<table>
<tr><td colspan="5">Devi Ahilya Vishwavidhyalaya, Indore, India
Institute of Engineering & Technology</td><td colspan="2">II Year B.Tech. (Electronics and Telecommunication Engineering)</td></tr>
<tr><td>Course Code & Name</td><td colspan="6">Instructions Hours per Semester and Credits</td></tr>
<tr><td rowspan="3">4RTPC4

ANALOG COMMUNICATION</td><td colspan="2">Classroom Instruction (CI)</td><td>Lab Instruction (LI)</td><td>Term Work (TW) and Self Learning (SL)</td><td>Total no. of Hours Per semester</td><td>Total Credits (Total Hours/30)</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>TW+SL</td><td rowspan="2">120</td><td rowspan="2">4</td></tr>
<tr><td>20</td><td>10</td><td>20</td><td>70</td></tr>
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Course Learning Objectives:

1. To analyse different signals given in time domain into frequency domain.
2. To learn probability theory and its importance in communication systems.
3. To understand the concept and need of Modulation. Analyse and compare various types of amplitude and frequency modulation systems.
4. To understand the various building blocks of AM & FM transmitters and receivers.
5. To know the importance of noises present in communication systems.

Prerequisites:
Basic knowledge of Signals and Systyem, Probability theory.

COURSE CONTENTS

Unit-1
Signal Analysis and Linear Systems: Fourier Series, Complex Fourier Spectrum, Fourier Transform, Continuous Spectrum, Fourier Transform Involving Impulse Function, Properties of Fourier Transform, Fourier Transform of Periodic Functions, Convolution. The System Function, Distortion less Transmission, Paley Wiener Criterion, Energy Signals and Power Signals, Correlation, Autocorrelation.

Unit 2
Probability and Random Signal Theory: Introduction to Probability, Conditional probability & Statistical Independence, Baye's Theorem, Random Variables, Discrete Random Variables, Continuous Random variables, Joint Distribution, Characteristics of Random Variables, Binomial, Poisson, Normal & Uniform Distributions, Random Processes.

Unit 3
Amplitude Modulation Systems: Need of Modulation, Types of Modulation, Suppressed Carrier Systems (DSB-SC), Single Sideband Modulation (SSB), Vestigial Sideband Modulation (VSB), Amplitude Modulation with Large Carrier (AM), Generation of AM Waves, Demodulation of AM Waves, AM Transmitters and Receivers, Comparison of Various AM systems.

Unit 4
Angle Modulation Systems: Definition, Narrrowband FM, Wideband FM, Phase Modulation, FM Modulators and Transmitters, FM Demodulators and Receivers, Comparison between AM & FM.

Unit 5
Noise: Sources of Noise, Types of Noise, Noise in communication System, White Noise, Narrowband Noise, In phase and Quadrature phase components. Noise Bandwidth, Noise Figure, Noise Temperature, Noise in DSB& SSB System Noise in AM System, Noise in Angle Modulation System, and Threshold effect in Angle Modulation System. Introduction to Pulse Modulation Systems.

Course Outcomes:

CO. No.	CO
CO1	To analyse different types of time domain signals in frequency domain and find the spectrum and bandwidth of the given signal.
CO2	To understand the probability theory & random variables and apply into various problems.
CO3	To learn need of modulation in wireless communication system and detailed analysis of various types of amplitude modulation, demodulation, transmitters and receivers.
CO4	To acquire insight into frequency modulation, demodulation, transmitters and receivers.
CO5	To study the types of Noises presents in communication systems with mathematical analysis.

BOOKS RECOMMENDED:

[1] Lathi B.P., "Analog and Digital Communication systems", Fourth Edition, Oxford Press, 2017.
[2] Singh R.P. & Sapre, "Communication systems Analog & Digital", 3/E TMH, 2012.
[3] Proakis and Salehi, "Fundamentals of Communication Systems", 2/E Pearson Education, 2014.
[4] Haykin Simon, "Communication Systems", 5/E John Willey & Sons, 2021.

CO-PO-PSO Relationship

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
4RTPC4.CO1	**3**	2	**1**	**2**	**2**	-	-	-	-	-	-	3		2
4RTPC4.CO2	3	3	**1**	**3**	2	-	-	-	-	-	-	3		2
4RTPC4.CO3	3	3	2	**1**	**1**	-	-	-	-	-	-	3		2
4RTPC4.CO4	3	3	2	**1**	**1**	-	-	-	-	-	-	3		2
4RTPC4.CO5	3	3	2	**2**	2	-	-	-	-	-	-	3		2

List of practicals for Analog Communication

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 (2π*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*π*10*t), carrier signal is cos(2*π*200*t), frequency deviation constant kf = 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) = cos2π*500t is phase modulated by message signal given as sin(2*π*50*t), the peak phase deviation is π/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) = 2cos 1000t, using carrier frequency fc = 300 KHz. Identify upper sideband and lower sideband spectra.
10. Write a MATLAB based code to generate multiple analog signals and implement Time division multiplexing and de-multiplexing.