Course Name	: Electronics Engineering Group
Course Code	: EJ/ET/EN/EX/DE/ED/EI
Semester	: Sixth for ET/EN/EX/EJ/DE and Seventh for ED/EI
Subject Title	: Advanced Communication System
Subject Code	: 17656

Teaching and Examination Scheme:

Tea	Teaching Scheme					Examinatio	on Scheme	
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04		02	03	100	25#		25@	150

NOTE:

- > Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.
- > Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).

Rationale:

Initially communication technology focused on simple transmission links, but then quickly moved to increasingly sophisticated networks. Nowadays modern high capacity, high speed telecom networks based on microwave principles, optical fiber technology, satellite communication and radar systems became integral part of industry, society and other organizations.

Advance communication system is an application of devices and basic communication techniques. It is useful to understand principles, working, use of microwave devices and systems. Knowledge of optical fiber technology is helpful in understanding of optical communication system, maintenance of optical links and related components.

Study of satellite and radar communication system is important for understanding operation, maintenance and monitoring of these systems.

This subject is also useful as a basis to acquire in depth knowledge of advance communication systems and for analysis of these systems.

General Objectives:

Students will be able to:

- 1. Understand concepts and applications of microwave and optical spectrum.
- 2. Understand construction and working of microwave components and devices.
- 3. Understand basic principle & operation of radar systems.
- 4. Understand the construction, working and uses of optical communication system components
- 5. Know the concept, working and application of satellite communication system.

Learning Structure:



Theory:

Topic and Contents	Hours	Marks
Topic 1: Wave Guide and Components:		
Specific Objectives:		
Students will be able to		
Identify band designation with range in microwave spectrum.		
Compare waveguide with two wire transmission line.		
Plot the field pattern for dominant mode (Lower) of rectangular		
waveguide.		
Contents:		
1.1 Introduction to basics of microwave transmission. [08]		
 Microwave spectrum and band designations. 		
• Comparison of wave guide with transmission line.		
• Rectangular waveguides: Propagation of waves through rectangular		
wave guide, Reflection of waves from a conducting plane- Basic		
behaviour, dominant mode at the conducting surface, dominant mode		
of operation, plane waves at conducting surface, parallel and normal		
wavelength, phase velocity. The parallel plane waveguide, cut off		• •
wavelength, cut off frequency, group and phase velocity.(Simple	12	20
numericals)		
• Rectangular waveguide modes: TEm,o modes, TEm,n modes, TMm,n		
modes, field patterns of TE1,0,TE2,0,TE1,1 modes.		
1.2 Circular waveguide- [04]		
Analysis of behavior		
• field patterns for dominant mode.		
• Advantages and applications of circular waveguide		
1.3 Waveguide components [08]		
• Flanges, Rotating coupling, Bends & corners, Taper & Twist,		
 Multiple Junctions - E plane H- plane and Hybrid junction 		
 Cavity resonators - operation, types and applications 		
Auxiliary components- Directional coupler. Isolator and circulators		
Detector mounts, switches - Dunlever		
Tonics 2: Microwave Devices:		
Specific Objectives:		
\blacktriangleright Sketch the constructional details and the working of klystron TWT &		
magnetron		
\triangleright Sketch and explain the construction of semi conductor microwave		
devices		
Contents:		
2.1 Microwave vacuum tube devices. [12]	12	20
Construction, working, specifications and applications of		
• Two cavity Klystron amplifier,		
• Reflex Klystron.		
Magnetron		
• TWT		
2.2 Microwave semiconductor devices [08]		
Construction working and applications of		

 IMPATT diode IMPATT diode Tunnel diode Tunnel diode Tunnel diode Tunnel diode Topics 3: Radar Systems: Specific Objectives: Interpret the radar range equation Explain operation of pulse radar, MTI and CW radar system Interpret the position of target by observing displays Explain the operation of A-scope, PPI, ATD displays Contents: Basic block diagram of radar system. Radar performance factors: Radar range equation, factors influencing max. Range, effect of noise. Basic pulse Radar system: Block diagram & description. Antenna scanning: Horizontal, vertical, helical and spiral. Antenna scanning: Horizontal, vertical, helical and spiral. Antenna racking: Sequential, conical and monopusl Display Methods: A-Scope, PPI, Automatic target detection Block diagram of various subsystems of satellite Explain the operation of adellite earth station Contents: Introduction to satellite communication system Condentis: Introduction to satellite communication system. Concept of orbit & its types Communication link: uplink & downlink frequency, look angle altitude, clevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station Attinude control subsystem Communication channel subsystem Attinude control subsystem Attinude control subsystem Attinude control subsystem Attinu	• Gunn diode, .		
 PIN diode. Tunnel diode Topics 3: Radar Systems: Specific Objectives: Interpret the radar range equation Explain operation of pulse radar, MTI and CW radar system Interpret the position of target by observing displays Explain the operation of A-scope, PPI, ATD displays Contents: Basic block diagram of radar system. Radar performance factors: Radar range equation, factors influencing max. Range, effect of noise. Basic pulse Radar system: Block diagram & description. Antenna scanning: Horizontal, vertical, helical and spiral. Antenna scanning: & Tracking (Definition, types and principle) of Antenna scanning: Horizontal, vertical, helical and spiral. Antenna scanning: A-scope, PPI, Automatic target detection Block diagram, operation and application of pulsed radar system and MTI and CW Doppler radar. Radar Becons Antannas used in RADAR: Topics 4: Satellite Communication System: Concept of orbit & its types Communication factor system. Concept of orbit & its types Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station Subsystems of satellite. Block diagram and Principle [08] Power subsystem Attitude control subsystem Attitude control subsystem Telemetry tracking and command subsystem Main & auxiliary propulsion subsystem Telemetry tracking and command subsystem Thermal control subsystem Thermal control subsystem Telemetry tracking and command subsystem Main & auxiliary propulsion subsystem Telemetry tracking and comma	• IMPATT diode		
• Tunnel diode Image: Content of the second of the sec	• PIN diode.		
Topics 3: Radar Systems: Specific Objectives: Interpret the radar range equation Explain operation of pulse radar, MTI and CW radar system Interpret the position of target by observing displays Explain the operation of A-scope, PPI, ATD displays Contents: Basic block diagram of radar system. Radar performance factors: Radar range equation, factors influencing max. Range, effect of noise. Basic pulse Radar system: Block diagram & description. Antenna scanning & Tracking (Definition, types and principle) of Antenna scanning & Tracking (Definition, types and principle) of Antenna scanning & Tracking (Definition of pulsed radar system and MTI and CW Doppler radar. Antannas used in RADAR: Topics 4: Satellite Communication System: Specific Objectives: Draw block diagram of various subsystems of satellite Explain the operation of satellite earth station Contents: 4.1 Introduction to satellite communication system 08 Mage altitude, elevation angle, Azimth angle footprint & station keeping Block diagram of various subsystem 0 Nationace of satellite communication system 10 16 Subsystems of satellite :Block diagram and Principle	• Tunnel diode		
Specific Objectives: > Interpret the radar range equation > Interpret the position of target by observing displays > Explain operation of A-scope, PPI, ATD displays Contents: • Basic block diagram of radar system. • Radar performance factors: Radar range equation, factors influencing max. Range, effect of noise. • Basic pulse Radar system: Block diagram & description. • Antenna scanning & Tracking (Definition, types and principle) of Antenna scanning: Horizontal, vertical, helical and spiral. • Antenna tracking: Sequential, conical and monopusl • Display Methods: A-Scope, PPI, Automatic target detection • Block diagram, operation and application of pulsed radar system and MTI and CW Doppler radar. • Radar Becons • Antannas used in RADAR: Topics 4: Satellite Communication System: > Drave block diagram of various subsystems of satellite > Explain the operation of satellite earth station Concept of orbit & its types • Communication film : uplink & downlink frequency, • Iook angle altitude, elevation angle, Azimth angle footprint & station keeping • Power subsystem • Communication channel subsystem • Attenna subsystem • Communication subsystem • Altintroduction to satellite communication system.	Topics 3: Radar Systems:		
 Interpret the radar range equation Explain operation of pulse radar, MTI and CW radar system Interpret the position of target by observing displays Explain the operation of A-scope, PPI, ATD displays Contents: Basic block diagram of radar system. Radar performance factors: Radar range equation, factors influencing max. Range, effect of noise. Basic pulse Radar system: Block diagram & description. Antenna scanning & Tracking (Definition, types and principle) of Antenna scanning: Horizontal, vertical, helical and spiral. Antenna tracking: Sequential, conical and monopusl Display Methods: A-Scope, PPI, Automatic target detection Block diagram, operation and application of pulsed radar system and MTI and CW Doppler radar. Radar Becons Antannas used in RADAR: Topics 4: Satellite Communication System: Contents: Importance of satellite communication system. Concept of orbit & its types Communication lifk: :plink & downlink frequency, look angle altitude, clevation angle, Azimth angle footprint & station keeping Power subsystem Antenna subsystem Antenna duction of satellite earth station 10 16 	Specific Objectives:		
 Explain operation of pulse radar, MT1 and CW radar system Interpret the position of target by observing displays Explain the operation of A-scope, PPI, ATD displays Contents: Basic block diagram of radar system. Radar performance factors: Radar range equation, factors influencing max. Range, effect of noise. Basic pulse Radar system: Block diagram & description. Antenna scanning: Horizontal, vertical, helical and spiral. Antenna scanning: Horizontal, vertical, helical and spiral. Antenna scanning: Horizontal, vertical, helical and spiral. Antenna scanning: Horizontal, vertical, nelical and monopusl Display Methods: A-Scope, PPI, Automatic target detection Block diagram, operation and application of pulsed radar system and MT1 and CW Doppler radar. Radar Becons Antannas used in RADAR: Topics 4: Satellite Communication System: Specific Objectives: Draw block diagram of various subsystems of satellite Explain the operation of satellite earth station Concept of orbit & its types Communication fink : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station Subsystems of satellite: Block diagram and Principle [08] Power subsystem Communication channel subsystem Attitude control subsystem Attitude control subsystem Antenna subsystem Antenna subsystem Antenna subsystem	Interpret the radar range equation		
 Interpret the position of target by observing displays Explain the operation of A-scope, PPI, ATD displays Contents: Basic block diagram of radar system. Radar performance factors: Radar range equation, factors influencing max. Range, effect of noise. Basic pulse Radar system: Block diagram & description. Antenna scanning & Tracking (Definition, types and principle) of Antenna scanning: Horizontal, vertical, helical and spiral. Antenna tracking: Sequential, conical and monopusl Display Methods: A-Scope, PPI, Automatic target detection Block diagram, operation and application of pulsed radar system and MTI and CW Doppler radar. Radar Becons Antannas used in RADAR: Topics 4: Satellite Communication System: Specific Objectives: Parw block diagram of various subsystems of satellite Explain the operation of satellite earth station Concept of orbit & its types Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station 10 16 Power subsystem Attitude control subsystem Attitude control subsystem Attitude control subsystem Attitude control subsystem Antenna subsystem Antenna subsystem Antenna subsystem Attitude control subsystem Antenna subsystem Antenna subsystem Antenna subsystem Antenna subsystem <li< td=""><td>Explain operation of pulse radar, MTI and CW radar system</td><td></td><td></td></li<>	Explain operation of pulse radar, MTI and CW radar system		
 Explain the operation of A-scope, PPI, ATD displays Contents: Basic block diagram of radar system. Radar performance factors: Radar range equation, factors influencing max. Range, effect of noise. Basic pulse Radar system: Block diagram & description. Antenna scanning & Tracking (Definition, types and principle) of Antenna scanning: Horizontal, vertical, helical and spiral. Antenna tracking: Sequential, conical and monopusl Display Methods: A-Scope, PPI, Automatic target detection Block diagram, operation and application of pulsed radar system and MTI and CW Doppler radar. Radar Becons Antannas used in RADAR: Topics 4: Satellite Communication System: Specific Objectives: Draw block diagram of various subsystems of satellite Explain the operation of satellite earth station Concept of orbit & its types Communication link: uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station 2. Subsystem of satellite Block diagram and Principle [08] Power subsystem Communication link: uplink & downlink frequency, look angle altitude, clevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station 10 16 	Interpret the position of target by observing displays		
Contents: • Basic block diagram of radar system. • Radar performance factors: Radar range equation, factors influencing max. Range, effect of noise. 12 16 • Basic pulse Radar system: Block diagram & description. • Antenna scanning: Horizontal, vertical, helical and spiral. 12 16 • Antenna scanning: Horizontal, vertical, helical and spiral. • Antenna scanning: Horizontal, vertical, helical and spiral. 12 16 • Antenna scanning: Horizontal, vertical, helical and spiral. • Antenna scanning: Horizontal, vertical, helical and spiral. 12 16 • Antenna scanning: Horizontal, vertical, helical and psiral. • Antenna scanning: Horizontal, vertical, helical and spiral. 12 16 • Antannas used in RADAR: • Topics 4: Satellite Communication System: • Parw block diagram of various subsystems of satellite 10 10 • Draw block diagram of various subsystem of satellite • Explain the operation of satellite earth station 10 16 • Importance of satellite communication system [08] 10 16 • Subsystem of satellite earth station 10 16 • Conept of orbit & its types • Communication channel subsystem 10 16 • Disck diagram and function of satellite earth station 10 16 16 <td>Explain the operation of A-scope, PPI, ATD displays</td> <td></td> <td></td>	Explain the operation of A-scope, PPI, ATD displays		
 Basic block diagram of radar system. Radar performance factors: Radar range equation, factors influencing max. Range, effect of noise. Basic pulse Radar system: Block diagram & description. Antenna scanning & Tracking (Definition, types and principle) of Antenna scanning: Horizontal, vertical, helical and spiral. Antenna tracking: Sequential, conical and monopusl Display Methods: A-Scope, PPI, Automatic target detection Block diagram, operation and application of pulsed radar system and MTI and CW Doppler radar. Radar Becons Antannas used in RADAR: Topics 4: Satellite Communication System: Specific Objectives: Draw block diagram of various subsystems of satellite Explain the operation of satellite earth station Concept of orbit & its types Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station 4.2 Subsystem of satellite !Block diagram and Principle [08] Power subsystem Communication subsystem Attitude control subsystem Attitude control subsystem Thermal control subsystem Attitude control subsystem Thermal control subsystem Attitude control subsystem Thermal control subsystem Attitude control subsystem Attitude control subsystem Antenna subsystem Antenna subsystem Main & auxiliary propulsion subsystem Antenna subsystem Cleasify optical fibers Optical spectrum: Band name and its range. 	Contents:		
 Radar performance factors: Radar range equation, factors influencing max. Range, effect of noise. Basic pulse Radar system: Block diagram & description. Antenna scanning & Tracking (Definition, types and principle) of Antenna scanning: Horizontal, vertical, helical and spiral. Antenna tracking: Sequential, conical and monopusl Display Methods: A-Scope, PPI, Automatic target detection Block diagram, operation and application of pulsed radar system and MTI and CW Doppler radar. Radar Becons Antannas used in RADAR: Topics 4: Satellite Communication System: Specific Objectives: Aramas used in RADAR: Topics 4: Satellite communication system [08] Importance of satellite communication system. Concept of orbit & its types Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station 10 16 16 16 16 16 17 16 16 16 16 16 10 16 16 16 10 16 10 16 10 16 10 10 16 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10<	• Basic block diagram of radar system.		
max. Range, effect of noise. 12 16 Basic pulse Radar system: Block diagram & description. 12 16 Antenna scanning & Tracking (Definition, types and principle) of Antenna scanning: Horizontal, vertical, helical and spiral. 16 Antenna tracking: Sequential, conical and monopusl 16 Display Methods: A-Scope, PPI, Automatic target detection 16 Block diagram, operation and application of pulsed radar system and MTI and CW Doppler radar. 17 Radar Becons 17 Antannas used in RADAR: 10 Topics 4: Satellite Communication System: 10 Specific Objectives: 2 > Draw block diagram of various subsystems of satellite 10 Explain the operation of satellite communication system 10 Introduction to satellite communication system. 10 Concept of orbit & its types 10 Communication link : uplink & downlink frequency, 10 Iok diagram and function of satellite earth station 10 4.2 Subsystems of satellite / Block diagram and Principle 108 • Power subsystem 10 • Communication channel subsystem 10 • Power subsystem 10 • Power	• Radar performance factors: Radar range equation, factors influencing		
 Basic pulse Radar system: Block diagram & description. Antenna scanning & Tracking (Definition, types and principle) of Antenna scanning: Horizontal, vertical, helical and spiral. Antenna tracking: Sequential, conical and monopusl Display Methods: A-Scope, PPI, Automatic target detection Block diagram, operation and application of pulsed radar system and MTI and CW Doppler radar. Radar Becons Antannas used in RADAR: Topics 4: Satellite Communication System: Specific Objectives: > Draw block diagram of various subsystems of satellite > Explain the operation of satellite earth station Contents: 4.1 Introduction to satellite communication system. Concept of orbit & its types Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station 4.2 Subsystems of satellite :Block diagram and Principle [08] Power subsystem Communication channel subsystem Attitude control subsystem Thermal control subsystem Antenna subsystem Telemetry tracking and command subsystem Antenna subsystem Antenna subsystem Contents: Optical spectrum: Band name and its range. 	max. Range, effect of noise.	12	16
 Antenna scanning & Tracking (Definition, types and principle) of Antenna scanning: Horizontal, vertical, helical and spiral. Antenna tracking: Sequential, conical and monopusl Display Methods: A-Scope, PPI, Automatic target detection Block diagram, operation and application of pulsed radar system and MT1 and CW Doppler radar. Radar Becons Antannas used in RADAR: Topics 4: Satellite Communication System: Specific Objectives: Draw block diagram of various subsystems of satellite Explain the operation of satellite earth station Contents: Introduction to satellite communication system. Concept of orbit & its types Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station Subsystems of satellite. Block diagram and Principle [08] Power subsystem Attitude control subsystem Attitude control subsystem Attitude control subsystem Thermal control subsystem Antenna subsystem Antenna tracking and command subsystem Antenna subsystem Antenna time and subsystem Antenna subsystem Optical spectrum: Band name and its range. 	• Basic pulse Radar system: Block diagram & description.		
 Antenna scanning: Horizontal, vertical, nenteal and spiral. Antenna tracking: Sequential, conical and monopusl Display Methods: A-Scope, PPI, Automatic target detection Block diagram, operation and application of pulsed radar system and MTI and CW Doppler radar. Radar Becons Antannas used in RADAR: Topics 4: Satellite Communication System: Specific Objectives: > Draw block diagram of various subsystems of satellite > Explain the operation of satellite earth station Contents: 4.1 Introduction to satellite communication system. Concept of orbit & its types Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station 4.2 Subsystems of satellite 'Block diagram and Principle [08] Power subsystem Communication channel subsystem Attitude control subsystem Thermal control subsystem Antenna subsystem Topics 5: Theory of optics & fundamentals of optical fiber Specific Objectives: > Draw constructional sketch of fiber optic cable > Classify optical fibers Optical spectrum: Band name and its range. 	• Antenna scanning & Tracking (Definition, types and principle) of		
 Antenna tracking: sequential, conteat and monopusi Display Methods: A-Scope, PPI, Automatic target detection Block diagram, operation and application of pulsed radar system and MTI and CW Doppler radar. Radar Becons Antannas used in RADAR: Topics 4: Satellite Communication System: Specific Objectives: > Draw block diagram of various subsystems of satellite > Explain the operation of satellite earth station Contents: 4.1 Introduction to satellite communication system. [08] Importance of satellite communication system. Concept of orbit & its types Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station 4.2 Subsystems of satellite. Block diagram and Principle Power subsystem Attitude control subsystem Telemetry tracking and command subsystem Antenna subsystem Classify optical fibers Optical spectrum: Band name and its range. 	Antenna scanning: Horizontal, vertical, helical and spiral.		
 Display Methods: A-Scope, PPI, Automate target detection Block diagram, operation and application of pulsed radar system and MTI and CW Doppler radar. Radar Becons Antannas used in RADAR: Topics 4: Satellite Communication System: Specific Objectives: Draw block diagram of various subsystems of satellite Explain the operation of satellite earth station Contents: Introduction to satellite communication system Importance of satellite communication system. Concept of orbit & its types Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station Subsystems of satellite. Block diagram and Principle [08] Power subsystem Communication channel subsystem Telemetry tracking and command subsystem Antenna subsystem Antenna subsystem Antenna subsystem Antenna subsystem Antenna subsystem Classify optical fibers Classify optical fibers Optical spectrum: Band name and its range. 	Antenna tracking: Sequential, conical and monopusi		
Block diagram, operation and application of pursed radar system and MTI and CW Doppler radar. Radar Becons Antannas used in RADAR: Topics 4: Satellite Communication System: Specific Objectives: > Draw block diagram of various subsystems of satellite > Explain the operation of satellite earth station Contents: 4.1 Introduction to satellite communication system 08] • Importance of satellite communication system. • Concept of orbit & its types • Communication link : uplink & downlink frequency, • look angle altitude, elevation angle, Azimth angle footprint & station keeping • Block diagram and function of satellite earth station 4.2 Subsystems of satellite :Block diagram and Principle 08] • Power subsystem • Communication channel subsystem • Attitude control subsystem • Telemetry tracking and command subsystem • Main & auxiliary propulsion subsystem • Main & auxiliary propulsion subsystem • Antenna subsystem • Antenna subsystem • Antenna subsystem • Cassify optical fibers Contents: • Optical spectrum: Band name and its range.	• Display Methods: A-Scope, PPI, Automatic target detection		
 Radar Becons Antannas used in RADAR: Topics 4: Satellite Communication System: Specific Objectives: Draw block diagram of various subsystems of satellite Explain the operation of satellite earth station Contents: Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station 10 16 Power subsystem Communication channel subsystem Attitude control subsystem Telemetry tracking and command subsystem Main & auxiliary propulsion subsystem Antenna subsystem Cansenty of optics & fundamentals of optical fiber Specific Objectives: Draw constructional sketch of fiber optic cable Classify optical fibers Optical spectrum: Band name and its range. 	• Block diagram, operation and application of pulsed radar system and MTL and CW Dopplar radar	X	
 Adda Decons Antannas used in RADAR: Topics 4: Satellite Communication System: Specific Objectives: Draw block diagram of various subsystems of satellite Explain the operation of satellite earth station Contents: Introduction to satellite communication system	Padar Bacons		
Topics 4: Satellite Communication System: Specific Objectives: > Draw block diagram of various subsystems of satellite > Explain the operation of satellite earth station Contents: 4.1 Introduction to satellite communication system 0 Concept of orbit & its types Concept of orbit & its types Communication link : uplink & downlink frequency, 1 look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station 4.2 Subsystems of satellite :Block diagram and Principle [08] • Power subsystem • Communication channel subsystem • Attitude control subsystem • Thermal control subsystem • Thermal control subsystem • Main & auxiliary propulsion subsystem • Main & auxiliary propulsion subsystem • Antenna subsystem • Draw constructional sketch of fiber optic cable > Contents: • Optical spectrum: Band name and its range.	• Antannas used in RADAR:		
Specific Objectives: > > Draw block diagram of various subsystems of satellite > Explain the operation of satellite earth station Contents: 4.1 Introduction to satellite communication system [08] Importance of satellite communication system Concept of orbit & its types Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station 4.2 Subsystems of satellite :Block diagram and Principle [08] Power subsystem Communication channel subsystem Attitude control subsystem Thermal control subsystem Main & auxiliary propulsion subsystem Main & auxiliary propulsion subsystem Antenna subsystem Draw constructional sketch of fiber optic cable Classify optical fibers Optical spectrum: Band name and its range.	Antainias used in KADAK. Topics 4: Satellite Communication System:		
 Draw block diagram of various subsystems of satellite Explain the operation of satellite earth station Contents: 4.1 Introduction to satellite communication system [08] Importance of satellite communication system. Concept of orbit & its types Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station 4.2 Subsystems of satellite :Block diagram and Principle [08] Power subsystem Communication channel subsystem Attitude control subsystem Thermal control subsystem Antenna subsystem Antenna subsystem Topics 5: Theory of optics & fundamentals of optical fiber Specific Objectives: Draw constructional sketch of fiber optic cable Classify optical fibers Optical spectrum: Band name and its range. 	Specific Objectives:		
 Explain the operation of satellite earth station Contents: Introduction to satellite communication system Importance of satellite communication system. Concept of orbit & its types Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station Subsystems of satellite :Block diagram and Principle [08] Power subsystem Communication channel subsystem Attitude control subsystem Thermal control subsystem Thermal control subsystem Antenna subsystem Antenna subsystem Classify optical fibers Classify optical fibers Optical spectrum: Band name and its range. 	Draw block diagram of various subsystems of satellite		
Contents:[08]4.1 Introduction to satellite communication system[08]• Importance of satellite communication system.[08]• Concept of orbit & its typesCommunication link : uplink & downlink frequency,• look angle altitude, elevation angle, Azimth angle footprint & station keeping10• Block diagram and function of satellite earth station104.2 Subsystems of satellite .Block diagram and Principle[08]• Power subsystem[08]• Communication channel subsystem[08]• Attitude control subsystem[08]• Thermal control subsystem[08]• Attenna subsystem[06]• Antenna subsystem[06]• Draw constructional sketch of fiber optic cable06• Classify optical fibers06• Optical spectrum: Band name and its range.12	> Explain the operation of satellite earth station		
4.1 Introduction to satellite communication system [08] • Importance of satellite communication system. [08] • Concept of orbit & its types Communication link : uplink & downlink frequency, • look angle altitude, elevation angle, Azimth angle footprint & station keeping 10 • Block diagram and function of satellite earth station 10 4.2 Subsystems of satellite :Block diagram and Principle [08] • Power subsystem [08] • Communication channel subsystem [08] • Attitude control subsystem [08] • Thermal control subsystem [08] • Telemetry tracking and command subsystem [08] • Antenna subsystem [06] • Antenna subsystem [06] • Draw constructional sketch of fiber optic cable [06] • Classify optical fibers [06] • Optical spectrum: Band name and its range. [06]	Contents:		
 Importance of satellite communication system. Concept of orbit & its types Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station Subsystems of satellite :Block diagram and Principle [08] Power subsystem Communication channel subsystem Attitude control subsystem Thermal control subsystem Telemetry tracking and command subsystem Antenna subsystem Antenna subsystem Constructional sketch of fiber optic cable Classify optical fibers Optical spectrum: Band name and its range. 	4.1 Introduction to satellite communication system [08]		
 Concept of orbit & its types Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station Subsystems of satellite :Block diagram and Principle [08] Power subsystem Communication channel subsystem Attitude control subsystem Thermal control subsystem Main & auxiliary propulsion subsystem Antenna subsystem Antenna subsystem Constructional sketch of fiber optic cable Classify optical fibers Optical spectrum: Band name and its range. 	Importance of satellite communication system.		
 Communication link : uplink & downlink frequency, look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station Subsystems of satellite :Block diagram and Principle [08] Power subsystem Communication channel subsystem Attitude control subsystem Thermal control subsystem Main & auxiliary propulsion subsystem Antenna subsystem Antenna subsystem Classify optical fibers Contents: Optical spectrum: Band name and its range. Power subsy and the range Description of patients and principle [08] 	• Concept of orbit & its types		
 look angle altitude, elevation angle, Azimth angle footprint & station keeping Block diagram and function of satellite earth station Subsystems of satellite .Block diagram and Principle [08] Power subsystem Communication channel subsystem Attitude control subsystem Thermal control subsystem Telemetry tracking and command subsystem Main & auxiliary propulsion subsystem Antenna subsystem Topics 5: Theory of optics & fundamentals of optical fiber Specific Objectives: Draw constructional sketch of fiber optic cable Classify optical fibers Optical spectrum: Band name and its range. 	• Communication link : uplink & downlink frequency,		
keeping1016• Block diagram and function of satellite earth station4.2 Subsystems of satellite :Block diagram and Principle[08]• Power subsystem[08]-• Communication channel subsystem[08]• Attitude control subsystem-• Thermal control subsystem-• Telemetry tracking and command subsystem-• Main & auxiliary propulsion subsystem-• Antenna subsystem-• Antenna subsystem-• Draw constructional sketch of fiber optic cable-> Classify optical fibers06• Optical spectrum: Band name and its range.06	• look angle altitude, elevation angle, Azimth angle footprint & station	10	16
 Block diagram and function of satellite earth station 4.2 Subsystems of satellite :Block diagram and Principle [08] Power subsystem Communication channel subsystem Attitude control subsystem Thermal control subsystem Telemetry tracking and command subsystem Main & auxiliary propulsion subsystem Antenna subsystem Topics 5: Theory of optics & fundamentals of optical fiber Specific Objectives: Draw constructional sketch of fiber optic cable Classify optical fibers Optical spectrum: Band name and its range. 	keeping V	10	16
 4.2 Subsystems of satellite :Block diagram and Principle [08] Power subsystem Communication channel subsystem Attitude control subsystem Thermal control subsystem Telemetry tracking and command subsystem Main & auxiliary propulsion subsystem Antenna subsystem Antenna subsystem Topics 5: Theory of optics & fundamentals of optical fiber Specific Objectives: Draw constructional sketch of fiber optic cable Classify optical fibers 06 12 	 Block diagram and function of satellite earth station 		
 Power subsystem Communication channel subsystem Attitude control subsystem Thermal control subsystem Telemetry tracking and command subsystem Main & auxiliary propulsion subsystem Antenna subsystem Antenna subsystem Topics 5: Theory of optics & fundamentals of optical fiber Specific Objectives: Draw constructional sketch of fiber optic cable Classify optical fibers 06 12 	4.2 Subsystems of satellite :Block diagram and Principle [08]		
 Communication channel subsystem Attitude control subsystem Thermal control subsystem Telemetry tracking and command subsystem Main & auxiliary propulsion subsystem Antenna subsystem Topics 5: Theory of optics & fundamentals of optical fiber Specific Objectives: Draw constructional sketch of fiber optic cable Classify optical fibers 06 12 Contents: Optical spectrum: Band name and its range. Its range. 	• Power subsystem		
 Attitude control subsystem Thermal control subsystem Telemetry tracking and command subsystem Main & auxiliary propulsion subsystem Antenna subsystem Antenna subsystem Topics 5: Theory of optics & fundamentals of optical fiber Specific Objectives: Draw constructional sketch of fiber optic cable Classify optical fibers 06 12 Contents: Optical spectrum: Band name and its range. 	Communication channel subsystem		
 Thermal control subsystem Telemetry tracking and command subsystem Main & auxiliary propulsion subsystem Antenna subsystem Topics 5: Theory of optics & fundamentals of optical fiber Specific Objectives: Draw constructional sketch of fiber optic cable Classify optical fibers 06 12 Contents: Optical spectrum: Band name and its range. 	Attitude control subsystem		
 Telemetry tracking and command subsystem Main & auxiliary propulsion subsystem Antenna subsystem Topics 5: Theory of optics & fundamentals of optical fiber Specific Objectives: Draw constructional sketch of fiber optic cable Classify optical fibers Contents: Optical spectrum: Band name and its range. Image: Content state of the state of th	Thermal control subsystem		
 Main & auxiliary propulsion subsystem Antenna subsystem Topics 5: Theory of optics & fundamentals of optical fiber Specific Objectives: Draw constructional sketch of fiber optic cable Classify optical fibers 06	 Telemetry tracking and command subsystem 		
● Antenna subsystem Image: Constructional sketch of fiber optic cable ▶ Draw constructional sketch of fiber optic cable 06 ▶ Classify optical fibers 06 • Optical spectrum: Band name and its range. Image: Constructional sketch of starting its range.	 Main & auxiliary propulsion subsystem 		
Topics 5: Theory of optics & fundamentals of optical fiberSpecific Objectives:> Draw constructional sketch of fiber optic cable> Classify optical fibers0612Contents:• Optical spectrum: Band name and its range.	Antenna subsystem		
Specific Objectives: > > Draw constructional sketch of fiber optic cable > > Classify optical fibers 06 12 Contents: • Optical spectrum: Band name and its range. 06	Topics 5: Theory of optics & fundamentals of optical fiber		
 Draw constructional sketch of fiber optic cable Classify optical fibers Optical spectrum: Band name and its range. 	Specific Objectives:		
 Classify optical fibers Contents: Optical spectrum: Band name and its range. 	Draw constructional sketch of fiber optic cable	0.6	10
Optical spectrum: Band name and its range.	 Classify optical fibers 	06	12
• Optical spectrum. Band name and its range.	Contents:		
Definition & concept of reflection refraction dispersion diffraction	 Optical spectrum. Dation failler and its failinge. Definition & concept of reflection refraction dispersion differention 		

 ,absorption & scattering with help of light theory Definition of critical angle, Snell's law, numerical aperture, acceptance angle, acceptance cone. Advantages & disadvantages of Fiber Optic communication Block diagram of Fiber Optic communication system Topics 6: Optical Communication System Specific Objectives: Explain construction & working of LED, Laser and avalanche photo diode. Explain splicing techniques Know causes of losses in fiber optic system and minimize them. Contents: Optical fiber optics cable and its losses [08] Optical fiber types & characteristics. 		
 6.2 Optical sources and detectors [04] Optical sources: Edge emitter and Surface emitter LED, Laser construction & working principle, Comparison of different sources. Photo Detector: Review of PIN photo diode, avalanche photo diodeconstruction & working principle. 6.3 Splicers and connectors : [04] Splicing techniques- Properties of splicing, fusion splice, V-groove splice and elastic tube splice. Fusion splice and V-groove splice Fiber connector-properties of connector, ferrule connector 6.4 Attenuation measurements: OTDR block diagram, working principle, and OTDR trace 	12	16
Total	64	100

Practical: Skills to be developed:

Intellectual Skills:

- 1. Interpret the characteristics.
- 2. Identify and select the microwave devices.
- 3. Calculate different parameters.

Motor Skills:

- 1. Measure different quantities related to waveguides and microwave devices.
- 2. Verify characteristics of microwave devices, fiber optic sources and detectors.

List of Practical:

- 1. Write specifications of Microwave Test Bench and five major Microwave components.
- 2. Verify the characteristics of Reflex Klystron.

- 3. Verify characteristics of microwave tees E-plane, H-plane and E-H plane.
- 4. Verify characteristics of the isolator.
- 5. Verify characteristics of circular.
- 6. Verify properties of Multi-Hole Directional Coupler.
- 7. Calculate the Numerical Aperture(NA) of given optical fiber by using Trigonometric method (visual method)
- 8. Measure the bend loss and attenuation in given FOC
- 9. Plot (i) V-I characteristics of LED (ii) Characteristics of the output light intensity against forward current of LED
- 10. V-I characteristics of photo-diode (Detector) at different luminance.

Assignments:

- 1. Radar- Block diagram and operation of pulsed radar system.
- 2. Satellite communication- Block diagram and operation of satellite Earth Station.
- 3. Visit to Earth station/ Radio station/ TV relay station/ Airport/ BSNL.

Learning Resources: Books:

Sr. No.	Author	Title	Publisher
01	John F Kennedy	Electronic Communication system	Tata McGraw Hill
02	Willium Schewber	Electronic Communication system	PHI publication
03	Wayne Tomasi	Advanced Electronic Communication system	PHI / Pearson publication
04	Gerd Keiser	Optical Fiber Communication	Tata McGraw Hill