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) Most LEO satellites that are allocated for mobile satellite communications, operate in L band in the
(a) 1500 & 1600MHz band (b) 1500 MHz band
(c) 1700 MHz band (d) 600 & 1700 MHz band

(ii) Orbit control is required to correct the effects of
(a) asymmetric gravitational field (b) solar radiation pressure
(c) lunar attraction (d) all the perturbation forces

(iii) The orbital period in case of Monliya satellites is
(a) 12 hr (b) 24 hr (c) 8 hr (d) 16 hr

(iv) The satellite subsystem that ensures that the antenna remain pointed towards a fixed point on the earth surface is
(a) attitude and orbit control subsystem (b) TT&C subsystem
(c) Antenna subsystem (d) Structural subsystem

(v) Geosynchronous orbit may be
(a) circular type (b) non-circular type
(c) both (a) and (b) (d) elliptical type

(vi) Subsatellite point lies directly between the satellite and center of the
(a) Earth station (b) Earth
(c) Moon (d) Equatorial plane

(vii) Which of the following best describes passive remote sensing?
(a) Uses its own source of illumination
(b) Uses artificial light to illuminate objects
(c) Relies on natural radiation from the target
(d) Sends radio waves and measures their reflection

(viii) What is the spectral signature of water in the near-infrared spectrum?
(a) High reflectance (b) Low reflectance
(c) High absorption (d) Both (b) and (c)

(ix) Which of the following instruments measures sea surface temperature using remote sensing?
(a) Scatterometer (b) Radiometer
(c) Altimeter (d) LIDAR

(x) Which satellite mission is dedicated to tropical rainfall measurement?
(a) AURA MLS (b) TRMM
(c) Megha-Tropiques (d) LANDSAT

Fill in the blanks with the correct word

(xi) The AKM is used to ____ Circularize____ the orbit at GEO.

(xii) Satellite system noise temperature (k) can be calculated from the noise temperature of the _____ satellite _____ Antenna.

(xiii) _____ rain _____ attenuation is the most important of the various losses above 10GHz.

(xiv) Remote sensing is the process of acquiring information about an object or phenomenon without _____ with it.

(xv) Passive remote sensing relies on _____ radiation, while active remote sensing systems provide their own source of energy.

Group - B

2. (a) Describe briefly with proper diagram the various mechanism of placing a satellite in geostationary orbit. *[(CO3)(Understand/LOCQ)]*
(b) State the Kepler's laws used in satellite communication. *[(CO1)(Remember/LOCQ)]*
8 + 4 = 12

3. (a) Analyze the reasons for which downlink frequencies are lower than uplink frequencies. *[(CO2)(Analyze/IOCQ)]*
(b) A satellite is in an elliptical orbit with a perigee of 1000 km and an apogee of 4000km. Using a mean earth radius of 6378.14 km, find the period of the orbit in hours, minutes, and seconds and the eccentricity of the orbit. Consider $\mu=3.986004418x10^5$ km^3 $/s^2$. *[(CO2) (Evaluate/HOCQ)]*
6 + 6 = 12

Group - C

4. (a) Differentiate between geosynchronous and geostationary orbits. *[(CO1)(Apply/IOCQ)]*
(b) Briefly describe the functions of antenna sub-sysytem. *[(CO1)(Remember/LOCQ)]*
6 + 6 = 12

5. (a) A 12 GHz receiver consists of an RF stage with gain G_1=30dB and nise temperature T_1=20K, a down converter with gain G_2=10dB and noise temperature T_2=360K and an IF amplifier stage with gain G_3=15dB and noise temperature T_3=1000K. Calculate the effective noise temperature and noise figure of the system. Take reference temperature to be 290K. *[(CO3)(Evaluate/HOCQ)]*

(b) Explain the Faraday rotation and scintillation phenomena. How do these phenomena adversely affect the satellite reception? *[(CO2)(Understand/LOCQ)]*

(c) Explain the processing gain with reference to CDMA. *[(CO2)(Understand/LOCQ)]*

4 + (2 + 3) + 3 = 12

Group - D

6. (a) Illustrate the propagation of Electromagnetic radiation through the atmosphere of the earth. *[(CO4)(Understand/LOCQ)]*

(b) Outline the advantages and the limitation of Remote Sensing. *[(CO5)(Analyze/IOCQ)]*

6 + 6 = 12

7. (a) 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. *[(CO6)(Analyze/IOCQ)]*

(b) Define Radio Occultation. *[(CO6)(Understand/LOCQ)]*

(c) How does radio occultation contribute to the collection of atmospheric data from space-based platforms? *[(CO6)(Understand/LOCQ)]*

6 + 2 + 4 = 12

Group - E

8. (a) Explain the role of weather forecasting radars in meteorology. *[(CO6)(Analyse/HOCQ)]*

(b) How do these radars operate, and what types of weather phenomena can they detect? *[(CO4)(Remember/LOCQ)]*

6 + 6 = 12

9. (a) Describe the Tropical Rainfall Measuring Mission (TRMM) satellite and its objectives. *[(CO5)(Remember/LOCQ)]*

(b) What technologies does TRMM utilize to measure tropical rainfall patterns? *[(CO5)(Remember/LOCQ)]*

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	58	25	17