M.TECH/ECE/1ST SEM/ECEN 5141/2018
SATELLITE COMMUNICATION & 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 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) The whole world can be covered with
(a) two geo-stationary satellites (b) three geo-stationary satellites
(c) four geo-stationary satellites (d) five geo-stationary satellites.

(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) The point of intersection of satellite's orbital plane and equatorial plane where the satellite enters the northern hemisphere into southern hemisphere is called
(a) ascending node (b) perigee
(c) apogee (d) descending node.

(iv) Bit capacity of a TDMA system is
(a) dependent on bit rate
(b) independent of the number of accesses
(c) affected by terrestrial network
(d) none of these.

(v) Polling method of channel allocation is adopted by
(a) FDMA (b)CDMA (c) DFDMA (d) none of these.

(vi) Telephone load activity factor calculated through DSI technique is
(a) 0.35 (b) 0.25 (c) 0.75 (d) 0.45.

(vii) Ionosphere scintillation refers to
(a) Faraday rotation (b) amplitude and phase variation
(c) troposcatter (d) multipath effects.

(viii) G/T ratio of earth stations depend on
(a) quality of receiving earth station (b) LNA
(c) antenna (d) none of these

(ix) Satellite DTH system operates mainly in the
(a) Ku band (b) Ka band (c) L band (d) C band.

(x) Gateway stations are
(a) receive only stations
(b) interface between satellite and terrestrial network
(c) used by telephone network only
(d)interconnection with GPS.

Group – B

2. (a) What are the typical frequency bands used in satellite communication? Why is uplink frequency 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 how the power supply subsystem is organized in a satellite and what are the precautions to be taken.
(b) The apogee and perigee distances of a satellite are 45000 kms and 7000 kms. Calculate i) semi- major axis ii) eccentricity iii) distance between centre of earth and the centre of elliptical orbit.

6 + 6 = 12

Group – C

4.(a) How many transponders can be carried by a satellite and how many may be active? Explain with a diagram, the frequency plan for both uplink and downlink.
(b) With a diagram, explain how satellite tracking is done from earth station with reference to the tasks that are performed by it.

(2 + 4) + 6 = 12

5.(a) Derive and explain the basic satellite link design equation. What are the various loss factors that are taken into consideration?
(b) What are the various sources of interference in the link?

8 + 4 = 12

Group – D

6.(a) In a TDMA scheme, explain, with suitable diagram, The frame and burst structure.
(b) What is digital speech interpolation and how does it help the network?

8 + 4 = 12

7. (a) Explain how inter modulation product are created in FDMA and how this can be controlled.
   (b) What are the major propagation effects in satellite link?
   (c) What are the various payloads in a satellite?

(3 + 2) + 4 +3 = 12

Group – E

8.(a) With a suitable diagram, explain the principle of operation of direct broadcast satellite system.
   (b) What is a global positioning system (GPS)? How is this used to fix co ordinates?

6 + 6 = 12

9.(a) Explain with a diagram, the MSAT network concept.
   (b) Explain how worldwide timing is maintained by a satellite relay link.

8 + 4 = 12