Government of Karnataka
DEPARTMENT OF TECHNICAL EDUCATION

Program	**Electronics and communication**	**Semester**	**3**
Course Name	**Communication Systems**	**Type of Course**	Integrated
Course Code	25EC32I	**Contact Hours**	8 hours/week
Teaching Scheme	L: T:P :: 4:0:4	**Credits**	6
CIE Marks	**50**	**SEE Marks**	**50 (Theory)**

1. Rationale:

Communication systems form the foundation of modern technology in Electronics and Communication Engineering, as it provides a foundational understanding of how information is transmitted, received, and processed across various mediums, enabling the transmission of data across vast distances. It helps ECE engineers to design, optimize, and maintain modern systems, which include everything from cellular networks and wireless communication to satellite systems and the Internet of Things (IoT). They are involved in key areas such as signal processing, network design, and ensuring data security in communications. These systems are crucial for technological advancements like 5G, high-speed data transfer, and global connectivity. As communication technologies evolve, Communication systems play an essential role in shaping innovations and addressing the growing demand for reliable, fast, and secure communication networks.

2. Course Outcomes: At the end of the Course, the student will be able to:

CO-01	Identify and Explain the different components and modulation techniques of Analog Communication systems.
CO-02	Design passive filters and attenuators for signal conditioning, apply network theorems to analyze electrical networks.
CO-03	Analyze components and modulation techniques of digital communication system.
CO-04	Comprehend the working principles of transceivers and multiplexing techniques, error detection and correction codes.

3. Course Content

WEEK	CO	PO	Theory	Practice
1	**1**	**1, 2**	**Analog Communication system:** • Introduction to Communication, Block diagram Explanation of Analog communication system. • Noise, Sources of Noise, signal to noise ratio(S/N) (only concept) • Analog Modulation Techniques: Need for Modulation, Definitions of Message signal and carrier signal. Amplitude Modulation: Concept of AM, Sketch AM wave for given carrier and message signal. • Mathematical expressions for message signal, Carrier signal and AM output. (No derivation).	• Generate a sine wave using a function generator and display the signal on an oscilloscope to understand its time-domain representation. Measure the Time, amplitude for different Audio frequencies and radio frequencies and tabulate them. • Study the working of AM Modulation and Demodulation using kit/Simulation. Sketch the AM wave for a given message and carrier signals in time - domain. Sketch the Frequency – domain representation of AM wave.

2.	**1**	**1,2**	• AM modulation Index, Modulation Index in case of simultaneous Modulations, • Frequency Spectrum and Bandwidth. Power in AM wave. • Working of AM modulator circuit using diode with waveforms. • Working of AM Linear Diode Detector Circuit with waveforms.	• Video demonstration and documentation on real-world applications of AM. • Video demonstration and documentation on different types of AM (DSB-SC, SSB, VSB) and their applications.
3	**1**	**1,2**	• Frequency Modulation: Concept, Sketch FM wave for given carrier and message signal, Definitions and Mathematical expressions for Frequency deviation, Modulation Index, Frequency Deviation Ratio and Bandwidth for FM. (No derivation) • Types of FM, Spectrum and sidebands. Carson's rule for Bandwidth. • Varactor diode method of Generating FM, Foster seeley FM Discriminator. • Illustrate Advantages and Disadvantages of FM over AM, real-world applications of AM and FM.	1. Study the working of FM Modulation and Demodulation using kit/Simulation. Sketch the FM wave for a given information and carrier signal in time-domain. Draw the Frequency–domain representation of FM wave. 2. Video demonstration and documentation on real-world applications of FM.
4	**1,2**	**1,2,3**	**Filters and attenuators:** • **Passive filters**: Types based on the passband and stop band. Passive Pi -type Low pass filter: Frequency response, Expression for cut-off frequency. (No derivation) • Simple problems on Passive Pi - type Low pass filter. • Passive Pi -type High Pass Filter: Frequency response, Expression for cut-off frequency. (No derivation). • Simple problems on Passive Pi - type High pass filter.	1. Design and Construct a passive Pi-type Low pass filter and determine its bandwidth by plotting its frequency response. 2. Design and Construct a Passive Pi -type High pass filter and determine its bandwidth by plotting frequency response.
5	**1,2**	**1,2,3**	• Band pass filter: Block diagram and Frequency response. • Band stop filter: Block diagram and Frequency response. • Attenuator: Introduction and applications, working of symmetrical PI-(π)– type attenuator, Expression for R1 and R2 given N and Ro. (No derivation). • Simple problems on symmetrical π-type attenuator.	1. Design and Simulate Band pass filter using Passive Pi –type Low pass and Passive Pi –type High pass filter using simulation software. 2. Design and construct Symmetrical PI (π)–type attenuator for given N and Ro.

6	**2**	**1,2,3**	**Network theorems** Necessity of Network theorems in communication system. Thevenin's theorem: Statement, steps to solve network using Thevenin theorem. • Solve simple problems Thevenin's theorem. • Maximum Power Transfer theorem: Statement, steps to solve network using Maximum Power transfer theorem. • Solve simple problems on Maximum Power transfer theorem.	1. Construct and verify Thevenin's theorem. 2. Construct and verify maximum power transfer theorem.
7	**2**	**1,2,3**	• Simple problems on thevinin and maximum transfer theorem. • Superposition theorem: Statement, steps to solve network using Superposition theorem. • Solve simple problems Superposition theorem. (Two voltage sources) • Solve simple problems Superposition theorem. (Two maximum sources)	1. Verify superposition theorem for a simple circuit consisting of two voltages sources.(4 Hrs).
8	**3**	**1,2**	**Digital Communication system:** • Functional Block diagram of digital communication system. • Discuss advantages of digital communication over analog communication. Sampling process, Sample and hold circuit • Sampling theorem for Low pass and band pass signals. • Niquist criterion, aliasing, Effect of under sampling and over sampling.	1. Video demonstration and documentation on real-world applications of Digital Communication systems. 2. Verify sampling theorem using kit / Perform sampling using Sample and Hold circuit using simulation. Sketch samples for the given analog signal.
9	3	1,2	• Uniform Quantization with neat diagram, Quantization Noise. • Pulse Code Modulation System: Introduction, Block diagram of PCM system. Advantages and disadvantages of PCM. • DPCM system: Introduction, Block diagram of DPCM transmitter, Receiver. • Discuss advantages and disadvantages of DPCM over PCM, Applications of DPCM.	1. Perform an experiment to study Pulse Code Modulation and Demodulation using kit/Simulation. 2. Video demonstration and documentation on practical applications of PCM and DPCM.

10	**3**	**1,2**	**Digital modulation techniques:** ● ASK: Concept, waveforms, frequency spectrum. ● ASK transmitter and coherent receiver. ● FSK: Concept, waveforms, frequency spectrum, transmitter and coherent receiver. ● Discuss ASK and FSK with respect to bandwidth and noise, Illustrate the Concept of PSK.	1. Perform an experiment to generate and detect BASK signals using kit/simulation. Sketch BASK signal for the given digital input. 2. Perform an experiment to generate and detect BFSK signal using kit/simulation. Sketch BFSK signal for the given digital input.
11	**4**	**1,2**	**Error detection and correction:** ● Errors-types (Single bit errors, Burst/Multiple bit errors), Redundancy. ● Error control schemes: Error detection with transmission, Forward error detection and correction. ● Error control codes: Block codes, its applications. ● Error detection scheme: Vertical Redundancy Check(parity check method) , CRC and their applications.	1. Perform an experiment to generate and detect BPSK signal using kit/Simulation. Sketch BPSK signal for the given digital input. 2. Design and implement an 4-bit Odd Parity generator using logic circuit/using suitable IC.
12	**4**	**1,2**	**Multiplexing Techniques:** ● Multiplexing: Concept, types and Need in communication. ● FDM –Explanation, advantages. ● TDM - concept, block diagram with explanation. ● Discuss Comparison and Applications of FDM and TDM.	1. Video demonstration and documentation on FDM. 2. Demonstrate TDM using Fiber Communication System.
13	**4**	**1,2**	**Transceivers:** ● Features and functions of transceivers. ● Transceiver structure and working. Principle ● Discuss the Types and applications of transceivers. ● Comparison between Transceiver and transmitter.	Industrial Visit to 1. Telephone exchange **or** 2. Any BTS station **or** 3. Fibre DSLAM of BSNL/other telecom operator and prepare a reports on the communication system, modulation techniques, multiplexing techniques, error detection and correction techniques employed in these systems.

Note:

1. In practice sessions all video demonstrations should be followed by MCQ/Quiz/ Subjective questions and evaluation has to be documented.

2. Online course completion certification to be done on relevant topics on Swayam/NPTEL/Infosys Springboard platforms or any other platform.

3. Problem statement to be collected from the relevant industries, resolve and submit it to the course coordinator.

4. References:

a) Electronic communication - George Kennady
b) Advanced Electronics Communication System. - Wayne Tomosi
c) Understanding communication systems - Texas Instruments
d) Fiber Optic Communication Systems, - Dr.R.K.Singh, Wiley India
e) Principles of Electronic Communication Systems - Louis E. Frenzel, Tata McGraw Hill
f) Digital and analog communication systems - K.Sham Shanmugam, Wiley India
g) https://www.geeksforgeeks.org/transceivers.

5. CIE Assessment Methodologies

Sl.No	CIE Assessment	Test Week	Duration (minutes)	Max marks	
1.	CIE-1 Theory Test	4	90	50	Average of all CIE=50 Marks
2.	CIE-2 Practice Test	7	180	50	
3	CIE-3 Theory Test	10	90	50	
4.	CIE-4 Practice Test	13	180	50	
5	CIE-5 Portfolio evaluation of all the activities through Rubrics	1-13		50	
				Total	**50 Marks**

Note: -

Portfolio evaluation may include average of (a)and (b)

a) Any one of the suggested activity model with report and presentation / **s**imulation evaluated for 50 marks.

b) Each laboratory exercise will be evaluated for a total of 50 marks. The evaluation will include the following components.

1. Written description of the experiment in the observation book.
2. Conducting the experiment and achieving the associated learning outcomes.
3. Result of the experiment.
4. Correction and evaluation of the experiment completed in the previous class, documented in the record book.

6. SEE - Theory Assessment Methodologies

Sl. No	SEE – Theory Assessment	Duration	Exam Paper Max marks	Exam Paper Max Marks scale down to (Conversion)	Min marks to pass
1.	Semester End Examination-Theory	3 Hours	100	50	20

7. **CIE Theory Test model question paper**

Program	**Electronics and Communication Engineering**			**Semester -3**	
Course Name	**Communication systems**			**Test**	**I**
Course Code	25EC32I	**Duration**	**90 min**	**Marks**	**50**
Name of the Course Coordinator:					
Note: Answer any one full question from each section. Each full question carries equal marks.					

Q.No	**Questions**	**Cognitive Level**	**Course Outcome**	**Marks**
	Section - 1			
1	a) Describe the functional block diagram of an analog communication system. b) Make use of the concept of AM modulation with mathematical expressions and sketch AM signal. c) Discuss the need for modulation.	L2 L3 L2		10 10 5
2	a) Explain the AM modulator circuit using diode. b) Discuss the impact on communication with Modulation index less than 1 in Amplitude Modulation. c) Interpret the Bandwidth requirement of an AM signal with its frequency spectrum.	L2 L3 L2		10 10 5
	Section – 2			
3	a) Describe the concept of Frequency modulation. b) Design Constant-K PI type Low pass filter for cut-off frequency of 4KHz and Ro of 600 Ohms. c)Identify advantages of FM over AM.	L2 L3 L2		10 10 05
4	a) Explain Foster seeley FM discriminator. b) Design Constant-K PI type High pass filter for cut-off frequency of 10 KHz and Ro of 600 Ohms. c) Infer on the relation between Frequency deviation and Bandwidth of FM.	L2 L3 L2		10 10 05

Note for the Course coordinator:
1. Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, cognitive level and course outcomes. 2. All questions must be framed under Understand (L2) & Apply (L3) cognitive level using Revised Bloom's Taxonomy.

Signature of the Course Coordinator	**Signature of the HOD**	**Signature of the IQAC Chairman**

8. CIE Practice Test model question paper

Program	**Electronics and Communication Engineering**			**Semester**	3
Course Name	Communication Systems			**Test**	**II/IV**
Course Code	25EC32I	**Duration**	**180 min**	**Marks**	**50**
Name of the Course Coordinator:					

Questions	**CO**	**Marks**
Write-up of any two experiments and conduction of one experiment.		**50**
Scheme of assessment **a) Write-up of any two experiments** **b) Rig up the circuit and conduction of any one /simulation** **d) Result** **e) Viva-voce**		 **20** **15** **05** **10**
Total Marks		**50**

Signature of the Course Coordinator	**Signature of the HOD**	**Signature of the IQAC Chairman**

9. Suggestive Activities for Tutorials:

The List is an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic

Sl.No.	**Suggestive Activities for Tutorials**
01	Build an FM receiver and check how many FM channels are received without any noise at your college.
02	Build an AM modulator and demodulator models and test its working.
03	Develop 8 bit ADC using TLC5540 to convert voltage into digital signal and display on the LCD display.
04	Develop 8 bit DAC model and demonstrate its working.
05	Build a basic PCM encoder and decoder system using a microcontroller. Test the system with real audio or data signals.

10. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		10	20	30	40	50	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	40
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	30
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	50
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	20
	Average Marks=(40+30+50+20)/4=35						**35**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

11. Equipment/software list with Specification for a batch of 30 students.

Sl.No.	Particulars	Specification	Quantity
01	RPS	Dual Channel 30V,2A	30
02	CRO	30 Mhz	30
03	Signal Generator	2Mhz	30
04	AM KIT,FM KIT,ASK KIT, FSK KIT, PSK KIT		10 EACH
05	SAMPLING THEOREM KIT, Fibre optic Communication KIT, TDM KIT		10 EACH