

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>II Year B.E. (Electronics &amp; Telecommunication)</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
<b>ETR4C4 ANALOG COMMUNICATION</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>5</b>
<b>Duration of Theory Paper: 3 Hours</b>							

**Learning Objectives:**

- The fundamentals of signals & linear time invariant systems used in communication systems.
- Knowledge of probability, random variables & random processes
- In depth knowledge of different types of analog communication system and different modulation techniques used in these systems.
- Analysis of noise and its impact on different modulation techniques.

**Prerequisite(s):** Basic Electronics

**COURSE CONTENTS**

**Unit-I**

Signals and Systems: Types of signals, Classification of Systems, Fourier series, Fourier transform & Its Properties, Convolution, Signal transmission through LTI Systems, Auto correlation, Cross correlation, Energy and power spectral density.

Probability, Random Variables & their moments, their significance, Gaussian & Rayleigh Probability density functions, their means and variances, Q-Function, Central limit theorem.

**Unit -II**

Amplitude Modulation: Need of Modulation, Block schematic of a typical communication system. AM modulation system, Modulation index, Generation (Squire Law & Switching Modulator ) & Detection ( Envelope & Squire Law Detector) of AM wave , Side bands & Power contents in AM Wave, DSB-SC (Balanced, Ring Modulator & Synchronous Detector), SSB-SC, Methods of generation & detection, VSB modulation, Comparison of various AM systems, Frequency division multiplexing, Group delay & phase delay.

**Unit -III**

Frequency Modulation: Relationships between Phase & Frequency Modulation, Narrowband FM, Wideband FM & their Spectrum, Transmission bandwidth of FM And PM signals, Methods of generation (Direct & Indirect ) & detection of FM (Discriminators : Balanced, Phase Shift And PLL Detector), Pre- Emphasis & De-Emphasis, Stereophonic FM Broadcasting.

### **Unit -IV**

AM transmitter block diagram, TRF receiver & its limitations, Necessity of heterodyning, Super heterodyne radio receivers, IF amplifiers & selection of IF. FM transmitters, FM receivers, AGC, AVC, AFC, Dynamic Range of Receivers.

### **Unit -V**

Random & Gaussian processes and their frequency domain analysis, Sources of noise, Noise figure and Noise figure of amplifiers in cascade, Noise bandwidth, Effective noise temperature, and quadrature components of noise, Rician noise as narrow band Gaussian noise. Performance of AM, FM in presence of low noise case.

Introduction to Digital Communication: Nyquist Sampling Theorem, Time division Multiplexing, PAM, PWM, PPM.

### **Learning Outcomes:**

On Completion of this course the students will be able to:

- Analyze analog communications in time domain and frequency domain.
- Distinguish between different analog modulation techniques.
- Understand the importance of noise considerations in communication systems.

### **BOOKS RECOMMENDED:**

- [1] Proakis and Salehi, “*Fundamentals of Communication Systems*”, 1/E Pearson Education, 2005.
- [2] Lathi B.P., “*Analog and Digital Communication systems*”, 3/E Oxford Press, 2007.
- [3] Haykin Simon, “*Communication Systems*”, 4/E John Willey & Sons, 2006.
- [4] Carlson, “*Communication Systems*”, 5/E McGraw Hill, 2004.
- [5] Taub & Schilling, “*Principles of communication systems*”, 3/E McGraw Hill, 2000.
- [6] Singh R.P. & Sapre, “*Communication systems Analog & Digital*”, 2/E TMH, 2007.

### **List of Practical Assignments:**

1. To Perform the fourier synthesis of the following signals
  - a) Square wave
  - b) Triangular wave
  - c) AM wave SC
  - d) AM wave FC
2. Generation of AM Waveforms.
  - a) Waveforms generation of DSB-SC Amplitude modulation System
  - b) Waveforms generation of SSB-SC Amplitude modulation System

- c) Waveforms generation of AM-FC System for different modulation index
- 3. To study the working of AM receiver.
  - a) (a)Detection of AM wave by envelope detector
  - b) (b)Detection of AM wave by square law detector
- 4. Receiving of AM signal using superhetrodyne receiver and analyzes it.
- 5. To modulate a message signal using FM modulator.
- 6. To demodulate a received FM signal using FM demodulator circuit.
- 7. To study the working of pulse width modulator and demodulator.
- 8. To study the working of pulse amplitude modulator and demodulator.
- 9. To study the working of pulse position modulator and demodulator.
- 10. To study the working of spectrum analyzer. Analyzing the different AM and FM waveforms on spectrum analyzer.