GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS (10) &
ELECTRONICS AND COMMUNICATION ENGINEERING (11)
DIGITAL COMMUNICATION
SUBJECT CODE: 2161001
B.E. 6th SEMESTER

Type of course: Program Core

Prerequisite: Basic Electronics, Digital electronics, Electronics Communication

Rationale: The course provides the basic knowledge of various digital modulation and demodulation techniques used in digital communication system. Comparison of various techniques will enable the student to select most appropriate technique for the application. The course includes the statistical analysis like mean, variance etc. The error detection and error correction codes are also included.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	100

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Base Band Modulation Base band system, sampling theorem, Sampling and signal reconstruction, Aliasing, Types of sampling, Quantization, PCM, Companding, DPCM, ADPCM, Delta modulation, Adaptive delta modulation, T1 carrier system	**10**	19
2	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	**6**	12
3	Digital Modulation Techniques Modulation techniques for ASK, QASK, FSK, M-ary FSK, BPSK, DPSK, DEPSK, QPSK, M-ary PSK, QAM, MSK, GMSK	**8**	15
4	Digital Carrier Demodulation Techniques Coherent and non coherent detection of ASK, QASK, FSK, PSK, QPSK, M-ary PSK, DPSK, Noise temperature, Noise bandwidth, Noise figure	**6**	12
5	Probability Theory and Random Variable Concept of probability, Conditional probability and independent event, random variable, types of random variable, CDF, PDF, Statistical Averages, Chebyshev's inequality, Central limit theorem, Concept of correlation,	**8**	15

6	Information Theory Measure of information, Entropy, Source encoding, Error free communication over noisy channel, channel capacity of discrete memory less channel, Channel capacity of continuous channel, Practical communication system in lights of Shannon theorem	**6**	12
7	Error Correcting Codes Introduction, Linear Block Code, Cyclic Code, Burst error detecting and correcting codes, Interlace codes for burst and random error correction, Convolution Code, Comparison of coded and un coded system	**8**	15

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**20**	**25**	**25**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and 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 Books:

1. Modern Digital and Analog Communication Systems, B. P. Lathi, (3rd Edition), Oxford Publication
2. Principles of Communication Systems, Taub & Schilling, (2nd Edition), Tata McGraw Hill Publication
3. S.Haykin, Communication systems, John Wiley 2001
4. Bhattacharya Amitabh, "Digital Communication", Tata McGraw-Hill, 1st Ed., 2006.

Course Outcome:

After learning the course the students should be able to:

1. Convert analog signal into digital signal using different techniques like PCM, DM, ADM.
2. Understand the concept of ISI and reduction of ISI through nyquist criteria.
3. Compare various digital modulation techniques
4. Understand behavior of various modulation-demodulation techniques in presence of noise.
5. Know probability, random variable and various statistical analysis methods.
6. Derive channel capacity for discrete memory less channel and continuous channel.
7. Compare various error detection and correction codes.

List of Experiments:

1 To understand sampling theorem and sample speech and audio signal

2 To generate and observe Pulse Amplitude Modulation, Pulse Width Modulation and Pulse position modulation waveforms.

3 To observe effect of oversampling and under sampling in PCM systems

4 To transmit and receive digital signal using Amplitude shift keying

5 To transmit and receive digital signal using Frequency Shift Keying

6 To transmit and receive digital signal using Phase Shift Keying (BPSK and QPSK)

7 To understand Pulse Code Modulation to digitize speech signal

8 To understand time division multiplexing and de-multiplexing

9 To Implement Differential pulse code modulation and demodulation

10 To understand the concept of Delta Modulation and to achieve the Delta Modulation /De- Modulation.

11 To understand Error Detection and Correction codes

12 Simulation exercises on digital communication techniques

Design based Problems (DP)/Open Ended Problem:

1 Design Sampling circuit.

2 Design different component of analog to digital converter.

3 Simulation of various digital modulation and demodulation techniques

4 Simulation of various error detection and correction codes.

Major Equipment:

C.R.O., Function Generator, Power Supply, Multimeter, Digital Storage Oscilloscope, Spectrum Analyzer, Experimental Trainer Kits, Bread Board, General Purpose PCB

List of Open Source Software/learning website:

Video lecture from NPTEL

Learning material available on MIT open course ware

SCILAB

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.