

**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) Which of the following is the first artificial satellite?
(a) Sputnik (b) GSAT-17
(c) INTELSAT 1 (d) IRNSS 1H.
- (ii) 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.
- (iii) A communication satellite uses _____ to transmit signal.
(a) Antenna (b) Transponder (c) Oscillator (d) VCO
- (iv) Orbital parameter that tells about the periodicity with which a remote sensing satellite revisits a given plane on the surface of Earth is known as
(a) Orbital period (b) Orbital cycle
(c) Orbital Velocity (d) Orbital plane inclination.
- (v) 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.
- (vi) 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) $M = \sigma * T^4$.
- (vii) Which of the following is not a classification of scattering principle?
(a) Faraday scattering (b) Raleigh scattering
(c) Mie scattering (d) Non-selective scattering.
- (viii) 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.

- (ix) 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°.
- (x) The multiple access technique in which each earth station is able to access only a small part of the transponder bandwidth is
(a) FDMA (b) TDMA (c) CDMA (d) None of these.

Group- B

2. (a) Compare the conditions required for an orbit to be Geostationary or geosynchronous. [(CO1)(Understand/LOCQ)]
(b) Discuss the launch mechanism of a geostationary satellite. [(CO1)(Remember/LOCQ)]
(c) Explain the possible causes of perturbation of the satellite orbit? [(CO1)(Analyze/IOCQ)]
4 + 3 + 5 = 12
3. (a) Compare with the function and use of GEO, MEO & LEO satellite. [(CO1)(Evaluate/HOCQ)]
(b) Briefly illustrate the important design considerations that need to be addressed while designing the structural subsystem of the satellite. [(CO2)(Understand/LOCQ)]
6 + 6 = 12

Group - C

4. (a) Classify the different types of noise and their significance in the design of a satellite link with necessary expression. [(CO2)(Analyze/IOCQ)]
(b) Briefly describe the functional principle of a time division multiple access (TDMA). [(CO3)(Analyze/LOCQ)]
(c) Explain the processing gain with reference to CDMA. [(CO3)(Understand/LOCQ)]
6 + 3 + 3 = 12
5. (a) Explain the Faraday rotation and scintillation phenomena. How do these phenomena adversely affect the satellite reception? [(CO4)(Understand/LOCQ)]
(b) Illustrate with the proper estimation of Link Budget of a satellite communication link. [(CO2)(Evaluate/HOCQ)]
(c) A 12 GHz receiver consists of an RF stage with gain $G_1=30\text{dB}$ and noise temperature $T_1=20\text{K}$, a down converter with gain $G_2=10\text{dB}$ and noise temperature $T_2=360\text{K}$ and an IF amplifier stage with gain $G_3=15\text{dB}$ and noise temperature $T_3=1000\text{K}$. Calculate the effective noise temperature and noise figure of the system. Take reference temperature to be 290K. [(CO3)(Evaluate/HOCQ)]
(2 + 2) + 4 + 4 = 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](Analyze/IOCQ)]
4 + 2 + 6 = 12

Group - E

8. (a) Explain how visible satellite images are used in the identification of cloud. [[CO6](Understand/LOCQ)]
 (b) Illustrate in brief the merits and de-merits of using satellites for weather forecasting as compared to the conventional methods. [[CO6](Analyze/IOCQ)]
 (c) Briefly discuss the mission Megha-Torpiques. [[CO6](Understand/LOCQ)]
4 + 4 + 4 = 12
9. (a) Explain the remote sensing technique by LIDAR. [[CO6](Analyze/IOCQ)]
 (b) Discuss Telemetry tracking and Command with respect to communicating with a satellite from ground station. [[CO5](Understand/LOCQ)]
 (c) Illustrate the SODAR technique of remote sensing. [[CO6](Analyze/IOCQ)]
4 + 4 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	42.71	42.71	14.58

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.