Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Electronics & Communication	**Semester**	IV
Course Code	20EC42P	**Type of Course**	Programme Core
Course Name	Wireless Communication	**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 purpose of wireless communication is to communicate messages over distances without the use of wires. It includes an exposure to microwave engineering, radar systems, cellular and satellite communication. In the microwave industry, job opportunities are available in assembly, production, installation, repair and maintenance of microwave transmitters and receivers. The knowledge of radar systems allows opportunities with civil and defence organizations dealing with aircraft and shipping. Satellite communication is used to relay signals around the curvature of Earth allowing communication between widely separated points. Mobile communication is a fast changing technology which offers voice and data connectivity between individuals.

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

CO-1	Identify the types of wireless communications, list differences and its applications.
CO-2	Identify the components of a given wireless communication system, explain the role of those components in the system and list their characteristics.
CO-3	Build a working model of a wireless communication system to be used for a specific application.
CO-4	Test a given set top Box / mobile phone, identify the problem and troubleshoot to ensure the device is fully functional.

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	1,2, 3	1	1. Wireless communication – Concept, block diagram, types, frequency spectrum used in different wireless communication systems. 2. Wireless metropolitan area network(WMANs), Wireless local area networks(WLANs), Wireless personal area network – (WPANs) 3. Wi-Fi- Features and applications, significance of hotspot.	Refer Table 1	1. Implement WLAN in your computer lab.

2	1,2, 3	1,3	1. RFID- concept & applications. 2 Bluetooth – components, connections, networking & applications. 3. Waveguides- Need, types, applications.	Refer Table 1	1. Conduct an experiment to connect PC to internet through bluetooth access point of mobile and transfer a text file/image file/video file. 2. Interface RFID reader for any application using Arduino controller.
3	1,2, 3	1,5	1. Microwave signals, microwave devices –Two cavity klystron, Reflex klystron. 2. Magnetron and Travelling Wave Tube (TWT) and their applications. 3. RADAR- principle of operation and applications.	Refer Table 1	1. Video demonstration & documentation on working of a. Two cavity klystron. b. Reflex klystron. 2. Video demonstration & documentation on working of a.Magnetron. b.TWT.
4	1,2, 3	1,2	1. Radar range equation (no derivation) and factors influencing the radar range. 2. Pulsed radar system- principle and block diagram, Duplexer. 3. Antenna scanning and tracking.	Refer Table 1	1. Study and measure the characteristics of pulse from signal generator using a CRO. 2. Conduct an experiment to use a smart phone as CCTV camera (or a CCTV camera) and connect it to another mobile to view the camera feed.
5	1,2, 3	1,5	1. Special purpose Radars- doppler radar, MTI radar-block diagram and their applications. 2. Secondary surveillance radar & ILS. 3. ZigBee –architecture, network topologies, applications.	Refer Table 1	1a.Video demonstration and documentation to understand radar scanning and tracking systems. b. Video demonstration and documentation to understand the working of secondary surveillance radar. 2. Interface Zigbee module for any application using Arduino controller.
6	1	1,5	Satellite Communication 1. Satellite - Types, orbits. apogee and perigee, azimuth and elevation angles, sub satellite point, sub satellite paths, ascending and descending nodes. 2. Posigrade and Retrograde orbits, Uplink and downlink, orbital period and radius of geosynchronous satellite, satellite eclipse. Polar and Geostationary satellites - advantages and disadvantages. 3. LEO, MEO & GEO satellites, Station keeping, Attitude control and thermal control	Refer Table 1	1. Study the features and working of different sections in a satellite communication trainer kit. 2. Conduct an experiment to Transmit & Receive three separate Signals (Audio, Video, and Tone/ Voice) simultaneously through satellite link and perform Link Fail Operations using satellite communication trainer kit.

7	1,2	1,5	1. Satellite communication system-block diagram. Transponder-single conversion, double conversion and regenerative transponder. 2. Increasing channel capacity-frequency reuse and spatial isolation. Communication satellite-satellite subsystems. 3. Earth station- block diagram, Applications payload.	Refer Table 1	1. Find the delay between Uplink transmitter and Downlink receiver during data transmission using satellite communication trainer kit. 2. Demonstrate working of satellite transponders using satellite communication trainer kit.
8	1,2, 3	1,5	1. Global Positioning System (GPS) –features, working. 2. Satellite for TV applications - Direct-To-Home (DTH) and cable TV. 3. Satellite for military applications, VSAT – features & applications.	Refer Table 1	1. Video demonstration and documentation on a.Working of GPS System b.Working of Satellite TV. 2. Conduct an experiment to tabulate latitude, longitude, Plus codes of different locations using a GPS receiver in mobile phone and learn sharing of live locations.
9	1,2, 4	1,5,7	1. Satellite for voice and data communication, Earth observation. 2. Set top box -concept, block diagram. 3. Set top box - working.	Refer Table 1	1. Video demonstration and documentation of TV Set top box repair. 2. Test and troubleshoot Set top box.
10	1,2	1,5	1. Cellular networks, cellular concept, frequency reuse. 2. Terminologies used in mobile communication. capacity expansion techniques-cell splitting and cell sectoring. 3. Handoff strategies. working of a typical cellular system.	Refer Table 1	1. Conduct an experiment to understand the working of different sections in a mobile phone using a mobile phone trainer kit. 2. Conduct an experiment to analyze MIC & Speaker section, Buzzer section using a mobile phone trainer kit.
11	3	7	1. GSM services and features. 2. GSM architecture, working. 3. LTE architecture and working.	Refer Table 1	1. Conduct an experiment to analyse vibrator section, LED control section using a mobile phone trainer kit. 2. Conduct an experiment to analyse the active mode/sleep mode/Partially ON mode while charging of a mobile phone using a mobile phone trainer kit.
12	1,2, 4	7	Mobile servicing 1. Mobile displays – working principle.		Video demonstration and documentation of

			2. Mobile camera – working principle. 3. Charging ports & battery - concept	Refer Table 1	1. Troubleshooting, testing and replacement of display, front camera. 2. Troubleshooting, testing and replacement of charging port, battery.
13	1,2, 3	7	1. IoT – introduction, characteristics of IoT, internet of things. 2. IoT protocols-MQTT, IoT-functional blocks. 3. IoT communication models, IoT enabling technologies.	Refer Table 1	1. Build an IoT based simple real time application using Arduino controller and prepare a report.
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 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	1. Give a presentation on differences between wired and wireless communication. 2. Demonstrate the implementation of Wi-Fi hotspot. 3, Video demonstration & documentation of working of industrial wireless communication.
02	1. Give a presentation on Bluetooth specification Standards (IEEE 802.15.1). 2. Build a simple application using RFID. 3. Analyse the CCTV setup in your department/college and troubleshoot the CCTV application if required and submit the report.
03	1. Prepare a report on microwave devices- IMPATT & TRAPATT. 2. Give a presentation on the working of any one type of waveguide.

04	1. Give a presentation on any one application of a Radar system in daily life. 2. Give a presentation about the usage of the Radar technology in case of searching a crashed aircraft in the ocean. 3. Solve problems on radar range equation.
05	1. Prepare and present a report on radar displays. 2. Give a presentation on aircraft landing systems (ILS). 3. Give a presentation on the design & performance analysis of the doppler radar system.
06	1. Give a presentation on applications of LEO & MEO satellites. 2. Prepare a report on satellites launched by ISRO. 3. Give a presentation on differences between geostationary and geosynchronous satellite. List some examples of geostationary satellites.
07	1. Present a report on satellite frequency allocation and satellite bandwidth. 2. Give a presentation on station keeping. 3. Give a presentation on the different types of antennas used in earth station.
08	1. Prepare & present a report on GPS applications. 2. Prepare a report on DRONE, its working and various uses. 3. Prepare a report on different types of launch vehicles used for launching a satellite in India and its significance.
09	1. Differences between cable box & set top box. 2. Compare the different set up boxes available in the market. 3. Prepare a report on the various experimentation and findings being conducted on the surface of MARS by NASA's Perseverance Rover (include actual pictures released from NASA website).
10	1. Prepare a report on different generations of cellular networks. 2. Give a presentation on different mobile operating systems.
11	1. Study of SIM card and its detection, SIM reset, SIM clock, SIM data, and SIM supply. 2. Give a presentation on CDMA system-services and features. 3. Give a presentation on LTE system services and features.
12	1. Prepare a report on compatibility of mobile phone battery size and its heat dissipation. 2. Discuss the types and characteristics of antennas used in mobile phones.

13	1. Study the latest technological changes in this course and present the impact of these changes on industry. 2. Demonstrate the importance of IoT based health monitoring system.

LINKS

1. https://youtu.be/Q97bVxd2r10
2. https://youtu.be/Fvud81pYGOg
3. https://youtu.be/bUsS5KUMLvw
4. https://youtu.be/4-wp_M1z4ls
5. https://youtu.be/qzBPSG1b5uo
6. https://youtu.be/H00_PVX2bRw
7. https://youtu.be/wCcARVbL_Dk
8. https://youtu.be/OpkatIqkLO8
9. https://youtu.be/AiT36qdoSCc.
10. https://youtu.be/oEa0Pfxl4C8
11. ttps://youtu.be/1JZG9x_VOwA
12. https://youtu.be/iS8jmhVAfoQ.
13. https://youtu.be/2UujN_pOcYI
14. https://youtu.be/iQeaK0NGMnA
15. www.ifixit.com-> Repair guides->select the particular model for ref.

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	Wireless Communication		Test	I/II/III	Sem	III/IV
Course Code	**20EC42P**		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	Identification of types of wireless communications & its applications.	10
2	2	Identify the various components of a given wireless communication system & their role in the system.	10
3	3	Build and demonstrate a WLAN/ RFID/ZIGBEE communication for a specific application. Construction / Setting up - 40 Marks. Result /Output - 30 Marks.	70
4	1,2,3	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	1	Identification of types of wireless communications & its applications.	10
2	2	Identify the various components of a given wireless communication system & their role in the system.	10
3	3	Demonstrate a wireless communication system for a specific application Construction - 10 Marks Output - 10 Marks	20
4	4	Test a given Set Top Box/Mobile Phone. Testing Steps -25 Marks Troubleshooting Steps -25 Marks	50
5	1,2,3, 4	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	Microwave Devices and Components by Sylio, Prentice Hall of India, New Delhi
2	Wireless Communications (Principles and Practice), by Thedore Rappaport
3	Wireless Communications and Networking, by William Stallings
4	Mobile Communication by John Schiller, Prentice Hall of India, New Delhi

8. SEE Scheme of Evaluation

SL. No.	COs	Particulars/Dimension	Marks
1	1	Identify the types of wireless communications and its uses/applications	10
2	2	Identify the various components of a given wireless communication system & their role in the system.	10
3	3	Demonstrate a wireless communication system for a specific application Construction - 15 Marks Output - 15 Marks	30
4	4	Test a given Set Top Box/Mobile Phone Testing Steps -15 Marks Troubleshooting Steps -15 Marks	30
5	1,2,3, 4	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 Software		
3	Dual trace oscilloscope	Up to 20-30MHz	10
4	CAT5 cable		100m
5	RJ 45 connectors		100
6	Arduino microcontroller board		10
7	RFID Reader , Tag		5, 20
8	ZigBee Module		10
9	Satellite Communication trainer kit	Uplink Transmitter, Inbuilt tone generator Satellite Link, Downlink receiver.	5
10	TV Set up box		10
11	Mobile phone trainer kit	Onboard Section: Keypad, Dual SIM, Charging Circuit, User interface: Buzzer, Vibrator, Mic, Speaker, Hands free port and display LEDs	5
12	Not- working mobile phones		5