

SATELLITE COMMUNICATION & REMOTE SENSING
(ECEN 4242)

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 4 (four) from Group B to E, taking one from each group.*

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) Which technique uses spot beam antennas to divide the area covered by the satellite into smaller segments?
(a) Spatial isolation (b) Frequency reuse
(c) Multiplexing (d) Modulation.
- (ii) In order to circularize an elliptical orbit, the required maneuver is executed at
(a) Apogee (b) Perigee
(c) Either apogee or perigee (d) None of these.
- (iii) What is the reason for shifting from c band to ku band in satellite communication?
(a) Lesser attenuation (b) Less power requirements
(c) More bandwidth (d) Overcrowding.
- (iv) A satellite injected into space from a launch station having a longitude of 45°W and a latitude of 5°N is likely to have an orbit inclination immediately after injection of
(a) 5° (b) 35° (c) 30° (d) 40°
- (v) Frequency in UHF range propagate by
(a) Ground wave (b) Sky waves
(c) surface waves (d) Space waves
- (vi) Where was the first experimental satellite telecommunication earth station built in India?
(a) Allahabad (b) Ahmedabad
(c) Aurangabad (d) Aiswal.
- (vii) What is the reason for carrying multiple transponders in a satellite?
(a) More number of operating channel (b) Better reception
(c) More gain (d) Redundancy.

- (viii) Energy flux may affect which of the following?
 (a) Lens (b) Aperture
 (c) Strength of signal (d) Declination.
- (ix) What is application of satellite systems?
 (a) whether forecasting (b) Terrestrial communication
 (c) point to point communication (d) None of the above.
- (x) The frequency below which the entire power gets absorbed is called ____
 (a) Maximum usable frequency (b) Optimum frequency
 (c) Critical frequency (d) Hopping frequency.

Fill in the blanks with the correct word

- (xi) The intensity of Rayleigh scattering varies inversely to the _____ power of wavelength.
- (xii) An EM wave of longer wavelength has _____ energy content.
- (xiii) The Earth approximates a black body of _____ K.
- (xiv) Remote sensing techniques make use of the properties of _____.
- (xv) The type of access used in GSM technology is _____.

Group - B

2. (a) Explain modulation techniques commonly used in satellite communication. How do these techniques facilitate efficient data transmission? [[CO2](Apply/IOCQ)]
- (b) How do factors like rain attenuation and ionospheric disturbances affect signal propagation? [[CO2](Remember/LOCQ)]
- 8 + 4 = 12**
3. (a) Describe the characteristics of geostationary orbit. How is it different from other types of orbits? [[CO2](Understand/LOCQ)]
- (b) Write about the principles of rocket propulsion and powered flight in the context of launch vehicles. [[CO2](Analyse/IOCQ)]
- (3 + 3) + 6 = 12**

Group - C

4. (a) Explain the functions of Telemetry, Tracking, and Command (TT&C) in satellite communication. [[CO3](Understand/LOCQ)]
- (b) Give the brief idea about the spacecraft antennas, transponders, and their contributions to satellite communication. [[CO3](Apply/IOCQ)]
- (2 + 2 + 2) + (3 + 3) = 12**
5. (a) Define the G/T ratio of an earth station in satellite communication. Discuss its significance and how it relates to the performance of the earth station in receiving satellite signals. [[CO3](Evaluate/HOCQ)]

- (b) Explain the Friis transmission equation and its relevance to satellite communication systems.

[[CO3](Remember/LOCQ)]

(4 + 3) + 5 = 12

Group - D

6. (a) Sketch a neat diagram of the various paths of radiance received by a Remote Sensing System. Explain clearly the cause of each and every radiance path.

[[CO3](Apply/IOCQ)]

- (b) Explain with the help of diagrams the types of scanning methods used in the Landsat satellite sensors.

[[CO3](Apply/IOCQ)]

(4 + 4) + 4 = 12

7. (a) Express the Radiation Budget Equation. Explain each term in the equation.

[[CO4](Understand/LOCQ)]

- (b) Define Radio Occultation.

[[CO4](Understand/LOCQ)]

- (c) Express the meaning of multi spectral data collection. Illustrate how the spectral signature of various land covers are useful in remote sensing data collection. Give two examples of sensors capable of collecting multi spectral data.

[[CO5](Analyse/IOCQ)]

4 + 2 + 6 = 12

Group - E

8. (a) Explain the role of weather forecasting radars in meteorology. How do these radars operate, and what types of weather phenomena can they detect?

[[CO6](Remember/LOCQ)]

- (b) Explain the concept of SODAR (Sonic Detection and Ranging) and its role in atmospheric research.

[[CO6](Remember/IOCQ)]

(3 + 4) + 5 = 12

9. (a) Describe the functions and significance of Telemetry, Telecommand, and Ranging (TTR) stations in satellite communication and control.

[[CO5](Remember/LOCQ)]

- (b) Explain the principles of LIDAR (light detection and ranging) technology. How is LIDAR used in atmospheric research and remote sensing applications?

[[CO6](Analyse/IOCQ)]

(2 + 2 + 2) + (3 + 3) = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	41.7	51	7.3

Course Outcome (CO):

After the completion of the course students will be able to

1. Know the basic principles of satellite communication and its various application areas in remote sensing.
2. Realize the physical, architectural and networking issues of the satellite system.
3. Understand modulation, coding and multiple access schemes, and review areas as speech and video coding, satellite networking, internet over satellite and satellite personal communications.

4. Know parameters associated with remote sensing using satellites through the use of mathematical and logical tools to gain insight into the concept.
5. Using basics of remote sensing principles and technology acquire knowledge about the important applications for satellite remote sensing in research and the public and private sectors.
6. Gain knowledge about the remote sensing techniques about various applications to improve social, economic and environmental conditions under agricultural, forestry and water body management

**LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*