

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

**PRINCIPLES OF ELECTRONIC COMMUNICATION
(Code: 3331103)**

Diploma Programme in which this course is offered	Semester in which offered
Electronics & Communication Engineering	3 rd semester

1. RATIONALE

Wireless communication plays vital role in the field of electronic communication systems which includes radio, mobile and satellite communication systems. This requires that an electronic engineering diploma holder will have to maintain electronic communication equipment and circuits related to this area. This course is intended to lay the foundation for understanding the advanced communication courses in the subsequent semesters. Hence this course describes fundamentals of wireless communication covering analogue and digital modulation techniques. Since it is a basic core course, students should develop in depth understanding of all concepts and principles so that they may learn advance courses easily and effectively.

2. COMPETENCY (Programme Outcome according to NBA Terminology):

The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competency

- **Maintain Electronic Communication Systems.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			C	ESE	PA	ESE	PA	
3	0	2	5	70	30	20	30	150

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Basics of Communication System	1a. Describe EM wave spectrum, frequency ranges and its applications.	1.1 Electromagnetic (EM) wave spectrum, frequency bands and their applications domain
	1b. Represent Sinusoidal, Rectangular, Saw-tooth, Impulse and Pulse waveform.	1.2 Signals and its representation: analog and digital Signal, Pulse, Impulse, Saw-tooth, sinusoidal and rectangular (In Time & frequency domain)
	1c. Describe communication system.	1.3 Block diagram of communication system
	1d. Justify the need for modulation. 1e. Differentiate between analog and digital modulation using waveforms.	1.4 Modulation: Definition & its classification based on analog & pulse signal as carrier. Concept of digital modulation
	1f. Distinguish between external and internal noise and noise sources.	1.5 Noise in communication system, classification of noise, signal to noise ratio(S/N) and noise figure
	Unit – II Amplitude and Angle Modulation	2a. Derive the mathematical expression for Double Sideband Suppressed Carrier (DSBSC) Amplitude Modulation (AM) signal 2b. Sketch the frequency spectrum of the DSBSC Amplitude Modulated wave.
2c. Sketch the frequency spectrum of Single sideband (SSB) Amplitude Modulated wave.		2.2 Single sideband (SSB) Amplitude modulated wave
2d. Derive mathematical relation between carrier power, modulated signal power and modulation index 2e. Calculate total transmitted power for single and multiple modulating signals.		2.3 Modulation Index, carrier power, modulated signal power and modulation index 2.4 Single and multiple signal modulation
2f. Explain generation of AM signal using square law modulator circuit.		2.5 AM using square law modulator circuit.
2g. Calculate the modulation index and bandwidth of frequency modulated (FM) signal.		2.6 Mathematical representation of FM wave, Frequency spectrum, Modulation index and Bandwidth of FM
2h. Discriminate between phase and frequency modulation with relevant sketches.		2.7 Phase Modulation (PM) and FM
2i. Distinguish between Pre-emphasis and De-emphasis		2.8 Pre-emphasis and De-emphasis circuits
2j. Describe various FM signal generation techniques		2.9 Generation techniques for FM wave : <ul style="list-style-type: none"> • Basic reactance modulation • Varactor diode modulation • Stabilized reactance FM modulator

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – III AM and FM receivers	3a. Define the characteristics of radio receiver 3b. Describe the functions of each block of super heterodyne receiver	3.1 Characteristic of radio receiver, Sensitivity, Selectivity, Fidelity, Image frequency rejection 3.2 Block diagram of super heterodyne receiver
	3c. Describe AM detection method	3.3 Envelope detector using diode
	3d. Explain working of various types of FM demodulator circuits.	3.4 Basic FM demodulators: Slope detection, Balanced slope detection, Phase discriminator, Balanced ratio detector
	3e. Explain functions of various blocks of FM receiver	3.5 Block diagram of basic FM receiver
	3f. Explain working of communication receiver using a block diagram	3.6 Communication receiver: Double conversion principle
	3g. Describe need and working of squelch circuit 3h. Describe need and working of Amplitude limiting circuit 3i. Describe need and working of AGC circuit	3.7 Squelch circuit, Amplitude limiting action, Automatic gain control circuits and its working
Unit IV Pulse Modulation	4a. Explain PAM, PWM and PPM signals timing diagram.	4.1 Pulse Modulation techniques: PAM, PWM, PPM
	4b. Calculate the sampling frequency for any modulating signal	4.2 Sampling of analog data (Sample & hold)
	4c. Explain various blocks of PCM system. 4d. Describe advantage & disadvantage of PCM system	4.3 Basic Block diagram of Single channel Pulse Code modulation (PCM) system
	4e. Pros & cons of digital data communication	4.4 Digital Communication
Unit V Introduction to Digital Modulation technique	5a. Differentiate between bit, symbol & Baud rate.	5.1 Bit rate, Baud rate, symbol
	5b. Draw RZ, NRZ (Polar & Unipolar), Manchester coding AMI & HDB-3 signal.	5.2 Channel coding techniques
	5c. Explain 4 level digital multiplexing hierarchy 5d. Describe TDMA frame.	5.3 Concept of Time division digital multiplexing, TDMA frame
	5e. Explain PCM-TDM system	5.4 Block diagram of basic PCM-TDM system
	5f. Sketch the waveforms of ASK, FSK, PSK, BFSK & BPSK & understands its importance in Digital communication	5.5 Digital modulation techniques: Concept of ASK, FSK, PSK, BFSK, BPSK using waveform & constellation diagram

5. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

5. Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of communication system	08	02	04	01	07
II	Amplitude and Angle modulation	10	05	10	06	21
III	AM and FM Receivers	08	04	05	05	14
IV	Pulse Modulation	08	05	10	06	21
V	Introduction to Digital Modulation Technique	08	02	02	03	07
Total		42	18	31	21	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised 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.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (**Course Outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

Note: Here only Course Outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.

S. No.	Unit No.	Practical/Exercise	Approx. Hrs. Required
1	I	Measure amplitude of different sinusoidal frequency signals in frequency domain using Spectrum Analyser.	2
2	II	Measure modulation index of an AM envelope.	2
3	II	Measure modulation index of an AM envelop by trapezoidal Method.	2
4	III	Obtain the frequency response of Pre-emphasis and De-emphasis circuit.	2
5	II	Determine Modulation Index of Frequency Modulated wave.	2
6	III	Locate various sections of AM radio receiver trainer kit and draw the waveforms at input and output side of each section.	2
7	III	Check the demodulated AM signal waveform using envelope detector and draw its input output waveform.	2
8	III	Demonstration of fault finding of AM or FM radio receivers.	2

S. No.	Unit No.	Practical/Exercise	Approx. Hrs. Required
9	III	Obtain the response of AGC circuit of the radio receiver.	2
10	IV	Based on the sampling frequency, reconstruct the signal	2
11	IV	Check the performance PCM system for various sinusoidal signals	2
12	IV	Check the performance of PAM system	2
13	II,III	Simulate AM,FM and SSB signal using Simulation software	2
14	V	Check the response of ASK modulator and Demodulator	2
15	V	Check the response of BFSK modulator and Demodulator	2
16	V	Check the response of BPSK modulator and Demodulator	2
Total			32

7. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities.

- i Explore circuit of AM / FM receiver, assemble and test it
- ii Explore circuit of AM / FM transmitter.
- iii Collect details of HAM radio and CB radio and watch the working demonstration if possible.
- iv Explore details (Freq. / Standards/Company/Model/Range) of Walky-Talky, Cordless phone and Wireless set used by Police department.
- v Industrial Visit of AM / FM Radio Transmitter

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- i Animation/video films showing the working principle and features of FM/AM radio receiver and PCM/DM/ADM should be shown to students while teaching the concern topic.
- ii Demonstrate working of AM/FM/Communication receiver.

9. SUGGESTED LEARNING RESOURCES

A) List of Books:

S. No.	Title of Books	Author	Publication
1	Analog and Digital Communication	Singal, T. L.	Tata Mcgraw Hill, India latest edition
2	Electronic Communication Systems	George Kennedy and Bernard Davis	Tata McGraw Hill 5 th edition or latest
3	Electronics Communication	Dennis Roddy and John Coolen	Pearson Education 4th Edition
4	Electronics Communication System (Fundamental to Advance)	Wayen Tomasi	Pearson Education, 5 th edition
5	Analog Communication	V.Chandra Sekar	Oxford University Press
6	Electronic Communications Modulation and Transmission	Robert J. Schoenbeck	PHI Learning, 2 nd Edition

7	Analog Communication	Dr.Sanjay Sharma	KATSON, 2012
8	Digital Communication	John G.Proakis,	McGraw Hill, latest Edition
9	Principles of Digital Communication	Taub and Schilling	Tata McGraw-Hill” 28th reprint, 2003

B) List of Major Equipment/Materials

- i Spectrum analyser, 30 MHz
- ii CRO – Dual trace, 100 MHz
- iii RF generator/wideband oscillator
- iv AM/FM radio receiver trainer Kit
- v Digital Modulation trainer Kit
- vi Communication receiver Kit

C) List of Software/Learning Websites

- i AM, FM and SSB signal generation using any simulation software.
- ii MATLAB software/ Electronics work bench software for the simulation PCM, ASK, PSK, FSK, AM and FM generation and detection circuits.

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. S.J. Chauhan**, HOD Electronics & Communication Engineering, G.P. Rajkot
- **Prof.M.N.Charel**, HOD Electronics & Communication Engineering, G.P. Ahmedabad
- **Prof. K.J. Pithadiya**, Lecturer, Electronics and Communication Engineering, BBIT, Vallabh Vidhyanagar
- **Prof. (Smt.) R.M. Mehta**, HOD Electronics and Communication Engineering, Sigma Polytechnic, Vadodara

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Anjali Potnis**, Associate Professor, Department of Electrical and Electronics Engineering
- **Dr. Joshua Earnest**, Professor, Department of Electrical and Electronics Engineering