

**SATELLITE COMMUNICATION & REMOTE SENSING
(ECEN 4242)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

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

**Group – A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Apogee is
 - (a) the point farthest from earth
 - (b) the point nearest from earth
 - (c) the point smallest from earth
 - (d) none of the above.
 - (ii) Calculate the radius of a circular orbit for which the period is 1 day?
 - (a) 42.241km
 - (b) 42.241m
 - (c) 4.241km
 - (d) 2.241km.
 - (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) 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.
 - (v) Which of the following is the first artificial satellite?
 - (a) Sputnik
 - (b) GSAT-17
 - (c) INTELSAT 1
 - (d) IRNSS 1H.
 - (vi) A satellite link uses different frequencies for receiving and transmitting in order to
 - (a) avoid interference from terrestrial microwave links
 - (b) avoid interference between its powerful transmitted signal and weak in coming signal
 - (c) minimise free-space losses
 - (d) maximise antenna gain.

- (vii) As the height of the satellite orbit gets lower, the speed of the satellite
(a) Increases (b) Decreases
(c) Remains the same (d) None of the above.
- (viii) A transponder is a satellite equipment which
(a) receives a signal from Earth station and amplifies
(b) changes the frequency of the received signal
(c) retransmits the received signal
(d) does all of the above-mentioned functions.
- (ix) Among the following, which describes Stefan- Boltzmann formula?
(a) $M = \sigma/T^4$ (b) $M = \sigma \cdot T^4$
(c) $M = \sigma + T^4$ (d) $M = \sigma \cdot T^4$.
- (x) Remote sensing uses which of the following waves in its procedure?
(a) Electric field (b) Sonar waves
(c) Gamma-rays (d) Electromagnetic waves.

Group- B

2. (a) Compare the conditions required for an orbit to be Geostationary or geosynchronous. [(C01)(Understand/LOCQ)]
(b) Define Sun Transit outage. [(C01)(Remember/LOCQ)]
(c) Explain the effect of non spherical earth atmospheric drag on the satellite orbit. [(C01)(Analyze/IOCQ)]
4 + 4 + 4 = 12
3. (a) Illustrate the phenomenon of Doppler shift and explain a useful application of this phenomenon. [(C01)(Analyze/IOCQ)]
(b) Compare between LEO, GEO and MEO satellites. [(C01)(Understand/LOCQ)]
(c) Explain the following propagation effects of the atmosphere:
(i) Faraday rotation of ionosphere
(ii) Scintillation. [(C01)(Analyze/IOCQ)]
4 + 4 + 4 = 12

Group – C

4. (a) Outline the different types of transmission losses in satellite communication with necessary expression. [(C03)(Analyze/IOCQ)]
(b) Distinguish the function of FDMA and TDMA in respect of the uplink power requirements of satellite. [(C03)(Analyze/IOCQ)]
6 + 6 = 12
5. (a) Deduce the Friis transmission equation explaining each term properly. [(C02)(Analyze/IOCQ)]

- (b) A geostationary satellite at a distance of 36,000 km from the surface of the earth radiates power of 10 W in the desired direction through an antenna having a gain of 20 dB. (i) Evaluate the power density at a receiving station on the surface of the earth (ii) Assess the amount of power received by the antenna having an effective aperture of 10 m². [[C02](Evaluate/HOCQ)]
- (c) Interpret the significance of G/T ratio. [[C02](Understand/LOCQ)]
- 6 + 4 + 2 = 12**

Group - D

6. (a) Illustrate the propagation of electromagnetic radiation through the atmosphere of the earth. [[C04](Understand/LOCQ)]
- (b) Outline the advantages and the limitations of remote sensing. [[C05](Analyze/IOCQ)]
- 6 + 6 = 12**
7. (a) Outline the functions of LANDSAT-MSS scanning method, with necessary schematic diagram. [[C05](Analyze/IOCQ)]
- (b) Critically analyze the necessity of introducing filters in remote sensing. [[C05](Evaluate/HOCQ)]
- (c) Outline the different type of filters used in aerial photography. [[C05](Analyze/IOCQ)]
- 6 + 3 + 3 = 12**

Group - E

8. (a) Outline with the relevant diagram the use and function of LiDAR sensor. [[C06](Analyze/IOCQ)]
- (b) Illustrate the brief idea about the weather forecasting radar. [[C06](Remember/LOCQ)]
- 6 + 6 = 12**
9. (a) What is doppler effect? Explain the function of SODAR. [[C06](Remember/LOCQ)]
- (b) Illustrate the different applications of satellite ranging stations. Describe the function of MLS (Microwave Limb Sounder). [[C06](Understand/LOCQ)]
- (2 + 4) + (3 + 3) = 12**

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	39.58	53.13	7.29

Course Outcome (CO):

- 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