

UEC401: ANALOG COMMUNICATION SYSTEMS

L	T	P	Cr
3	1	2	4.5

Course Objective: The aim of this course is to build fundamental understanding of a communication system and its performance metrics. The course will describe the theory of modulation and its different counterparts with the help of mathematical analysis of their various characteristics. The generation of AM, FM and PM waves will be described. The course will also focus on the design of AM and FM receivers and will deal with various types of noises in the communication channel.

Introduction to Communication systems: Introduction to Communication system, analog and digital messages, signal to noise ratio, Noise, Resistor noise, Multiple resistor noise sources, Noise Temperature, Noise bandwidth, Effective input noise temperature, channel bandwidth, rate of communication, modulation, necessity for modulation, signal distortion over a communication channel, signal energy and signal energy density, signal power, power spectral density,

Amplitude Modulation: Baseband and carrier communication, Theory of amplitude modulation, DSB-AM, SSB-AM, Vestigial sideband transmission, carrier acquisition, , power calculations, Square law modulation, Amplitude modulation in amplifier circuits, Suppressed carrier AM generation (Balanced Modulator) ring Modulator, Product Modulator/balanced Modulator.

AM Reception: Tuned Ratio Frequency (TRF) Receiver, Super heterodyne Receiver, RF Amplifier, Image Frequency Rejection, AM diode detector, AM receiver using a phase locked loop (PLL), AM receiver characteristics.

Angle Modulation: Concept of instantaneous frequency, bandwidth of angle modulated waves, Theory of frequency modulation, Mathematical analysis of FM, Spectra of FM signals, Narrow band FM, Wide band FM, Phase modulation, Phase modulation obtained from frequency modulation, FM allocation standards, Generation of FM by direct method, Indirect generation of FM, The Armstrong method RC phase shift method,, Noise triangle. Comparison of AM, FM and PM

FM/PM Reception: Direct methods of Frequency demodulation, Travis detector/frequency discrimination (Balanced slope detector), Foster seely of phase discriminator, Ratio detector, Indirect method of FM demodulation, FM detector using PLL, Zero crossing detector as a Frequency Demodulator, Pre-emphasis / de-emphasis, Limiters, The FM receiver

Analog Pulse Modulation: Introduction, Pulse amplitude modulation (PAM), Pulse Time Modulation (PTM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM), Spectra of pulse modulated signals, SNR calculations for pulse modulation systems.

Laboratory work: Study of AM modulators / demodulators: (Balanced modulator, Ring modulator) / (Balanced modulator Super heterodyne Receiver), Study of FM/PM modulators/demodulators: (direct method, Varactor diode Modulator, Indirect generation of

FM) / (Balanced stop detector, Foster seely of phase discriminator, Ratio detector), FM stereo receiver.

Course learning outcome (CLOs): The students will be able to

1. describe different types of noise and predict its effect on various analog communication systems.
2. analyze energy and power spectral density of the signal.
3. express the basic concepts of analog modulation schemes
4. evaluate analog modulated waveform in time /frequency domain and also find modulation index.
5. develop understanding about performance of analog communication systems
6. calculate bandwidth and power requirements for analog systems.
7. analyze different characteristics of receiver

Text Books:

1. Kennedy, G., *Electronic Communication Systems*, McGraw-Hill (2008) 4th ed.
2. Lathi.B.P., *Modern Digital and Analog Communications Systems* 3rd ed.

Reference Books:

1. Taub, H., *Principles of Communication Systems*, McGraw-Hill (2008) 3rd ed.
2. Haykin, S., *Communication Systems*, John Willey (2009) 4th ed.
3. Proakis, J. G. and Salehi, M., *Fundamentals of Communication Systems*, Dorling Kindersley (2008) 2nd ed.

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40