



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3151104

Subject Name: Analog and Digital Communication
Semester V

Type of course:

Prerequisite: Analog Electronics, Digital Electronics, Fourier Series, Fourier Transform.

This course explores the fundamentals of electronic communication systems. The course has two primary focuses:

- (1) Understanding Analog communications systems with design and analysis of various basic modulation systems.
- (2) Understanding Digital communications systems with design and analysis of various basic Digital modulation systems.

Rationale: The students need to learn basic concepts of analog and digital communication, components of Analog and Digital Communication systems, Advantages and disadvantages of Analog and Digital communication systems.

Teaching and Examination Scheme:

| Teaching Scheme | | | Credits C | Examination Marks | | | | Total Marks |
|-----------------|---|---|--------------|-------------------|-----------|-----------------|-----------|----------------|
| L | T | P | | Theory Marks | | Practical Marks | | |
| | | | | ESE (E) | PA (M) | ESE Viva (V) | PA (I) | |
| 4 | 0 | 2 | 5 | 70 | 30 | 30 | 20 | 150 |

| Sr. No. | Content | Total hours | % Weightage |
|---------|--|-------------|-------------|
| 1 | Introduction To Communication System. Analog and Digital Messages, Channel Effect, Signal-to Noise ration and capacity, Modulation and Detection, History of Communications. (Revision of Signal Transmission through a linear system, Signal distortion over a communication channel, Signal Energy and Energy spectra density, Signal power and power density). | 7 | 20 |
| 2 | Amplitude modulation And Demodulations Single and Double sideband Amplitude modulation, Amplitude modulation, Bandwidth-efficient Amplitude modulation, VSB, Local Carrier synchronization, FDM, PLL. | 7 | 15 |
| 3 | Angle Modulation and demodulation Nonlinear Modulation, Bandwidth of Angle-modulated Waves,, Generating FM waves, Demodulation of FM signals, Nonlinear distortion and interference, Superheterodyne Receivers, FM broadcasting System. | 7 | 15 |
| 4 | Sampling and Analog to digital Conversion Sampling theorem, Sampling and signal reconstruction, Aliasing, Types of sampling, Quantization, PCM, Companding, DPCM, ADPCM, Delta modulation, Adaptive delta modulation, T1 carrier system | 9 | 20 |
| 5 | Digital Data Transmission Components of digital communication system, line coding, pulse shaping, Scrambling, Regenerative Repeater, Eye Diagram, Timing Extraction, Detection Error Probability, M-ary communication, Digital Carrier Systems | 9 | 20 |



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| | | | |
|---|--|-----------|------------|
| 6 | Introduction to Digital Modulation-Demodulation Techniques Modulation techniques for ASK,FSK, PSK, MSK, BPSK, QPSK, GMSK | 6 | 10 |
| | Total | 45 | 100 |

Suggested Specification table* with Marks (Theory):

| Distribution of Theory Marks | | | | | |
|------------------------------|---------|---------|---------|---------|---------|
| R Level | U Level | A Level | N Level | E Level | C Level |
| 15 | 15 | 10 | 15 | 10 | 5 |

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

**This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.*

Reference Books:

1. Digital and analog communication system by B.P.Lathi .Zhi Ding 4th edition.
2. Communication Systems by Simon Haykins.
3. Electronic Communications Systems by Wayne Tomasi.

Suggested List of practicals:-

1. To understand and the concept of Pulse Code Modulation and To observe the Performance of PCM system.
2. To understand and the role of signal compression/Expansion on S/N ratio.
3. To understand the concept of Delta Modulation and to achieve the Delta Modulation / De- Modulation.
4. To study the performance of An-adaptive Delta modulator/De-modulator circuits
5. To Study and observe the performance of Digital carrier system—ASK.
6. To Study and observe the performance of Digital carrier system—FSK.
7. To Study and observe the performance of Digital carrier system—PSK.
8. To Study and observe the performance of Return to Zero (RZ) types of line codes.
9. To Study and observe the performance of Non- Return to Zero (NRZ) types of line Codes.
10. To establish a PCM based transmission-reception link.
11. To Study and observe the effect of signal Distortion using EYE-Diagram.
12. To Study and Perform sampling theorem and reconstruction.
13. To Study and perform Error Detection and Correction codes.
14. To perform TDM-PCM Transmission and Reception.
15. To study and perform Data Conditioning carrier modulation.
16. To study and perform Data Re-Conditioning carrier De-modulation.
17. To study and perform TDM pulse amplitude modulation/demodulation.
18. To study and perform PAM, PWM, PPM. 19 Few simulation exercises on digital communication techniques / basic systems.

Mini Project:

Mini project with emphasis on design and implementation is compulsory with the help of hardware and simulation tools.



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Useful Tools and LRs:-

1. NPTEL MOOC Courses
2. Swayam Portal AICTE
3. National Digital Library, IIT KGP.
4. Virtual Lab by IIT Bombay.
5. MATLAB
6. SCILAB
7. LABVIEW
8. Various Analog and Digital Communication Trainers.

Course Outcomes:

After learning the course, the students should be able to

| Sr. No. | CO statement | Marks % weightage |
|---------|--|-------------------|
| CO-1 | Understand the Basics of Analog and Digital Communication Systems and Modulation as well as Transmission Techniques. | 20 |
| CO-2 | Analyse the various Analog and Digital Modulation and Transmission Techniques | 40 |
| CO-3 | Implement the Analog and Digital Communication Systems. | 40 |