators; Coherent detection of double side band suppressed carrier modulated waves; Costas loop; Noise in amplitude modulation, noise in double side band suppressed carrier.

| UNIT-III | SINGLE SIDE BAND AND VESTIGIAL SIDE BAND MODULATION | Classes: 08 |
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Frequency domain description, frequency discrimination method for generation of amplitude modulation single side band modulated wave; time domain description; Phase discrimination method for generating amplitude modulation single side band modulated waves; Demodulation of single side band waves.

Noise in single side band suppressed carrier; Vestigial side band modulation: Frequency description, generation of vestigial side band modulated wave; Time domain description; Envelope detection of a vestigial side band modulation wave pulse carrier; Comparison of amplitude modulation techniques; applications of different amplitude modulation systems.

| UNIT-IV | ANGLE MODULATION | Classes: 09 |
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Basic concepts, frequency modulation: Single tone frequency modulation, spectrum analysis of sinusoidal frequency modulation wave, narrow band frequency modulation, wide band frequency modulation, transmission bandwidth of frequency modulation wave, phase modulation, comparison of frequency modulation and phase modulation; Generation of frequency modulation waves, direct frequency modulation and indirect frequency modulation, detection of frequency modulation waves: Balanced frequency discriminator, Foster Seeley discriminator, ratio detector, zero crossing detector, phase locked loop, comparison of frequency modulation and amplitude modulation; Noise in angle modulation system, threshold effect in angle modulation system, pre-emphasis and de-emphasis.

| UNIT-V | RECEIVERS AND SAMPLING THEORM | Classes: 08 |
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Receivers: Introduction, tuned radio frequency receiver, super heterodyne receiver, radio frequency amplifier, mixer, local oscillator, intermediate frequency amplifier, automatic gain control; Receiver characteristics: Sensitivity, selectivity, image frequency rejection ratio, choice of intermediate frequency, fidelity; Frequency modulation receiver, amplitude limiting, automatic frequency control, comparison with amplitude modulation receiver; Sampling: Sampling theorem, graphical and analytical proof for band limited signals, types of sampling, reconstruction of signal from its samples.

**Text Books:**


1. B.P. Lathi, “Signals, Systems and Communications”, BS Publications, 5th Edition, 2009.
2. S. S. Haykin, “Communication Systems”, Wiley Eastern, 2nd Edition, 2006.
3. Taub, Schilling, “Principles of Communication Systems”, Tata McGraw-Hill, 4th Edition, 2013.


**Reference Books:**


1. B.P. Lathi, “Communication Systems”, BS Publication, 2nd Edition, 2006.
2. John G. Proakis, Masond, Salehi, “Fundamentals of Communication Systems”, PEA, 1st Edition, 2006.
3. George Kennedy,Bernard Davis, “Electronics and Communication System”, Tata McGraw Hill , 5th Edition, 2011.

4. B.P. Lathi, Zhi Ding, “Modern analog and digital Communication Systems”, Oxford Publication, 4th Edition, 2011.

**Web References:**

1. http://www.web.eecs.utk.edu
2. https://everythingvtu.wordpress.com
3. http://nptel.ac.in/
4. http://www.iare.ac.in

**E-Text Books:**

1. http://www.bookboon.com/
2. http://www.jntubook.com
3. http://www.smartzworld.com
4. http://www.archive.org

**Course Home Page:**