

ADVANCED COMMUNICATION

Subject Title : **ADVANCED COMMUNICATION**
Subject Code : **EC**
Hours Per Week : **04**
Hours Per Semester : **64**

TOPIC ANALYSIS

SL. No	Major Topics	Hours Allotted
UNIT-I		
1	Microwave devices	09
2	Radar principles	11
UNIT-II		
3	Satellite fundamentals	06
4	Satellite communication system	07
5	Satellite applications	07
UNIT-III		
6	Digital Telephony	05
7	Mobile communications	15
	Tests and revision	04
	Total	64

On the completion of the course the students should be able to:

1. Understand the importance of microwave signals and devices.
2. Understand the working principle of RADAR system.
3. Understand the satellite communication system and its applications.
4. Understand the working of Digital telephony.
5. Understand the working principle of Mobile communication.

Details of Course Contents

1. MICROWAVE DEVICES

Microwave signals - challenges and applications. Waveguides-introduction, types, application, energy coupling, operating range, mode of operation, TE and TM modes. Cavity resonators-operation, types and applications. Microwave semiconductor devices, Microwave tubes-construction, working of two cavity klystron, Reflex klystron, Magnetron, TWT and mention their practical consideration and applications.

2. RADAR PRINCIPLES

Radar principle, Radar frequencies and powers, Definition of pulse, PW, PRF, PRI, average power, peak power and duty cycle. Radar range equation, factors influencing radar range, simple problems. Block diagram of pulse radar system, modulator, duplexer, displays, antenna scanning and tracking, special purpose radars-MTI system, radar beacons, CW Doppler radar, FMCW Radar, Aircraft landing system- GCA, and ILS.

3. SATELLITE FUNDAMENTALS

Definition of satellite, orbit fundamentals, orbit shape, satellite speed and period, angles, satellite repeater, geosynchronous satellites, LEO, MEO, GEO satellites, station keeping, attitude control and satellite position.

4. SATELLITE COMMUNICATION SYSTEM

Satellite communication system-transponder, frequency allocation, satellite bandwidth, increasing channel capacity, frequency reuse and spatial isolation. Satellite subsystem - block diagram explanation, architecture and organization transponders-types and explanation of each, multi channel system, application payload. Earth station- blocks diagram and explanation of each section.

5. SATELLITE APPLICATIONS

Introduction to satellite applications-different areas, satellite television- direct broadcast satellite, cable TV, direct home reception, telephone services via satellite, data communication services, satellite for earth observation, satellites for military applications, GPS, VSAT.

6. DIGITAL TELEPHONY

Digital exchange-introduction, block diagram of digital exchange, mass memory, call processing in an electronic exchange, types of signaling, national subscriber dialing, basic telecommunication network and network hierarchy.

7. MOBILE COMMUNICATIONS

Evolution of mobile radio communication-1G,2G,3G,4G cellular networks , cellular concept- frequency re-use, Capacity expansion techniques, channel allocation, working of a typical cellular system, cellular component identification. Call establishment-mobile terminated and mobile originated call, mobility management-location management, location updating, paging messages, and handoff strategies.

GSM-GSM services and features, GSM system architecture, IS 95 CDMA,CDMA 2000 system-services and features, architecture.

SPECIFIC INSTRUCTIONAL OBJECTIVES

1.0 MICROWAVE DEVICES

- 1.1 Introduction to microwave signals, bandwidth benefits, challenges and applications.
- 1.2 Introduction to waveguides and discuss its importance.
- 1.3 List the types and application of waveguides.
- 1.4 Explain energy coupling, operating range, mode of operation, TE and TM modes.
- 1.5 Explain the operation, types and applications of Cavity resonators.
- 1.6 List the microwave semiconductor devices and discuss the importance of Schottky diode, Varactor diode, Tunnel diode and Gunn diode for microwave applications.
- 1.7 Explain the construction, working of two cavity klystron and Mention the practical considerations and applications.
- 1.8 Explain the construction, working of Reflex klystron and Mention the practical considerations and applications.
- 1.9 Explain the construction, working of Magnetron and Mention the practical considerations and applications.
- 1.10 Explain the construction, working of TWT and Mention the practical considerations and applications.

(For 1.1 to 1.6 Refer article no.10.1 to 10.3 of TEXT 2 and for 1.7 to 1.10 Refer article no.11.2, 11.3, 11.4 and 11.5 of TEXT 1)

2.0 RADAR PRINCIPLES

- 2.1 Explain the Radar basic principles.

- 2.2 List the frequencies and powers used.
 - 2.3 Define pulse, PW, PRF, average power, peak power and duty cycle and solve simple problems.
 - 2.4 Derive Radar range equation.
 - 2.5 Discuss the factors influencing radar range simple problems.
 - 2.6 Explain Block diagram of pulse radar system.
 - 2.7 Discuss the different antenna scanning and tracking methods.
 - 2.8 List the types of modulators.
 - 2.9 Explain branch type duplexer.
 - 2.10 Explain A-scope and PPI displays.
 - 2.11 Explain the special purpose Radars-Doppler effect, MTI system, Radar beacons, CW Doppler radar and FMCW Radar.
 - 2.12 Explain the Aircraft landing systems –GCA and ILS.
- (For 2.1 & 2.2, 2.4 to 2.11 of TEXT 1 and for 2.3 and 2.12 Refer TEXT 3)

3.0 SATELLITE FUNDAMENTALS

- 3.1 Define a satellite. Distinguish between passive and active satellites.
- 3.2 Explain satellite orbits, orbit fundamentals, orbit shape, satellite speed, period and angles.
- 3.3 Explain satellite repeater.
- 3.4 Explain geosynchronous satellites.
- 3.5 Compare LEO, MEO and GEO satellites.
- 3.5 Explain station keeping, attitude control and satellite position.

4.0 SATELLITE COMMUNICATION SYSTEM

- 4.1 Discuss Satellite communication system regarding transponder, frequency allocation, satellite bandwidth, increasing channel capacity, frequency reuse and spatial isolation.
- 4.2 Explain the role of each section of a Satellite subsystem with a block diagram.
- 4.3 Explain the different types of transponders and explain applications payload.
- 4.4 Explain the working of each section of a typical Earth station with a block diagram.

(For chapter 3 and 4 refer article no.11.1 to 11.4 of TEXT 2)

5.0 SATELLITE APPLICATIONS

- 5.1 Introduction to satellite applications.
- 5.2 Discuss the Satellite applications in different areas.
- 5.3 Discuss Satellite television systems such as direct broadcast satellite, cable TV and direct home reception and explain DBS-TV receiver.
- 5.4 Explain telephone services via satellite.
- 5.5 Discuss the data communication services-data broadcasting using satellite and interactive data communication.
- 5.6 List the various applications of Satellite for earth observation.
- 5.7 List the military applications of satellite.
- 5.8 Introduction to GPS and explain the constituents of a GPS system.
- 5.9 List the technical structure and the services provided by GPS.
- 5.10 Explain the finding the position of GPS receiver using Trilateration method.
- 5.11 Give the GPS position location layout.
- 5.12 Explain the block diagram of a GPS receiver.
- 5.13 List the applications of GPS system.
- 5.14 Discuss the VSAT concept and its application in WLL networks.

(For 5.1 to 5.8 Refer article no.16.1 to16.6,16.9,16.10 and for 5.9 to 5.13 Refer article no 21.1 to 21.3,21.4,21.6,21.9 and for 5.14 refer 20.1 and 20.2 of TEXT 4)

6.0 DIGITAL TELEPHONY

- 6.1 Introduction to Digital exchange
- 6.2 Explain the block diagram of digital exchange.
- 6.3 Explain the mass memory of SPC system.
- 6.4 Explain the call processing in an electronic exchange.
- 6.5 Discuss the types of signaling -out-band, in-band, common channel signaling.
- 6.6 Explain national subscriber dialing.
- 6.7 Explain the basic telecommunication network.
- 6.8 Explain network hierarchy.

(For 6.1 to 6.8 Refer article no.23.1 of TEXT 4)

7.0 MOBILE COMMUNICATIONS

- 7.1 Briefly discuss the Evolution of mobile radio communication.
- 7.2 List the 1G, 2G, 3G, 4G cellular networks, their important features in the form of a table.
- 7.3 Discuss the cellular concept and frequency re-use with example.
- 7.4 Explain Capacity expansion techniques-cell splitting and cell sectoring.
- 7.5 Explain channel allocation with examples.
- 7.6 Discuss the multiple access techniques used.
- 7.7 Explain the working of a typical cellular system.
- 7.8 Explain cellular component identification.
- 7.9 Explain call establishment sequence in mobile terminated and mobile originated call.
- 7.10 Explain mobility management-location management, location updating, paging messages.
- 7.11 Explain handoff strategies.
- 7.12 Introduction to GSM system and list its specifications.
- 7.13 List the services and features of GSM.
- 7.14 Explain GSM system architecture.
- 7.15 Mention the features of IS-95 CDMA.
- 7.16 Explain the network nodes of CDMA 2000 system.
- 7.17 List the features of CDMA 2000 system.

(For 7.1, 7.2, 7.6 to 7.7, 7.11 to 7.15 TEXT 5 for 7.2 TEXT 5 and 6, for7.4, 7.5, 7.8 to 7.10 ,7.9,7.16 and 7.17 TEXT 6)

TEXT BOOKS:

- 1 Electronic communication system by George Kennedy and Davis Fourth Edition.
- 2 Communication Electronics by Frenzil Third Edition, TMH Publications
- 3. Radio Engineering by F E Terman, TMH Publications
- 4 Satellite communications by Dr. D.C. Agarwal. Seventh edition, Khanna publishers.
- 5. Wireless communications by Theodore S.Rappaport. II Edition,PHI publications.
- 6. Introduction to wireless telecommunications systems and networks by Mullett, CENGAGE Learning.

REFERENCE BOOKS

1. Advanced Communication By –K Shashidhar, Sapna Publications
2. Mobile and personal communications system and services by Raj Pandya.PHI
3. Electronic communication system by Rodi and Coolen
4. Mobile communications by Jochen Schiller.
5. Satellite Communication by Anil K Maini, Wiley India Publications
6. Introduction to Radar Systems by Skolnic, TMH Publications

DEPARTMENT OF TECHNICAL EDUCATION

DIPLOMA COURSE IN ELECTRONICS AND COMMUNICATION ENGINEERING

FIFTH SEMESTER

ADVANCED COMMUNICATION

MODEL QUESTION PAPER

NOTE: Section 1 is compulsory, answer two questions each from the remaining three sections.

SECTION-1

Q 1a) Fill in the blanks with appropriate words: (1X5=5)

- a) ----- Modulation technique is used in A-Scope.
- b) MTI is also called-----Doppler radar.
- c) TWT uses ----- to reduce the velocity of RF wave.
- d) Minimum -----number of geosynchronous satellites are required to cover the entire earth for communication.
- e) The process of transferring a call from one cell to another during a call is called -----

1b) Explain the working of FMCW radar with block diagram. (5)

SECTION-2

Q 2a) List the HF limitations of HF conventional tubes. (3)

b) Explain operation of magnetron as microwave oscillator with necessary sketches. (7)

c) What is cavity resonator? Explain the working of cavity resonator.(5)

Q 3a) Define Pulse width, Peak power, duty cycle (3)

b) Derive Maximum Radar range equation. (6)

c) What is a duplexer? Explain how duplexer is used as microwave switch. (6)

- Q 4a) Explain the working operation of MTI radar system with a neat block diagram. (8)
- b) Explain the working of ILS. (7)

SECTION-3

- Q 5a) Define Satellite orbit? Explain geosynchronous satellite. (5)
- b) Explain Satellite subsystems with neat block diagram. (7)
- c) What is the necessity of the transponder in satellites and list various types of transponders. (3)
- Q 6a) What are the services provided by GPS? Explain various constituents of GPS system. (8)
- b) Explain how position of GPS receiver is located using trilateration method. (5)
- c) List the applications of GPS. (2)
- Q 7a) Explain telephone services via satellite. (5)
- b) Explain how cable TV service is provided by the satellites. (5)
- c) List various applications of satellite for Earth observation. (5)

SECTION-4

- Q 8a) Explain the block diagram of digital exchange. (5)
- b) Explain In-band, Out-band and Common Channel Signaling. (6)
- c) Compare 2G and 3G cellular network features. (4)
- Q 9a) Explain frequency reuse, mobility management and handoff strategies used in cellular network. (7)
- b) Explain the architecture of GSM system. (8)
- Q10a) Explain call establishment procedure for mobile originated call. (5)
- b) Explain the architecture of CDMA 2000 System. (7)
- c) List any three services and features of CDMA 2000 system. (3)
