III B.Tech I Semester

15AEC24 - ANALOG COMMUNICATION SYSTEMS

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Course Objectives:

1. *To study the fundamental concept of the analog communication systems.*
2. *To study the various analog modulation and demodulation techniques.*
3. *To understand the influence of noise on the performance of analog communication systems, and to acquire the knowledge about information and capacity.*

UNIT- I

Introduction: Elements of communication systems, Information, Messages and Signals, Modulation, Modulation Methods, Modulation Benefits and Applications.

Amplitude Modulation & Demodulation: Baseband and carrier communication, Amplitude Modulation (AM), Side band and carrier power of AM, Generation of amplitude modulated wave- square law Modulator, switching Modulator, Demodulation of AM Waves- Envelope detector, Rectifier detector, Suppressed carrier Modulation, Double sideband suppressed carrier (DSB-SC) Modulation, Generation of DSB-SC signals- Balanced Modulator, Ring Modulator, Demodulation of DSB-SC signals- Synchronous detector, Quadrature amplitude modulation (QAM), Single side band suppressed carrier (SSB-SC) Modulation, Generation of SSB-SC signals-Frequency & Phase discrimination methods, Demodulation of SSB-SC signals-Synchronous detector, Vestigial sideband (VSB) modulation & demodulation, Frequency mixer.

Radio Receiver: Super-heterodyne AM receiver, Sensitivity, Selectivity, and fidelity. Illustrative Problems.

UNIT- II

Angle Modulation &Demodulation: Concept of instantaneous frequency, Generalized concept of angle modulation, Bandwidth of angle modulated waves – Narrow band frequency modulation (NBFM); and Wide band FM (WBFM), Phase modulation, Features of angle modulation, Generation of FM waves – Indirect method, Direct generation; Demodulation of FM, Band pass limiter, Practical frequency demodulators, Power Spectral density, Pre-emphasis & De-emphasis filters, FM receiver, FM Capture Effect, Illustrative Problems.

UNIT- III

Noise in Communication Systems: Thermal noise, Properties of Thermal Noise, Time domain representation of narrowband noise, Filtered white noise, Quadrature representation of narrowband noise, Envelope of narrowband noise plus sine wave, Signal to noise ratio & probability of error, Noise equivalent bandwidth, Effective noise temperature, and Noise figure, Baseband systems with channel noise, Performance analysis of AM, DSB-SC, SSB-SC, FM, PM in the presence of noise, Illustrative Problems.

UNIT- IV

Sampling: Sampling theorem, sampling of continuous time signals, Reconstruction of Signal From its samples, Effect of under sampling, Natural and Flat top sampling

Analog pulse modulation schemes: Pulse amplitude modulation (PAM) & demodulation, Pulse-Time Modulation – Pulse Duration and Pulse Position modulations, and demodulation schemes, Illustrative Problems.

UNIT- V

Information & Channel Capacity: Introduction, Information content of message, Entropy, Entropy of symbols in long independent and dependent sequences, Entropy and information rate of Mark off sources, Shannon's encoding algorithm, Discrete communication channels, Rate of information over a discrete channel, Capacity of discrete memory less channels, Discrete channels with memory, Shannon – Hartley theorem and its implications, Illustrative problems.

***Course Outcomes**:*

This course provides the foundational education in Analog Communication systems, and applications. The students are provided the learning experience through class room teaching and solving assignment & tutorial problems. At the end of course, students should be able to:

a. Acquire knowledge on the basic concepts of Analog Communication Systems.
b. Analyze the various modulation and demodulation systems.
c. Verify the effect of noise on the performance of communication systems.
d. Analyze the bandwidth and power requirements of analog systems.
e. Analyze the different characteristics of receiver.
f. Analyze the various Pulse modulation techniques, Information and channel capacity.

TEXT BOOKS:

1. Simon Haykin, "Communication Systems", 3rd edition, Wiley-India edition, 2010.
2 B. P. Lathi, "Modern Digital and Analog Communication Systems," 3rd Edition, Oxford Univ. press, 2006.
3 A. Bruce Carlson, & Paul B. Crilly, "Communication Systems – An Introduction to Signals & Noise in Electrical Communication", 5th Edition, McGraw-Hill International Edition, 2010.

REFERENCES:

1 Herbert Taub, Donald L Schilling, "Principles of Communication Systems", 3rd Edition, Tata McGraw-Hill, 2009.
2 George Kennedy, Bernard Davis, "Electronics & Communication System", 3rd Edition, Tata McGraw Hill, 2004.