



Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Electronics and Communication	Semester	III
Course Code	20EC33P	Type of Course	Programme Core
Course Name	Communication Systems	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1. Rationale

The communication system describes the information exchange between any two points. The process of transmission and reception of information is called communication. Without communication the world ceases to exist. Information or Data can be transmitted and received across any part of the world by adapting suitable techniques, process and medium, hence making the world reachable and smaller through Technology.

2. Course Outcomes : On successful completion of the course, the students will be able to :

CO-01	Identify all the components of a communication system, list their role and characteristics in the system.
CO-02	Propagate a signal through a transmission medium to obtain a desired output for given conditions in the communication system.
CO-03	Construct an analog/digital communication system for a given application and demonstrate its working either in a Real or Simulated environment.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1	1,4,5	Network theorems 1. Superposition theorem- statement and explanation with an example. 2. Maximum Power Transfer theorem- statement and explanation with an example. 3. Thevenin's theorem and Norton's theorem-statements and explanation with an example each.	Refer Table 1	1. Construct and verify maximum power transfer theorem. 2. Construct and verify Thevenin's theorem.

2	1,3	1,2,4,6	Resonance 1. Series resonance - circuit diagram, phasor diagram, resonance plot and characteristics. 2. Condition for series resonance, expression for frequency of resonance. Parallel resonance- circuit diagram, phasor diagram. 3. Parallel resonance-resonance plot and characteristics, Condition for resonance, expression for frequency of resonance.	Refer Table 1	1. Construct a series/parallel resonant circuit and plot its frequency response. 2. Construct a series/parallel resonant circuit and find its bandwidth and Q factor.
3	1,3	1,2,4,6	Filters 1. Classification of filters, cut-off frequency, pass band and stop band. 2. Ideal characteristics curve of passive LPF, HPF, BPF and BRF. 3. Circuit diagram & formula for cut-off frequency of T and Π configurations of LPF and HPF.	Refer Table 1	1. Construct and test the passive low-pass T-type filter circuit for a given cut-off frequency. 2. Construct and test the passive high pass Π -type filter circuit for a given cut-off frequency.
4	1,3	1,2,4,6	Attenuators 1. Classification and applications of attenuators. Definition of Bel, Decibel and Neper. 2. Symmetrical T type attenuator- Circuit diagram, expression for attenuation. 3. Symmetrical Π type attenuator- Circuit diagram, expression for attenuation	Refer Table 1	1. Construct and test T type attenuator circuit for the given attenuation & Ro. 2. Construct and test Π type attenuator circuit for the given attenuation & Ro.
5	1,2,3	2,3,4,5	Transmission Media 1. Need, different types of transmission media(guided, unguided), Transmission lines- Electrical model, Primary constants - R, L, G and C , Secondary constants - Characteristic Impedance and Propagation Constant. 2. Optical fiber -principle of operation, Numerical aperture, Angle of acceptance, Classification, fiber losses. 3. Basic components of Fiber optic system, splices, connectors , couplers and switches.	Refer Table 1	1. Demonstrate PC to PC communication using Fiber Optic Digital Link. 2. Demonstrate installation , testing, repair and power budgeting of fiber optic cable (using simulator/video)
6	1,2,3	1,4,5,6	Antennas 1. Concept of electric and magnetic fields in a dipole, antenna terminology- polarization, radiation pattern, antenna gain, directive gain, directivity, power gain, antenna resistance.	Refer Table 1	1. Video demonstration and documentation on the working of the dipole antenna and observe its radiation pattern.

			<p>2. Antenna efficiency, beam width, bandwidth, isotropic radiators. Effects of ground on antennas, effect of antenna height, Antenna types, examples and applications.</p> <p>3. Working of Dish Antenna, Feed mechanisms-Cassegrain and Horn feed.</p>		<p>2. Video demonstration and documentation of antenna types with examples and applications.</p>
7	2,3	1,4,5,6	<p>Wave Propagation</p> <p>1. Wave Propagation: Fundamentals of Electromagnetic Waves, electromagnetic spectrum.</p> <p>2. Modes of wave propagation-ground wave propagation and sky wave propagation and space wave propagation, comparison.</p> <p>Analog modulation</p> <p>3. Block diagram of communication system, Need for modulation and types of analog modulation techniques.</p>	Refer Table 1	<p>1. Video demonstration and documentation on the fundamentals of electromagnetic waves and electromagnetic spectrum.</p> <p>2. Video demonstration and documentation on the need for modulation and demodulation techniques.</p>
8	3	1,2,3,4,6	<p>1. AM Transmitter and Receiver -block diagram & waveforms.</p> <p>2. Expressions for modulating signal, Carrier signal, modulated signal, modulation index and power.</p> <p>3. Frequency Transmitter and Receiver-block diagram, waveform, Expressions for frequency deviation, modulation index.</p>	Refer Table 1	<p>1. Construct and verify amplitude modulation and demodulation using kit.</p> <p>2. Construct and verify frequency modulation and demodulation using kit.</p>
9	1,3	1,3,4,5,6,7	<p>Digital communication</p> <p>1. Block diagram of digital communication system. Definition of information capacity, entropy, bit-rate, baud rate and bandwidth of digital data.</p> <p>2. Sampling- Sampling theorem for low pass and band pass signals, Nyquist criterion and aliasing effect.</p> <p>3. Explain Analog pulse modulation techniques-PAM, PPM, PWM using waveforms.</p>	Refer Table 1	<p>1. Verify sampling theorem for low pass signals using kit.</p> <p>2. Conduct an experiment to study the effect of aliasing using kit.</p>

10	1,3	1,2,3,4,6	Digital Coding 1. Quantization -process, classification. Quantization noise and companding process. 2. PCM and DPCM system. 3. Delta modulation and adaptive delta modulation system.	Refer Table 1	1. Perform an experiment to study Pulse Code Modulation and Demodulation using kit. 2. Generation of Delta modulated signal using kit.
11	1,3	1,2,4,6	1. Baseband transmission - significance of inter symbol interference (ISI) and eye pattern. Digital modulation techniques-types. 2. Generation and detection of Binary ASK and Binary FSK. 3. Generation and detection of Binary PSK and QPSK.	Refer Table 1	1. Perform an experiment to generate and detect BASK signal using kit. 2. Perform an experiment to generate and detect BPSK signal using kit.
12	1,3	1,2,6,7	Multiplexing 1. FDM & TDM- concept applications 2. PAM/TDM system -Block diagram, transmission bandwidth, synchronization, crosstalk and guard time. 3. Digital multiplexers-Principle, classification and performance factors.	Refer Table 1	1. Demonstrate TDM using Fiber Communication System. 2. Video demonstration and documentation of FDM and TDM.
13	3	1,2,4,6	Error detection & correction 1. Errors-types, redundancy, error control schemes. 2. Error control codes- types, Parity check bit coding, error detection methods-LRC. 3. VRC, CRC, Checksum with examples.	Refer Table 1	1. Video demonstration and documentation of error detection and correction. 2. Video demonstration and documentation on LRC, VRC, CRC.
Total in hours			39	13	52

Note: 1. In Practice sessions Video demonstration should be followed by MCQs/Quiz/Subjective questions and the evaluation has to be documented.

2. In Practice sessions, all discrete circuits should be simulated using suitable software before its construction and verification.

TABLE 1: Suggested activities for tutorials

The list is shared as an example and not inclusive of all possible activities of the course.

The list of activities for one week can be shared among teams in a batch of students.

Week No.	Suggested activities for tutorials
01	<ol style="list-style-type: none"> 1. Write a report on implementation fields of all the theorems. 2. Solve problems on all theorems.
02	<ol style="list-style-type: none"> 1. Give a presentation on demonstrations of series and parallel resonance. 2. Solve problems on series and parallel resonance.
03	<ol style="list-style-type: none"> 1. Write a report on the needs of LPF, HPF, BPF, BRF and their comparison. 2. Give a presentation on the working of BPF & BRF. 3. Solve problems on Filters.
04	<ol style="list-style-type: none"> 1. Give a presentation on the relationship between Bel, Decibel and Neper. 2. Give a presentation on the importance of attenuators in communication circuits.
05	<ol style="list-style-type: none"> 1. Prepare a report on properties of light and its significance in optical communication. 2. Visit a nearest telephone exchange, collect and prepare a handwritten brief report on optical fibers for the communication purpose with specifications. 3. Present a report on the FIBERNET broadband and compare it with traditional broadband.
06	<ol style="list-style-type: none"> 1. Give a presentation on miniature antennas. 2. Demonstrate how a mobile phone antenna performance can be improved. 3. Study the technical paper and present it. <p>https://documentcloud.adobe.com/link/review?uri=urn:aaid:scds:US:3d5cab35-a6d0-49e4-b4b3-06c745d34d98</p>
07	<ol style="list-style-type: none"> 1. Give a presentation on uses of each range of frequency in the Electromagnetic spectrum. 2. Give a presentation on different types of wave propagation. 3. Demonstration and explain different waveforms in Analog modulation.
08	<ol style="list-style-type: none"> 1. Give a presentation on working of superheterodyne receiver. 2. Prepare a report on the merits, demerits and applications of AM and FM. 3. Collect the specifications of FM receivers and explain it.
09	<ol style="list-style-type: none"> 1. Give a presentation on comparison of analog and digital communication. 2. Collect and prepare a report on the functional blocks in the digital communication system such as scramblers, unscramblers, equalizers with applications. 3. Give a presentation on types of sampling.

10	1. Give a presentation on advantages, disadvantages and applications of PCM and DPCM. 2. Give a presentation on advantages, disadvantages and applications of delta modulation and adaptive delta modulation.
11	1. Prepare a report on the type of digital modulation technique used for voice signal transmission in telephone systems. 2. Give a presentation on generation and detection of DPSK. 3. Give a presentation on comparison of digital modulation techniques.
12	1. Give a presentation on applications of TDM and FDM. 2. Prepare a report on the type of multiplexing used in mobile communication with specifications of multiplexer.
13	1. Study the latest technological changes in this course and present the impact of these changes on industry. 2. Give a presentation on the merits, demerits and applications of all error detection methods.

Links.

1. <https://www.gopracticals.com/electrical/basic-electrical/verify-thevenin-theorem/>
2. <https://youtu.be/Ok7DJGuOulQ>
3. https://youtu.be/B_u3sGbpM8M
4. <https://documentcloud.adobe.com/link/review?uri=urn:aaid:scds:US:3d5cab35-a6d0-49e4-b4b3-06c745d34d98>
5. <https://www.wikihow.com/Design-a-Simple-Antenna>
6. <https://youtu.be/r4NikIMA4dQ>
7. <https://youtu.be/8P6DBAxbQxY>
8. <https://youtu.be/00ZbuhPruJw>

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
Total CIE Marks					60
Semester End Examination (Practice)			180	100	40
Total Marks					100

5. Format for CIE (1, 2, 3) Written Test

Course Name	Communication Systems	Test	I/II/III	Sem	III/IV
Course Code	20EC33P	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					
Section	Assessment Questions	Cognitive Levels	Course Outcome	Marks	
I	1				
	2				
II	3				
	4				
III	5				
	6				
Note for the Course coordinator: 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.					

5. (a).Format for CIE-4 Skill Test -Practice

SL. No.	COs	Particulars/Dimension	Marks
1	1	Conduct an experiment on Network Theorems/ Resonance/ Filters/ Attenuators Writing schematic diagram -20 Marks Conduction -30 Marks Result - 10 Marks	60
2	2	Conduct an experiment on Transmission media/Antennas	30
3	1,2	Portfolio evaluation of Practice sessions through Rubrics	10
Total Marks			100

5. (b).Format for CIE-5 Skill Test-Practice

SL. No.	COs	Particulars/Dimension	Marks
1	2	Explain propagation of signals through transmission media to obtain desired output.	20
2	3	Demonstrate an analog/digital modulation / demodulation technique Write schematic diagram (2 Circuits) -30 Marks Conduction using kit -20 Marks Result -20 Marks	70
3	2,3	Portfolio evaluation of Practice sessions through Rubrics	10
Total Marks			100

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
Average Marks= (8+6+2+2)/4=4.5							5

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

7. Reference:

Sl. No.	Description
1	Electronic communications - George Kennady
2	Advanced Electronics Communication System. - Wayne Tomosi
3	Understanding communication systems - Texas Instruments
4	Fiber Optic Communication Systems, - Dr.R.K.Singh, Wiley India
5	Principles of Electronic Communication Systems - Louis E. Frenzel, Tata McGraw Hill
6	Digital and analog communication systems - K.Sham Shanmugam, Wiley India

8. SEE Scheme of Evaluation

SL. No.	COs	Particulars/Dimension	Marks
1	1	Conduct an experiment on Network Theorems/ Resonance/ Filters/ Attenuators Writing schematic diagram -15 Marks Conduction - 15 Marks Result -10 Marks	40
2	2	Identify the type of Transmission media/Antenna used in a given application	10
3	3	Demonstrate an analog/digital modulation / demodulation technique Write schematic diagram -10 Marks Conduction using kit - 10 Marks Result - 10 Marks	30
4	1,2,3	Viva-voce	20
Total Marks			100

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Computers	Intel Core i5 11th gen/8GB RAM/1 TB HDD/256GB SSD/ Graphics 2 GB	20
2	MATLAB/PSPICE/Electronic Workbench Software Simulator		
3	Amplitude modulation and demodulation trainer kits		05
4	Frequency modulation and demodulation trainer kits		05
5	Generation and detection BASK,BFSK,BPSK trainer kits		05 each
6	Regulated Power supply	(1A/2A, 0-30V)	10
7	Dual trace oscilloscope	up to 20 to 30MHz	10
8	Digital multimeters		10
9	Function/Signal generators		10
10	Step down transformer, Capacitors, Resistors, Inductors, BJT, Opamp IC-741, Regulator IC-7812, Diode		Consumables as required
11	Single strand wire/Patch cards (different lengths)		150
12	Probes		10
13	Analog trainer kit		5
14	DC Voltage supply	(+/-5v, +/-12V, +/-15V)	10
15	Kit to demonstrate Sampling theorem and aliasing effect		05
16	Kit to demonstrate PCM		05
17	Delta Modulation and Detection trainer kit		05
18	Adaptive Delta Modulation and Detection trainer kit		05
19	Optical fiber communications trainer kit to cover all the experiments.		05
20	Computers	Pentium and higher,8GB RAM,512 HDD	20
21	Tool kit		02 set