

<b>Devi Ahilya Vishwavidhyalaya, Indore, India Institute of Engineering &amp; Technology</b>					<b>II Year B.Tech. (Electronics and Instrumentation Engineering)</b>	
<b>Course Code &amp; Name</b>	<b>Instructions Hours per Semester and Credits</b>					
<b>4REPC4  ANALOG AND DIGITAL COMMUNICATION</b>	<b>Classroom Instruction (CI)</b>		<b>Lab Instruction (LI)</b>	<b>Term Work (TW) and Self Learning (SL)</b>	<b>Total no. of Hours Per semester</b>	<b>Total Credits (Total Hours/30)</b>
	<b>L</b>	<b>T</b>	<b>P</b>	<b>TW+SL</b>	<b>120</b>	<b>4</b>
	<b>20</b>	<b>10</b>	<b>20</b>	<b>70</b>		

### Course Learning Objectives

1. Be familiarize with basic principles and techniques used in analog and digital communications
2. Know the origin and simulation of FM and FM-Demodulation process in communication
3. Acquaint with AM and FM basic functionalities
4. Discriminate the AM and FM functionalities
5. Interpret with various angle modulation and demodulation systems
6. Classification of digital modulation techniques and also focus on modern digital communications theory and systems.

- Prerequisites: The basic knowledge of signals and systems and probability theory.

### COURSE CONTENTS

#### UNIT-I: Signals and Systems

Types of signals-deterministic & random, periodic & non-periodic, analog & discrete, energy & power signals, Fourier series, Fourier transform & its properties, convolution, signal transmission through LTI systems, auto correlation, cross correlation, energy and power spectral density, their relationship with correlation function, probability, random variables & their moments, Gaussian probability density functions, its mean and variance.

#### UNIT-II: Amplitude Modulation system:

Need of modulation in a communication system, block schematic of a typical communication system, AM modulation system, modulation index, generation (square law & switching modulator) & detection (envelope & square law detector) of AM wave, side bands & power content in an AM wave, a brief review of DSB-SC, SSB, VSB, AM transmitter block diagram, super heterodyne radio receivers and its advantages.

**UNIT-III: Frequency Modulation system:**

Relationships between phase & frequency modulation, narrowband FM, wide band FM & their spectrum, transmission bandwidth of FM and PM signals, FM generation methods (direct & indirect ) & FM detection methods (discriminators: balanced, phase shift and PLL detector), pre-emphasis & de-emphasis, FM transmitters, FM receivers (block diagram), comparison with AM systems in presence of noise, frequency division multiplexing.

**UNIT-IV: Digital encoding & Line Coding:**

Sampling, sampling theorem, types of sampling, quantization, digital encoding techniques PCM, DPCM, DM, ADM, line coding techniques NRZ, RZ, Biphasic, Duo Binary, their comparison based on various desirable properties.

**UNIT-V: Digital modulation & Channel coding:**

A brief overview of generation, detection, constellation points of digital modulation techniques, ASK, FSK, PSK, MSK, introduction to optimum filter, matched filter. Channel coding techniques: error detection and correction codes, parity check code, minimum distance, hamming distance, overview of linear block code, cyclic code, convolutional code and their applications.

**Course Outcome:**

CO. No.	CO
CO1	Able to analyze and demonstrate the block diagram of communication system and different types of signals.
CO2	Able to analyze and design of various modulation and demodulation techniques Amplitude Modulation.
CO3	Analyze and design of various modulation and demodulation techniques Frequency Modulation.
CO4	Design and analyze the various digital modulation technique and line coding technique of digital data
CO5	Able to apply different Digital coding technique to the digital data.

**CO-PO-PSO Relationship**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
4REPC4.CO1	2				2		3				3	3	2	2
4REPC4.CO2	2	3									2	3	2	2
4REPC4.CO3	1	2	2	3	2		2				4	3	1	3
4REPC4.CO4	3	2	3	3							1	2	1	3
4REPC4.CO5	2	5	2	3	3		1					2	1	3

### BOOKS RECOMMENDED:

- [1] Lathi B.P., *Analog and Digital Communication Systems*, 3/e, Oxford Press, 2007
- [2] Proakis and Salehi, *Fundamentals of Communication Systems*, Pearson Education, 2005
- [3] Taub & Schilling, *Principles of Communication Systems*, 4/e, McGraw Hill, 2013
- [4] Bernard Sklar, *Digital communication*, 2/e, Pearson Education, 2007.
- [5] Haykins Simon, *Analog and Digital Communication*, 3/e Willey Publication, 2007.
- [6] Singh R.P. & Sapre, *Communication systems Analog & Digital*, TMH, 2007
- [7] Carlson, *Communication Systems*, McGraw Hill, 2004

### List of practical

1. Generate the following periodic signals using MATLAB and plot over two time periods.
  - (i) Square wave
  - (ii) Triangular wave
2. Generate the following signals and plot them using MATLAB.
  - (i) Unit step
  - (ii) Signum function
3. Using MATLAB, compute the Fourier series coefficients for the following waveforms and plot the amplitude and phase spectrum:
  - (i) Square wave
  - (ii) Triangular wave
4. Using MATLAB compute the Fourier transform of the following and plot the amplitude and phase spectrum:
  - (i)  $\text{rect}(t/\tau)$
  - (ii)  $e^{-2t} u(t)$
5. Using MATLAB, determine the spectra of the message signal  $m(t)$  and amplitude modulated signal (AM with carrier and both side bands).
  - (i) Plot message signal  $m(t)$  which is a sinusoid signal of 8.34 Hz.
  - (ii) Carrier signal is given as  $\cos(2\pi*250*t)$ . Plot the carrier signal.
  - (iii) Modulation index is given as  $m=0.63$ ; plot the AM modulated signal.
6. Using MATLAB, determine the detection of above generated AM modulated signal using envelope detector.
7. Message signal is given as  $\sin(2*\pi*10*t)$ , carrier signal is  $\cos(2*\pi*200*t)$ , frequency deviation constant  $k_f = 50$ , Using MATLAB determine the following:
  - (i) plot the message signal
  - (ii) Plot the FM modulated signal
  - (iii) Plot the spectrum of FM modulated signal.
  - (iv) Plot the spectrum of message signal.
  - (v) Plot the demodulated signal where demodulation is carried using ideal LPF with BW of 400Hz.
8. Carrier signal is given as  $c(t) = \cos 2\pi*500t$  is phase modulated by message signal given as  $\sin(2*\pi*50*t)$ , the peak phase deviation is  $\pi/5$ , Using MATLAB determine the following:
  - (i) Plot the PM modulated signal.
  - (ii) Plot the spectrum of PM modulated signal.

9. Write a MATLAB based code to generate DSB-SC modulated signal for the baseband signal  $m(t) = 2\cos 1000t$ , using carrier frequency  $f_c = 300$  KHz. Identify upper sideband and lower sideband spectra.
10. Write a MATLAB based code to generate sampled digital signals and also reconstruct it.
11. Write a MATLAB based code to implement different Digital modulation technique.