

<b>COURSE TITLE</b>	<b>ANALOG AND DIGITAL COMMUNICATION</b>
<b>COURSE CODE</b>	<b>01CT0404</b>
<b>COURSE CREDITS</b>	<b>4</b>

**Objective:**

- 1 This course explores the fundamentals of electronic communication systems it provides the knowledge of various analog and digital modulation and demodulation techniques used in communication system. Comparison of various techniques will enable the student to select most appropriate technique for the application.
- 2 This course explores the fundamentals of electronic communication systems. It provides the knowledge of various analog and digital modulation and demodulation techniques used in communication system. Comparison of various techniques will enable the student to select most appropriate technique for the application.
- 3 This course explores the fundamentals of electronic communication systems it provides the knowledge of various analog and digital modulation and demodulation techniques used in communication system. Comparison of various techniques will enable the student to select most appropriate technique for the application
- 4 This course explores the fundamentals of electronic communication systems it provides the knowledge of various analog and digital modulation and demodulation techniques used in communication system. Comparison of various techniques will enable the student to select most appropriate technique for the application
- 5 This course explores the fundamentals of electronic communication systems it provides the knowledge of various analog and digital modulation and demodulation techniques used in communication system. Comparison of various techniques will enable the student to select most appropriate technique for the application

**Course Outcomes:** After completion of this course, student will be able to:

- 1 To understand basics of analog and digital communication techniques.
- 2 To learn working of AM-FM Transmitters and receivers.
- 3 To facilitate the understanding of the baseband and carrier modulation.
- 4 To understand the effect and performance of communication systems in presence of noise.
- 5 Analyze Communication System based on different Modulation & Demodulation Techniques and analyze performance.

**Pre-requisite of course:** Basic electronics, Digital Electronics, Basic Mathematics and Introduction to communication engineering

### Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25
Contents : Unit	Topics						Contact Hours
1	<b>Linear Modulation: Amplitude modulation</b> Concept of amplitude modulation, Double Sideband suppressed carrier modulation, Single side band suppressed carrier modulation, Generation of AM- Chopper circuit, Balanced modulator, Modulation by multitone modulating signal, Independent Side band, Theme example- VSB transmission of Analog and Digital Television.						8
2	<b>Angle modulation</b> Concept of instantaneous frequency and phase modulation, sinusoidal FM and its time domain representation, spectral components of angle modulated signals, power in sinusoidal FM and modulation index, Carson's rule, Multitone wideband FM, Generation of Wideband FM from Narrow band FM, Generation of WBFM by Armstrong method						6
3	<b>Noise in communication systems</b> Classification of noise, Signal to noise ratio (SNR), Noise factor and noise figure, Equivalent input noise generators, Noise temperature, Narrow band noise, PSD of in-phase and quadrature noise, Noise performance in AM, FM, Digital baseband and carrier communication systems, Concept of optimum threshold detection, matched filter, correlation receiver, optimum binary receiver, bit error rate (BER)						5
4	<b>Base Band Modulation</b> Base band system, sampling theorem, Sampling and signal reconstruction, Aliasing, Types of sampling, Quantization, PCM, Companding, DPCM, ADPCM, Delta modulation, Adaptive delta modulation, Theme Example- Digitization of video and MPEG.						11
5	<b>Digital Modulation Techniques</b> Modulation techniques for ASK, QASK, FSK, M-ary FSK, BPSK, DPSK, QPSK, M-ary PSK, QAM, Comparison of Noise performance of various PSK and FSK systems, Theme Example- Orthogonal Frequency Division Multiplexing (OFDM)						12
<b>Total Hours</b>							<b>42</b>

**Suggested List of Experiments:**

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Experiment No.1</b> Perform Frequency Division Multiplexing of two standard signal and speech signal, A. To observe amplitude modulation waveforms for different modulation index B. Perform amplitude demodulation of DSB and SSB waveforms using AM receiver and observe waveforms at different stages of AM superheterodyne receiver.	2
2	<b>Experiment No.2</b> Perform modulation and demodulation of digital carrier ASK technique for given binary input., A. Perform frequency modulation using FM modulation trainer, observe FM waveforms and frequency spectrums and measure frequency deviation and modulation index. B. Perform frequency demodulation of FM signals using FM demodulation trainer and observe waveforms and frequency spectrums at outputs different demodulator circuits.	2
3	<b>Experiment No.3</b> Perform modulation and demodulation of digital carrier FSK technique for given binary input., A. Generate synchronization and control signals for Time Division Multiplexing B. Demonstrate the effect of switching delay of synchronization and control signals for Time Division Multiplexing C. Demonstrate the importance of frame synchronization signal in receiving the correct output at correct output channel	2
4	<b>Experiment No.4</b> Perform modulation and demodulation of digital carrier PSK technique for given binary input., A. Demonstrate working of PLL B. Perform Time Division Multiplexing with PAM Signals.	2
5	<b>Experiment No.5</b> Perform modulation and demodulation of digital carrier QPSK technique for given binary input., A. Perform Sampling and reconstruction of signal and observe the effects of changes in sampling rate with reference to Nyquist rate. B. Demonstrate the effect of sample and hold circuitry on reconstructed signal. C. Demonstrate the effect on reconstructed signal by changing order of reconstruction low pass filter for different sampling rates.	2
6	<b>Experiment No.6</b> Perform PCM generation and demodulation using CODEC chip for analog standard signal and speech signal., To transmit and receive digital signal using Amplitude shift keying	2
7	<b>Experiment No.7</b> Perform DPCM modulation and demodulation, To transmit and receive digital signal using Frequency shift keying	2
8	<b>Experiment No.8</b> Perform frequency modulation of a given analog signal., To transmit and receive digital signal using Binary Phase shift keying	2

### Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
9	<b>Experiment No.9</b> Perform frequency demodulation using different technique of a FM signal., To transmit and receive digital signal using Quadrature Phase shift keying	2
10	<b>Experiment No.10</b> Perform QAM modulation of given digital input., Perform QAM Modulation and Demodulation	2
11	<b>Experiment No.11</b> Perform demodulation of QAM signal., A. Perform PCM generation and demodulation using CODEC chip for analog (std.) signal B. Perform PCM generation and demodulation using CODEC chip for speech signal	2
12	<b>Experiment No.12</b> Perform modulation and demodulation of input signal by MSK technique., A. Perform Differential Pulse Code Modulation and Demodulation B. Establish voice link using DPCM process.	2
13	<b>Experiment No.13</b> Industrial visit report., A. Perform Frequency Division Multiplexing and Demultiplexing with sinusoidal input signal B. Perform Frequency Division Multiplexing and Demultiplexing with audio input signal C. Observe the frequency spectrum of FDM signal.	2
14	<b>Experiment No.14</b> Simulation of various digital carrier techniques of given binary input., A. Implement step by step Transmission and Reception for OFDM signal B. Calculate BER for OFDM in presence of AWGN noise.	2
<b>Total Hours</b>		<b>28</b>

### Textbook :

- 1 Communication Systems: Analog and Digital, by R. P. Singh and B. D. Sapre, Tata-McGraw Hill, 2012
- 2 Modern Digital and Analog Communication Systems, Bhagwandas Pannalal Lathi, Zhi Ding, Oxford University Press, 2010

### References:

- 1 Electronic Communications, Electronic Communications, by Kennedy, McGraw Hill Publication, 2008
- 2 Electronic Communications, Electronic Communications, by Dennis Roddy & John Coolen, PHI., 1984
- 3 Principles of Communication Systems,, Principles of Communication Systems,, Taub & Schilling, Tata Mcgraw-Hill Publishing Company Limited, 1991

### Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
<b>Remember / Knowledge</b>	<b>Understand</b>	<b>Apply</b>	<b>Analyze</b>	<b>Evaluate</b>	<b>Higher order Thinking / Creative</b>
10.00	25.00	25.00	20.00	10.00	10.00

#### **Instructional Method:**

- 1 The course delivery method will depend upon the requirement of content and need of the students. The teacher in addition to conventional teaching method (Chalk and Talk) may use any of the tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc. for effective teaching
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 3 Practical examination will be conducted at the end of the semester for evaluation of performance of students in laboratory.
- 4 Students may use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory, etc.

#### **Supplementary Resources:**

- 1 [https://www.tutorialspoint.com/digital\\_communication/digital\\_communication\\_analog\\_to\\_digital.html](https://www.tutorialspoint.com/digital_communication/digital_communication_analog_to_digital.html)
- 2 <https://www.classcentral.com/course/swayam-analog-communication-13893>
- 3 <https://www.udemy.com/course/analog-communication/>