SATELLITE COMMUNICATION AND APPLICATIONS
(ECEN 5141)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> 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) The unit that collects very weak signal from a broadcast satellite is
  (a) helical antenna   (b) satellite dish
  (c) LNA   (d) TWT.

(ii) For a satellite moving in a elliptical orbit with major axis of 42000 km and perigee of 8000 km, apogee is
  (a) 34240 km   (b) 35000 km
  (c) 50000 km   (d) 34000 km.

(iii) Molniya orbit is
  (a) 12 hour orbit   (b) widely used in Russia
  (c) highly eccentric   (d) all of (a), (b) and (c).

(iv) Orbital perturbations cause
  (a) a change in the orbit   (b) a change in orientation
  (c) a change in orbital parameters   (d) all of (a), (b) and (c).

(v) The satellite subsystem that monitors and controls the satellite is the
  (a) propulsion subsystem   (b) power subsystem
  (c) telemetry, tracking & command (d) communications subsystem.

(vi) 500 MHz bandwidth is allocates to
  (a) dish antenna   (b) satellite channels
  (c) tracking radar   (d) none of (a), (b) and (c).

(vii) Power amplification in a satellite transponder is provided by
  (a) TWTA   (b) LNA
  (c) Klystron   (d) Magnetron.

(viii) In Satellite packet communication, throughput signifies
  (a) packet size   (b) number of overhead bits
  (c) rate at which packets are transmitted (d) guard bits.

(ix) Polling method is used in
  (a) Satellite random access   (b) demand assigned FDMA
  (c) SDMA   (d) none of (a), (b) and (c).

(x) WHOLE GPS systems around the globe comprises of
  (a) 66 satellites   (b) 32 satellites
  (c) 24 satellites   (d) 16 satellites.

Group – B

2. (a) What are the typical frequency bands used in Satellite Communication? Why uplink frequency is kept higher than downlink?

(b) What are the advantages of Satellite network over terrestrial networks?

(c) Explain, with a diagram, the concept of coverage angle.

(3 + 3) + 4 + 2 = 12

3. (a) Explain the concept of Look angle and explain how Azimuth and Elevation are measured with proper diagram.

(b) The difference between the farthest and closest points in a satellite's elliptical orbit from the surface of the Earth is 30,000 km and the sum of the distances is 50,000 km. If the mean radius of the Earth is considered to be 6400 km, determine the orbit eccentricity.

6 + 6 = 12

Group – C

4. (a) With a diagram, explain how transponders are arranged in a satellite. What are active and passive transponders?

(b) Explain a typical satellite tracking system with a diagram.

(5 + 2) + 5 = 12

5. (a) Explain the salient features of an Earth Station antenna. What are its limitations?

(b) What are the essentials for uplink and downlink design?

6 + 6 =12

Group – D

6. (a) What is Digital Speech Interpolation technique and how Telephone load Activity Factor is arrived at?

(b) Draw and explain the TDMA burst structure.

6 + 6 = 12

7. (a) Explain the concepts of Frame acquisition and synchronization.

   (b) Derive the General link design equation of a Satellite link with an expression for carrier to noise ratio.

(3 + 3) + 6 = 12

Group – E

8. (a) With a suitable diagram, explain the principle of operation of Direct broadcast Satellite system.

   (b) What are the various segments in a GPS system? Explain briefly.

6 + 6 = 12

9. (a) Explain the concept of a polling VSAT network with a diagram.

   (b) Draw and explain briefly the concept of a typical Iridium Satellite constellation.

6 + 6 = 12