SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

B. Tech. Semester V

Subject Name: **Analog and Digital Communication** **Subject Code: BTEC13501**

Type of course: PCC

Prerequisite: Basic Electronics, Analog Electronics

Rationale: Communications is a highly important and growing field leading to massive market value. Students should have the opportunity to gain familiarity with communication test equipment and measurement techniques. It is common in many communications systems to use an analog signal, which acts as an interface for the transmission medium to transmit and receive information and digital signal for processing, storing, encrypting etc. This course provides practical hands-on exposure to communication system building blocks, such as filters, mixers, amplifiers, digital modulation schemes.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	4	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. no.	Topics	Teaching Hrs.	Module % Weightage
1.	**Introduction Overview:** Elements of a Communication System, Classification of electronic communication systems, Baseband and band pass signals, Need for modulation. **Amplitude modulation** DSB-FC, DSB-SC, SSB, VSB and ISB transmissions: mathematical Analysis-time and frequency domain analysis, modulation index, generation and detection methods, AM modulation schemes, Quadrature Carrier Multiplexing (QAM). Demodulation of AM waves	6	15
2.	**Angle Modulation:** Frequency Modulation (FM), Phase Modulation (PM), Spectrum Analysis, Types of FM, Transmission Bandwidth of FM Waves, Generation of FM waves: Direct and Indirect, Various techniques of angle demodulation.	5	15

3.	**Radio Receivers:** Sources of noise, classification of noise, Noise factor, Noise Temperature, FRISS formula, Basic receiver (TRF), Super heterodyne receiver for AM and FM, receiver characteristics, AGC technique.	5	10
4.	**Digital Communication and Sampling:** Basic Digital Communication Block Diagram, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse Position Modulation, Sampling, Sampling Theorem and signal Reconstruction, Types of Sampling, Aliasing, Pulse Code Modulation - Quantization, Companding - A-Law and Mu Law, Signal-to-Noise-Ratio, DPCM, ADPCM, Delta Modulation, Adaptive Delta Modulation, Time Division Multiplexing, Frequency Division Multiplexing, T1 carrier System	11	20
5.	**Digital Data Transmission and Data Formatting:** Components of Digital Communication System, line Coding schemes and its requirements, NRZ, RZ, Manchester, Differential Manchester, Alternate Mark Inversion, Pseudoternary type line coding schemes, Power Spectral Density, scrambling, regenerative repeater, Eye diagram, Detection Error Probability, M-ary Communication.	6	10
6.	**Band-Pass System:** Signal representation and constellation diagram, ASK, FSK, PSK, MSK, BPSK, QPSK, QAM, MSK, coherent detection.	6	20
7.	**Introduction to Information Theory:** Measure of Information, Source Encoding, Channel Capacity of a Discrete memory less channel, Channel capacity of a continuous channel - Shannon's Channel capacity Theorem.	6	10

Suggested Specification table with Marks (Theory):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
30	30	15	15	5	5

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

Note: 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 slightly from above table.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition

1.	Modern Digital and Analog Communication Systems	B.P. Lathi Zhi Ding	Oxford University Press	2019	5th
2.	Communication Systems (Analog and Digital)	Sanjay Sharma	S.K. Kataria 8188458201 9788188458202	2013	Latest
3.	An Introduction to Analog and Digital Communications	Simon Haykin	John Wiley & Sons 978-1118734643	2016	3rd
4.	Electronic Communication Systems.	Roddy Coolen	Pearson Education	2008	4th

Course Outcome:

Sr. No.	CO Statement After learning this subject students will be able to	Marks % weightage
CO-1	Analyze different components of analog communication systems such as modulator, demodulator, mixer, receiver, etc. in time and frequency domain.	15
CO-2	Design the modulators, demodulators for amplitude and frequency modulated systems.	15
CO-3	Analyze and compare different Digital Modulation and demodulation schemes.	20
CO-4	Apply various line coding schemes for digital data transmission and hence, analyze the power spectrum density.	20
CO-5	Apply Shanon's theorem to obtain the Channel capacity of a continuous channel.	15
CO-6	Analyze different components of analog communication systems such as modulator, demodulator, mixer, receiver, etc. in time and frequency domain.	15

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	2	-	2	2	-	1	-	3	2	-	2	3	2	2
CO-2	3	2	2	-	3	-	2	-	2	3	3	3	3	3	2
CO-3	3	2	3	2	2	-	2	-	2	3	2	3	2	2	2
CO-4	3	2	1	2	3	-	2	-	2	2	2	3	3	-	3
CO-5	2	2	-	2	2	-	1	-	2	2	2	2	3	2	2
CO-6	3	2	2	3	2	2	3	-	-	2	3	2	3	3	2

List of practical:

1. To verify Sampling Theorem (Nyquist Criteria) and reconstruct the original signal using Pulse Amplitude Modulation and Demodulation with different Sampling techniques
2. To modulate the input signal (AC + DC) using Pulse Width Modulation with different sampling frequency and Demodulate the same.
3. To modulate the input signal (AC + DC) using Pulse Position Modulation with different sampling frequency and Demodulate the same.
4. To modulate and demodulate the signal using Amplitude Modulation scheme
5. To study and observe the performance of the Pulse Code Modulation including TDM (Time Division Multiplexing)
6. To Study and observe the performance of Delta Modulation and Demodulation.
7. To study and observe the performance of Adaptive Delta Modulation and Demodulation.
8. To observe different data formatting techniques and compare them using the performance parameters.
9. To study and observe the performance of Digital Carrier System using Amplitude Shift keying (ASK).
10. To study and observe the performance of Digital Carrier System using Frequency Shift keying (FSK).
11. To study and observe the performance of Digital Carrier System using Phase Shift keying (PSK).
12. To develop a working mini-project model using the fundamentals of Analog and Digital Communication.

Major Equipment:

- Digital Storage Oscilloscope
- Various kits associated with ADC

List of Open Source/learning website:

- **https://nptel.ac.in/courses/117105143-** Analog Communication
- **https://nptel.ac.in/courses/117101051-** Digital Communication

List of Open Source Software:

- Scilab