GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Electronics and communication Engineering / Information and Communication Technology

Course / Subject Code: DI03000121

Course / Subject Name: Principle of Electronics Communication

w. e. f. Academic Year:	2024-25
Semester:	3rd
Category of the Course:	PCC (Professional Core Courses)

Prerequisite:	Basic knowledge of electronic circuits, signal and EM wave
Rationale:	Students of diploma Electronics and Communication Engineering need to have a thorough understanding of fundamental concepts of Communication Engineering. Diploma students undertaking this course are expected to apply the fundamentals of basic electronic communication system to analyze the different communication (Modulation and Demodulation) methods with its techniques, various antenna for specific application this basic course develop skills required to learn communication to meet the expectations of the industry.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Distinguish various signals and noise in communication system.	R, U, A
02	Maintain AM based communication system.	R, U, A
03	Maintain FM based communication system	R, U, A
04	Understand sampling theory and waveforms coding techniques	R, U, A
05	Use relevant type of antenna for various applications.	R, U, A

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA(M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Basics of Communication System 1.1 Electromagnetic (EM) wave spectrum, frequency bands and their applications domain 1.2 Signals and its representation: analog and digital Signal, Pulse, Impulse, Saw-tooth, sinusoidal and rectangular (In Time & frequency domain) 1.3 Block diagram of Analog and Digital communication system 1.4 Modulation: Definition & its classification based on analog & pulse signal as carrier. 1.5 Noise in communication system, classification of noise, signal to noise ratio(S/N) and noise figure	7	12%
2.	Amplitude Modulation (AM) Communication 2.1 Need of modulation 2.2 Types of modulation techniques, Amplitude Modulation: Modulating signal, Carrier signal, modulation Index, mathematical representation of AM Signal, representation in time and frequency domain, Frequency Spectrum, Types of AM band spectrum (DSB, SSB) and their applications, Power relations in AM wave, bandwidth, Power saving in SSB 2.3 Generation of AM: DSBSC signal using balanced modulator circuit. 2.4 Demodulation of AM signal: Envelope detector using diode 2.5 Block diagram and working of each block of super heterodyne receiver with waveforms Characteristics Selectivity, Sensitivity, Image frequency rejection and Fidelity	10	25%
3.	Frequency Modulation (FM) Communication 3.1 Frequency modulation: Mathematical representation of FM signal Use of Bessel's function (no derivation), representation of FM signal in time domain and frequency domain, frequency deviation ratio, modulation index (numerical), types of frequency modulation (Narrow Band and Wide Band FM), 3.2 Phase Modulation: definition, waveforms and applications 3.3 Pre-emphasis and De-emphasis	10	25%

	3.4 Generation techniques for FM wave: Phase locked loop FM modulator 3.5 Basics and types of FM demodulators: Ratio detector and PLL as FM demodulator 3.6 FM Receiver: Block diagram and working with waveforms 3.7 compare AM, FM and PM		
4.	Sampling theory and waveform coding 4.1 Statement and proof of sampling theorem, 4.2 Nyquist rate and interval 4.3 Aliasing error, under sampling, over sampling and critical sampling 4.4 Ideal, Natural and flat top sampling 4.5 Pulse Modulation techniques: PAM, PWM, PPM 4.5 Concept of Quantization 4.6 Classification of quantization 4.7 PCM transmitter and receiver	9	18%
5.	Electromagnetic Wave and antenna 5.1 Properties of EM (electromagnetic) wave 5.2 Antenna fundamentals: Resonant antenna and Nonresonant antennas, ideal antenna, principle of transmitting and receiving antenna 5.3 Antenna parameters: Radiation pattern, polarization, bandwidth, beam width, antenna resistance, directivity and power gain, antenna gain 5.4 Dipole antenna and radiation pattern and Radiation Pattern for Unidirectional, bidirectional and Omni directional antenna 5.5Antenna (working principle, construction, radiation pattern and applications) : Loop antenna, , folded dipole ,Yagi-Uda antenna antenna And smart antenna.	9	20%
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
30%	**35%**	**35%**	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(A) Books:

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Communication systems (Analog and Digital)	Sanjay Sharma	S K Kataria and Sons, 4th Edition KATSON
2	Electronics Communication System (Fundamental to Advance)	Wayen Tomasi	Pearson Education, 5th edition
3	Analog Communication	V.ChandraSekhar	Oxford University Press
4	Electronic Communications Modulation and Transmission	Robert J. Schoenbeck	PHI Learning, 2nd Edition
5	Electronic Communication Systems	George Kennedy and Bernard Davis	Tata McGraw-Hill 5th edition or latest
6	Electronics Communication	Dennis Roddy and John Coolen	Pearson Education 4th Edition
7	Antenna and Wave propagation	Prasad, K.D. and Handa, Deepak	Satya Prakashan , New Delhi, 3 rd edition or lates

(B) Open-source software and website:

a. **Analog communication**
https://nptel.ac.in/courses/117105143
b. **Sampling Signal reconstruction**
http://ssl-iitg.vlabs.ac.in/Sampling%20and%20signal%20reconstruction%20(objective).html
c. **Amplitude Modulation**
https://www.etti.unibw.de/labalive/index/analogmodulation/
d. **FM transmitter**
https://www.etti.unibw.de/labalive/index/analogmodulation/
e. **FM Signal Spectra**
https://www.etti.unibw.de/labalive/index/analogmodulation/
f. **FM Receiver**
https://www.etti.unibw.de/labalive/index/analogmodulation/
g. **SNR Demonstration**
https://www.etti.unibw.de/labalive/index/analogmodulation/
h. **Quantization**

https://www.etti.unibw.de/labalive/index/analogmodulation/

i. **PAM**
https://www.multisim.com/content/TbNG4WmBH8htyxzRDzkeU8/pulse-amplitude-modulation/open/

j. **PWM**
https://www.falstad.com/circuit/e-555pulsemod.html

k. **PLL FM Modulator**
https://www.researchgate.net/publication/256133199_PLL_Based_High_Frequency_FM_Modulator

l. **PLL FM Demodulator**
https://electronicspost.com/pll-fm-demodulator-phase-locked-loop-fm- demodulator/

Suggested Course Practical List:

S. No.	Unit No.	Practical/Exercise	Approx. Hrs. Required
1	I	Measure amplitude of different sinusoidal frequency signals in frequency domain using Spectrum Analyzer.	2
2	I	To study about basic block diagram of communication system and list various communication channel	2
3	II	To generate amplitude modulation (AM) and to measure modulation index of AM.	2
4	II	Measure modulation index of an AM envelop by trapezoidal Method.	2
5	II	To perform AM modulation and AM demodulation using trainers/simulation.	2
6	II	Locate various sections of AM radio receiver trainer kit and draw the waveforms at input and output side of each section.	2
7	III	To perform FM modulation and FM demodulation using trainers/simulation.	2
8	III	Obtain the frequency response of Pre-emphasis and De-emphasis circuit.	2
9	III	Determine Modulation Index of Frequency Modulated wave.	2
10	III	Demonstration of fault finding of AM or FM radio receivers.	2
11	IV	Based on the sampling frequency, reconstruct the signal.	2
12	IV	Check the performance of PAM system.	2

13	IV	Check the performance of PWM system.	2
14	IV	Check the performance of PPM system.	2
15	IV	Check the performance PCM system for various sinusoidal Signals	2
16	V	To plot the radiation pattern of an Omni-directional antenna (Polar plot on log/linear scales & Cartesian plot on log/linear scales)	2
17	I to V	Check radiation pattern of folded dipole antenna.	2
18	I to V	Mini/Micro project	2
		Total: Min 15 Practical	**Min. 30**

List of Laboratory/Learning Resources Required:

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	RF Signal Generator (10Hz to 100MHz)	ALL
2	Audio Oscillator (20Hz to 20KHz)	3-5
3	CRO 2/3/4 channel (25-100MHz)	ALL
4	Spectrum Analyzer	1
5	Digital Multimeter (3-1/2 display)	ALL
6	AC Mill voltmeter	ALL
7	Digital Storage oscilloscope	ALL
8	Pulse generator	11-15
9	Trainer Board for different Communication Mod-Demod. Techniques.	3-15
10	Antenna Trainer Kit	16-17

Suggested Project List:

a) Build AM transmitter circuit using transistor/IC.
b) Demonstrate AM communication System including AM transmitter and receiver.
c) Build FM Transmitter circuit using IC.

d) Demonstrate FM communication System including FM transmitter and receiver.
e) Build a PAM Modulator using 555/OPAMP.
f) Build a PWM Modulator using 555/OPAMP.
g) Build a PPM Modulator using 555/OPAMP.
h) Demonstrate Analog Communication system on Virtual Lab.
i) Visit nearby FM radio station and prepare brief report including Gain, Frequency and Area specifications.
j) Prepare Chart on Different Pulse Modulation techniques.
k) Prepare Chart on Different line coding techniques.
l) To prepare chart for recent trends of antenna applications i.e. PCB mounted miniature antennas, Automobile antennas, Car Keys antennas, Wi-Fi adaptor antennas, LORA antennas, IOT gateways antennas etc.
m) To prepare demonstrative models of different antennas (i.e Dish, Yagi-Uda, Dipole, Helix)

Suggested Activities for Students: Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Prepare specification of electronic components/ICs used in communication system.
b) Give seminar on modulators, demodulators and communication techniques, types and applications.
c) Prepare a PPT/animation of various pulse modulation techniques.
d) Undertake a survey of different communication methods used in field.
e) Prepare chart of radiation pattern of various antenna.
f) Prepare the PPT/animations of 3-D radiation pattern and wave propagation of radio waves.
g) Visit Satellite Earth Station (SAC)/ Doordarshan / AIR/ FM Radio Station.

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