GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Level: UG
Subject Code: BE04000031
Subject Name: Principles of Communication

WEF Academic Year :	2025-26
Semester :	4
Category of the Course :	PCC-06

Prerequisite :	Fourier series, Fourier Transforms, Circuit Theory
Rationale :	This course explores the fundamentals of electronic communication systems. The course has two primary focuses: (1) Understanding electronic communications systems in analog form from deterministic approach (2) Design and analysis of analog communications systems.

Course Outcome :

After Completion of the Course, Student will able to :

No	Course Outcomes	RBT Level*
01	Demonstrate a clear understanding of the fundamental principles, components, and the need for modulation in communication systems.	RM and UN
02	Analyze passive communication circuits and interpret signal behavior using Fourier transforms and spectrum analysis.	AN
03	Identify various types of noise, assess their impact on system performance, and apply relevant parameters for analysis.	AN
04	Apply amplitude and frequency modulation/demodulation techniques and evaluate the performance of related circuits.	AP
05	Explain the working of superheterodyne receivers, AM/FM transmitters, and recognize the role of amateur radio in communication.	AP

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Course Scheme:

Teaching and Examination Scheme:

Teaching / Learning Scheme (in Hours per semester)					Total Credits	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL*	Total no of hours per semester		ESE (E)	PA / CA (M)	PA/ CA (I)	TW/SL (I)	ESE (V)	
45	0	30	45	120	4	70	30	20	30	50	200

*** Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.**

Course Content:

Sr. No.	Course Content	Total Hrs	% Weightage
1	Introduction to communication systems: Communication system, Analog and digital Messages, Channel effect, Modulation and detection, Bandwidth of different information signals, Historical review of telecommunication, Applications	3	2
2	Analysis and transmission of signals: Aperiodic (non-periodic) signal representation by Fourier integral, Fourier transforms of some useful functions, signal transmission through a linear system, signal distortion over a communication channel, Signal energy and energy spectral density, signalpower and power spectral density.	6	12
3	Passive Circuits: Introduction, Series tuned circuits, Parallel tuned circuits, self-capacitance of a coil, Skin effect.	3	5
4	Amplitude modulation(AM)/Demodulation: Concept of modulation, Mathematical representation of sinusoidal Amplitude modulated signals in time and frequency domain- Double sideband Full carrier (DSBFC) , Double sideband suppressed carrier(DSBSC) and single sideband suppressed carrier modulations(SSBSC), Vestigial Sideband (VSB) modulation and Quadrature amplitude modulation(QAM), power and bandwidth calculations for DSBFC, DSBSC, SSBSC, VSB and QAM modulations, Non sinusoidal AM – effective modulation index, Effective voltage and current for sinusoidal and non-sinusoidal AM, AM generation: FET balanced modulator and IC balanced modulator circuits, Diode ring modulator, SSB generation: balanced modulator-filter method, phasing method and the third method, AM detection: peak (envelope detector), synchronous detectors, square law detectors.	10	18

5	Angle modulation/demodulation: Conceptof instantaneous frequency and angle modulation, sinusoidal FM and its time domain representation, spectral components of angle modulated signals, power in sinusoidal FM and modulation index, Carson's rule, equivalence between Frequency modulation(FM) and Phase modulation(PM), Angle modulator circuits, Fm transmitters, Armstrong method of FM generation, Fm stereo broadcast, FM detection: Basic slope detector, Foster-Seeley discriminator, ratio detector, PLL detector and Quadrature detector, Concept of Amplitude limiter, Pre-emphasis and de-emphasis circuits, Interference in angle modulated systems.	12	24
6	Radio receivers: Functions of radio receivers, working of super heterodyne radio receivers, tuning ranges, tracking, sensitivity and gain, image rejection, spurious responses, Adjacent channel selectivity, Automatic gain control, Electronically tuned, receivers, IC receivers, AM receivers, FM receivers	8	16
7	Noise: Introduction, thermal noise, Shot noise, Partition Noise, Low frequency noise, Burst noise, a noise, High frequency noise, BJT and FET noises, Equivalent input noise generators, Signal to noise ratio (SNR), SNR of Tandem connection, Noise factor and noise figure, Amplifier input noise in terms of noise figure, Noise factor in cascaded amplifiers, Noise factor and equivalent input noise generators, noise factor of a lossy network, Noise temperature, Measurement of noise temperature and noise factor, narrow-band band pass noise. Behavior of Analog systems in presence of Noise	8	16
8	Introduction of amateur radio technology What is Ham radio? How to become radio amateur? Importance of Ham radio during natural calamities, Technology used in amateur radio	2	6

Reference Book :

1. Electronic Communications by Dennis Roddy & John Coolen IV Edition PHI.
2. Digital and analog communication system by B.P.Lathi .Zhi Ding (international 4th Edition), OXFORD university press.
3. Electronic Communications by Kennedy McGraw Hill Publication.
4. Electronic Communications Systems by Wayne Tomasi. Pearson education India.
5. Electronic Communication Systems by Roy Blake By Cengage learning.
6. Communication Systems By Simon Haykins By Wiley India.
7. Theory and Problem Of Electronic Communication By Lloyd Temes and Mitchel E.Schulz(Second edition), McGraw Hill Publication.

Suggested Course Practical List :

1. To observe amplitude modulation waveforms for different modulation index.
2. To observe frequency modulation waveform and to measure peak frequency deviation.
3. To observe frequency spectrum of AM and FM waveforms.
4. To generate amplitude modulation signal.
5. To extract information signal from AM signal using diode detector.
6. To extract information signal from FM signal using ratio detector or PLL detector.
7. To obtain frequency response of pre-emphasis and de-emphasis circuits.
8. To obtain frequency response of RF amplifier.
9. To understand working of AGC circuit. To measure output of amplifier circuit with and without AGC circuit.
10. To generate and detect SSB signal.
11. To obtain fidelity response of AM or FM receiver.
12. To understand block diagram of FM receiver and observe signals at different stages.
13. Visit of AM/FM radio station

List of Open Source Software/learning website:

- NPTEL Video lectures
- gEDA Analog Simulation tool to simulate analog communication circuits (In Linux operating
- system)
- Website for Amateur radio technology: http://www.arrl.org/technology
- SCILAB

List of Laboratory/Learning Resources Required:

- Digital storage oscilloscope
- RF Signal generator
- Function generator

- Spectrum Analyzer (optional)
- Communication Engineering trainer kits like Generation and detection of Amplitude and frequency
- Modulation

Activities suggested under Problem Based Learning

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h Total = 10h	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.
2.	Technical Video based learning related to the subject	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
3.	Assignment writing. Numericals based assignment is preferable.	5 assignments of 2h each. Total = 10h	Based on the assignment submitted.
4.	Problem solving/Coding using C, C++, Python, SCILAB, MATLAB, MS-EXCEL or any other relevant software	5 small coding based assignment of 2h each. Total = 10h	Based on the coding solution submitted.
5.	Self learning on-line course	Minimum duration of the course should be 10h.	Examination based assessment at the end of course. Based on the certificate produced.
6.	Complex problem solving	Maximum 2 problem. Study of the problem and solution finding, Total = 10h	Based on the depth of the solution submitted.
7	Videos on Industrial safety aspects based on subject	Duration of video = 5h Report preparation = 5h Total = 10h	Based on quiz/report submitted
8	Discussion on research paper based on relevant subject	5 research paper = 20 h	Summarize research paper and evaluation critical parameters
9.	Poster/chart/power point preparation on technical topics	Duration = 6 h	Based on poster/chart preparation and presentation skills
10	Working/non-working model on technical topics	Working = 12 h Non- working = 8 h	Based on inter department/external evaluation

11	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment/health/any other issue	Duration = 15 h for industrial exposure Problem identification and tentative solution = 10 h Total = 20 h	Based on evaluation of critical problems and solutions
12	Group Discussion on emerging/trending technical topics based on subject	Duration = 1 h each	Based on performance in group discussion, technical depth, knowledge etc.
13.	Real world case studies-based learning	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.
14.	Application/Software development	Duration = 10 h	Depending on the complexity of the Application/Software

Note:
1. All the suggested activity should be related to the subject.
2. The number of hours are suggestive. Faculty can sub-divide the number of hours based on the activity. However, total number of hours is fixed.
3. Rubrics for the evaluation can be prepared by the faculty.

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