

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title : Advanced Communication	Course Code: 15EC53T
Semester : 5	Course Group: Core
Teaching Scheme in Hrs (L:T:P) : 4:0:0	Credits : 4
Type of course: Lecture + activity	Total Contact Hours: 52
CIE : 25 Marks	SEE : 100 Marks

Prerequisites

Knowledge of analog and digital communication, and basics semiconductor devices.

Course Objectives

1. To learn Microwave and Radar systems.
2. To study Satellite basics and Satellite communication systems.
3. To understand the concepts of mobile communication and other wireless technologies.

Course Outcomes

On completion of the course, students will be able to-

1. Appreciate the importance of microwave signal and learn important microwave devices.
2. Describe the working principle of different RADAR systems and their applications.
3. Understand the Satellite fundamentals and types of satellite.
4. Explain the working of a Satellite communication system and its other subsystems.
5. Know the applications of Satellites in different areas.
6. Explain the working principle of Mobile communication and GSM Services.

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Appreciate the importance of microwave signal and learn important microwave devices.	R/U/A	1,2,3,6,10	09
CO2	Describe the working principle of different RADAR systems and their applications.	R/U/A /E	1,2,3,4,10	10
CO3	Understand the satellite fundamentals and types of satellite.	R/U/A	1,2,3,10	08
CO4	Explain the working of a Satellite communication system and its other subsystems.	R/U/A	1,2,3,4,5,10	07
CO5	Know the applications of satellites in different areas.	R/U/A	1,2,5,6,9,10	06
CO6	Explain the working principle of Mobile communication and GSM Services	R/U/A /C	1,2,3,4,9,10	12
Total sessions				52

Legends: PO-Program Outcome, CO-Course Outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply, E-Evaluate, C-Create

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	*	*	*	--	--	*	--	--	--	*
CO2	*	*	*	*	--	--	--	--	--	*
CO3	*	*	*	--	--	--	--	--	--	*
CO4	*	*	*	*	*	--	--	--	--	*
CO5	*	*	--	--	*	*	--	--	*	*
CO6	*	*	*	*	--	--	--	--	*	*

Legend: * Linked, -- No link

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Advanced Communication	3	3	3	1	1	1	--	--	1	3

Legend: Addressing levels: 1-Slight, 2-Moderate, 3-Substantial, -- Not addressed

Quantification Method: This is to relate the level of PO with the number of hours devoted to the COs which address the given PO. If $\geq 40\%$ of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3; if 25 to 40%, Level 2; if 5 to 25%, Level 1; and if $< 5\%$, not addressed.

Course content and pattern of marks for SEE

Unit No	Unit Name	Hour	Questions to be set For SEE					Marks Weightage	Weightage (%)
			R	U	A	E	C		
1	Microwave and Devices	09	05	10	10	00	00	25	17.24
2	Radar Principles and Applications	10	05	10	10	05	00	30	20.69
3	Satellite Fundamentals	08	05	05	05	00	00	15	10.34
4	Satellite communication System	07	05	05	05	00	00	15	10.34
5	Satellite Applications	06	05	05	10	00	00	20	13.80
6	Mobile and Wireless Communications	12	05	15	15	00	05	40	27.59
Total		52	30	50	55	05	05	145	100

Course Content

Unit 1: Microwave Devices

Duration:09Hrs

Microwave signal: Definition, frequency bands, advantages and applications. Waveguides: Need and Types, Energy coupling methods: Probe, Loop and Aperture coupling. Definition of TE and TM modes. Dominant mode for rectangular and circular waveguides.

Microwave semiconductor devices – Construction and applications of: IMPATT and TRAPATT. Microwave tube devices- Construction, Working, Performance and Applications:Two cavity Klystron, Reflex klystron, Magnetron and Travelling Wave Tube (TWT).

Unit 2: Radar Principles and Applications

Duration:10Hrs

Radar: Introduction and applications. Definitions: PRF, PRI, Average power, peak power and duty cycle. Radar range equation and factors influencing the radar range. Pulsed radar system- Principle and Block diagram. Modulator - Line type. Duplexer - Branch type. Displays: A-scope and PPI.

Antenna Scanning: Horizontal, Vertical, Nodding and Spiral. Tracking: Sequential lobing, conical scan and Monopulse. Special purpose radars- MTI Radar, CW Doppler radar, FM-CW Radar.Radar beacons, Aircraft landing system: GCA and ILS.

Unit 3: Satellite Fundamentals

Duration:08Hrs

Definition of Satellite, Satellite orbits, Kepler's Laws (only statements), Apogee and Perigee, Azimuth and Elevation angles, Subsatellite point, subsatellite path, Ascending and descending nodes, Posigrade and Retrograde orbits, Uplink and Downlink, Orbital period and radius of Geosynchronous satellite, Satellite Eclipse, Polar and Geostationary satellites-Advantages and Disadvantages. LEO, MEO & GEO satellites.Station keeping, attitude control and Thermal control.

Unit 4: Satellite Communication System

Duration:07Hrs

Satellite communication system- Block diagram, Transponder- Single conversion, double conversion, regenerative transponder. Satellite frequency allocation and satellite bandwidth. Increasing channel capacity- frequency reuse and spatial isolation. General block diagram of communication satellite, Satellite subsystems- Classification, Power subsystem, TT&C subsystem. Applications payload. Earth station- block diagram.

Unit 5: Satellite Applications

Duration:06Hrs

Global Positioning System(GPS). Satellite for Television applications: Direct-To-Home (DTH) and Cable TV. Voice and Data communication, Earth observation (Remote Sensing) applications, Military applications, Introduction to VSAT.

Unit 6: Mobile and Wireless Communications

Duration:12Hrs

Mobile communication: Principle of digital telephony. Features of 1G, 2G, 2.5G, 3G, 4G cellular networks, Cellular concept, Frequency reuse, Capacity expansion techniques- Cell splitting and cell sectoring, working of a typical cellular system. GSM services and features, GSM system architecture, CDMA 2000 system-services and features. LTE services and features. Handoff strategies.

Wireless communication: Bluetooth-Components, Stack, Links and channels, Bluetooth networking, Bluetooth connections, Transmissions characteristics, Applications. Features and applications of Wi-Fi , Hot-spot.

ZIGBEE- Stack, Zigbee Addressing- Messaging, Broadcast addressing, Group addressing. Zigbee network topologies, Applications of Zigbee.

References

1. Electronic communication system by George Kennedy and Davis Fourth Edition.
2. Communication Electronics by Frenzil Third Edition, TMH Publications
3. Microwave Engineering, by Vasuki, Helena and Rajeswari, McGrawHill education
4. Satellite communications by Dr. D.C. Agarwal. Seventh edition, Khanna publishers.
5. Introduction to Radar Systems by Skolnic, TMH Publications
6. Wireless communications by Theodore S.Rappaport. II Edition, PHI publications.
7. Communication engineering, S Vijayachitra, McGrawHill Education. ISBN-13: 978-1-25-900686-9
8. Introduction to wireless telecommunications systems and networks by Mullett, CENGAGE Learning
9. Mobile and personal communications system and services by Raj Pandya
10. Satellite communications, by Dennis Roddy, , McGrawHill education
11. Mobile communications by Jochen Schiller.
12. Satellite Communication by Anil K Maini, Wiley India Publications

Suggested List of Student Activities

Duration: 4hrs

Note: The following activities or similar activities for assessing CIE (IA) for 5 marks:

Sl. No.	Activity
	<ol style="list-style-type: none">1. Prepare a report on the limitations of microwave signals for conventional low frequency devices.2. Prepare a report on Microwave device: Pin diode, Varactor diode and Tunnel diode.3. Visit the local BSNL office and prepare a report on it.4. Visit the local Microwave station and prepare a report on it.5. Prepare a report on different types of antennas used in radar application.6. Visit the local Radar station and prepare a report on it.7. Prepare a report on Historical background of Satellite.8. Prepare a report in Indian satellites.9. Prepare a report on activities of ISRO.10. Visit a local Mobile service Centre and prepare a report on it.11. Prepare a report on cashless transaction.
Execution Mode	
<ol style="list-style-type: none">1. Maximum of 3-4 students in each batch should do any one of the above activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.2. Each batch should conduct different activity and no repeating should occur.3. Submit a brief report on the activity done on 4-6 pages, A4 size handwritten paper. Papers should be simple stapled or tagged. Avoid plastic-based files for submitting of reports.	

4. Activities can be carried off-class or in the laboratory, as the case may be.
5. Assessment shall be made based on quality of activity/ presentation/ demonstration and report.

Institutional Activities

Note: One activity to be conducted each month of the semester.

Sl. No.	Activity
1	Organize Seminar, workshop or Lecture from experts on Microwave and Radar engineering field.
2	Organize a workshop from experts on servicing and repairing of Mobile phones.
3	Arrange for student's visit to nearest Microwave/ Mobile station.

Course Delivery

The course will be delivered through lectures, presentations and support of modern tools.

Course Assessment and Evaluation Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Three tests ⁺	20	Blue Books	1 to 6
				Activity*	05	Activity Sheets	1 to 6
	SEE	End exam		End of the course	100	Answer Scripts at BTE	1 to 6
				Total	125		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3& Delivery of course
	End of course survey			End of the Course	Nil	Questionnaires	1 to 6, Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

⁺ Every I.A. test shall be conducted for 20 marks. Average of three tests, by rounding off any fractional part thereof to next higher integer, shall be considered for IA.

*Students should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term and assessed through appropriate Rubrics.

Questions for CIE and SEE will be designed to evaluate the various CLs as per the weightage shown in the following table.

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	20
2	Understanding	35
3	Applying	37
4	Evaluate	04
5	Create	04
Total		100

(i) Model of rubrics for assessing student activity

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Research and gathering information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
Total marks						ceil(13/4) = 4

(iii) CIE/IA Tests (20 Marks)

Three tests have to be conducted in accordance with the test pattern given below and average marks of them are considered for CIE/IA with specified schedule.

(iv) Format of CIE/IA test question paper

CIE Question Paper					
Institution Name and Code					
Course Co-ordinator/Teacher					
Program Name		Test No.		Units	
Class/Sem		Date		CL	
Course Name		Time		COs	
Course Code		Max. Marks		POs	
Note to students: Answer all questions					

Question No.	Question	Marks	CL	CO	PO
1					
2					
3					
4					

Legends: PO-Program Outcome, CO-Course outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply
Note: Internal choice may be given in each CO at the same cognitive level (CL).

(v) Model question paper for CIE

CIE Question Paper					
Institution Name and Code					
Course Co-ordinator/Teacher					
<i>Program Name</i>	Electronics & Communication	<i>Test No.</i>	1	<i>Units</i>	1 & 2
<i>Class/Sem</i>	5 th Sem	<i>Date</i>	1/1/2017	<i>CL</i>	R/U/A
<i>Course Name</i>	Advanced Communication	<i>Time</i>	10-11AM	<i>COs</i>	1 & 2
<i>Course Code</i>	15EC53T	<i>Max. Marks</i>	20	<i>POs</i>	1, 2 & 3
<i>Note to students: Answer all questions</i>					
No.	Question	Marks	CL	CO	PO
1	Explain the need for waveguides in microwave systems. OR Explain the construction of a two cavity klystron device.	05	U/A	1	1,2,3,6 ,10
2	Define Dominant mode. Mention the dominant mode for rectangular and circular waveguides.	05	R	1	1,2,3,6 ,10
3	Define: PRF, PRI, Average power, Peak power and Duty cycle. OR Derive the Radar range equation.	05	R/U/ A	2	1,2,3,4 ,10
4	Sketch and explain the block diagram of CW Doppler Radar.	05	U/A	2	1,2,3,4 ,10

Semester End-exam Evaluation (SEE)

(i) End-exam question-paper pattern

Unit No.	Unit Name	Study Duration (Hrs.)	No. Questions for End-exam	
			5 marks Part - a	10 marks Part - b
1	Microwave and Devices	09	1	2
2	Radar Principles and Applications	10	2	2
3	Satellite Fundamentals	08	1	1
4	Satellite communication System	07	1	1
5	Satellite Applications	06	2	1
6I	Mobile and Wireless Communications	12	2	3

	Total	52	09 (45 Marks)	10 (100 Marks)
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(ii) Model question paper

Course Title : **Advanced Communication**

Course Code : **15EC53T**

Semester : **Fifth**

Time : **3 Hrs**

Max. Marks: **100**

Instructions: 1. Answer any **SIX** question from **Part A** (5x6=30 Marks)

2. Answer any **SEVEN** full questions from **Part B** (7x10=70 Marks)

Part A

1. Define Microwave signals. List the frequency bands
2. Explain the factors that influence radar range.
3. Justify the need for Duplexers in a radar system.
4. State the three Kepler's laws.
5. Explain single conversion transponder with neat figure.
6. List the different applications of satellite technology.
7. Explain DTH television application of satellite.
8. List the Bluetooth components and explain.
9. Write the techniques of capacity expansion in mobile communication.

Part B

1. Explain the construction, working and applications of a Magnetron.
2. Sketch the construction of a TWT and explain its working.
3. Derive the radar range equation.
4. Explain the ILS method of aircraft landing system.
5. Classify and explain the different satellite orbits based on distance from earth.
6. Draw the block diagram of Earth station and explain.
7. Explain the voice and Data communication using satellite..
8. a) Explain the features of 1G and 2G mobile communication system.
b) Explain GSM architecture with neat sketch.
9. Explain the Cell splitting and cell sectoring methods.
10. Describe Zigbee addressing methods.

Model Question Bank

Course Title : **Advanced Communication**

Course Code: **15EC53T**

UNIT 1.Microwave Devices

05 Marks

Remember

1. Define Waveguide. List the types of Waveguides
2. List the application of Waveguides
3. Define and Sketch the figures of IMPATT & TRAPATT diodes.
4. List the application of Reflex klystron tubes.

Understand

1. Explain the applications of microwave signals.
2. Explain the construction detail of IMPATT diode.
3. Explain the construction detail of TRAPATT diode.
4. Explain the advantages of microwave Signals.

Applying

1. Sketch a neat diagram and explain dominant Mode of Rectangular Waveguide.
2. Sketch a neat diagram and explain dominant Mode of Circular Waveguide.

10-mark Questions

Remember

Understand

1. Explain construction & working of Reflex Klystron.
2. Explain construction & working of TWT.
3. Explain construction & working of Magnetron.
4. Explain construction & working of two cavity klystron.

Applying

1. Explain the construction and working of an IMPATT diode.
2. Explain the construction and working of an TRAPATT diode

Unit 2.Radar Principles and Applications

Remember

1. Define PRF and duty cycle.
2. List the factors that affect radar range equation.
3. List the applications of radar.
4. List the antenna scanning and tracking methods.
5. Define Average power and Peak power
6. Explain the advantages and disadvantages of Pulsed radar system.

Understand

1. Explain A-scope display with neat figure.
2. Explain PPI display with neat figure.
3. Explain applications of RADAR.
4. Explain different types of antenna scanning.
5. Explain the factors influencing the RADAR range equation.
6. Explain Monopulse tracking of radar.

Evaluate

1. Compare A-scope and PPI displays
2. Compare Pulsed Radar and CW Doppler radar systems.
3. Compare the different antenna scanning methods.

10 marks

Understand

1. Derive RADAR range equation and list the factors which influence it.
2. Explain different methods of antenna tracking.
3. Explain working of CW Doppler RADAR.
4. Explain the working of FM-CW RADAR.
5. Explain the working of MTI RADAR.
6. Explain instrument landing system (ILS).
7. Explain branch type duplexer.
8. Explain the importance of Radar beacons.

Applying

1. Write a note on Pulsed radar system and its uses.
2. Illustrate the working of GCA landing system for aircrafts.
3. Write short notes on radar displays.
4. Sketch the block diagram of CW Doppler radar and explain its working.
5. Sketch the block diagram of FM-CW radar and explain its working.
6. Sketch the block diagram of MTI radar and explain its working.

Unit 3. Satellite fundamentals

5mark

Remember

1. Define satellite. Distinguish between passive and active satellite.
2. Define angle of azimuth and angle of elevation.
3. Define station keeping and attitude control.
4. Define LEO, MEO and GEO
5. List the advantages and disadvantages of LEO.
6. List the advantages and disadvantages of MEO.
7. List the advantages and disadvantages of GEO.
8. Define Posigrade and Retrograde orbits.
9. Define subsatellite point and subsatellite path.

Understand

1. Explain Apogee and Perigee heights with a neat sketch.
2. Explain Ascending and Descending nodes of a satellite orbit.
3. Explain Thermal control of a satellite.

Applying

1. Illustrate the block diagram of a satellite communication system with neat figure.
2. Explain the satellite orbits with neat sketch.
3. With neat figure, explain Uplink and downlink frequencies.

10 marks

Understand

1. Explain polar satellite. List their merits and demerits
2. Explain geostationary satellite. List their merits and demerits.
3. Explain LEO, GEO and MEO satellite.

Applying

1. Compare LEO, GEO and MEO satellite.
2. Derive the expression for finding the orbital period and radius of a geosynchronous satellite.
3. Sketch and explain the different orbits of a satellite based on inclination.

Unit 4. Satellite communication system

5 marks

Remember

1. Define Satellite frequency allocation and bandwidth.
2. Define Transponders and List the types of satellite transponders.
3. List the different types of satellite subsystems.

Understand

1. Explain Single conversion transponder with neat sketch.
2. Explain double conversion transponder with neat sketch.
3. Explain Regenerative transponder with neat sketch.
4. Explain Power subsystem of a satellite.
5. Explain TT&C subsystem of a satellite.
6. Explain applications payload of a satellite.

Applying

1. Illustrate the importance of a transponder in a satellite system.
2. Explain methods of increasing channel capacity of a satellite.
3. Explain Frequency and spatial isolation techniques for increasing the satellite channel capacity.
4. Describe the general block diagram of a communication satellite.

10 marks

Understand

1. Explain the working of TTC satellite subsystem with neat block diagram.
2. Explain working of a satellite earth station with block diagram.
3. Describe transponder. Explain working of regenerative transponder with neat sketch.

Unit 5. Satellite application:

5 marks

Remember

1. List satellite applications in different areas.
2. List the remote sensing applications of satellite.
3. List the components and applications of GPS.
4. Define VSAT concept.

Understand

1. Explain GPS.
2. Explain VSAT.
3. Explain earth observation application of satellite.
4. Describe cable TV application of satellite

10 marks

Applying

1. Explain DTH system with neat figure.
2. Explain GPS system with neat sketch.
3. Illustrate voice and data communication through satellite.
4. Explain satellite TV applications.

Unit 6. Mobile and Wireless communications.

5marks

Remember

1. Define mobile communication and list the generations of mobile communication.
2. List the features of CDMA 2000 system.
3. List the components of Bluetooth.
4. List the application and features of Wi-Fi.
5. List the application and features of Hot-spot..
6. Define Zigbee and list its addressing types.
7. List the Zigbee network topologies.

Understand

1. Explain 1G and 2G mobile systems.
2. Explain GSM services.
3. Explain the features of GSM.
4. Explain Handoff strategies.
5. Explain Bluetooth operation.
6. Explain Zigbee network topologies.

Applying

1. Sketch the GSM system architecture.
2. Sketch the Bluetooth stack organisation explain it
3. Explain applications of Zigbee.
4. Illustrate the cell splitting and cell sectoring.

Create

1. Write the concept of cellular network.
2. Write the importance of frequency reuse in mobile communication.
3. Write the importance of cell splitting and cell sectoring in mobile networks.

10 marks

Understand

1. Explain the operation of GSM architecture with neat sketch.
2. Explain GSM services and features.
3. Explain Bluetooth components and its links & channels.
4. Explain the transmission characteristics and applications of Bluetooth.
5. Explain the network topologies and applications of Zigbee.

Applying

1. Illustrate the various generations of mobile communication.
2. Write a note on GSM services and features.
3. Explain the working of a typical cellular system.
4. Explain the features of Wi-Fi and Hot-Spot technologies.
5. Explain the Zigbee addressing methods.

End

