*Name* : ...................................................................

*Roll No.* : ...........................................................

*Invigilator's Signature* : .........................................

**CS/M.Tech(ECE)/SEM-2/MCE-205A/2013**
# 2013
# SATELLITE COMMUNICATION

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

*The figures in the margin indicate full marks.*

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

Answer Q. No. 1 and any *four* from the rest.      5 × 14 = 70

1.    Answer any *seven* from the following :          7 × 2 = 14

   a)    Which satellite system is known as Irridium satellites
          and why ?

   b)    What are the conditions for a perfect geostationary orbit
          of a satellite ?

   c)    How many type of satellite orbits do you know based on
          inclination ?

   d)    What is meant by frequency reuse ?

   e)    The range between a ground station & a satellite is
          42000 km. Calculate the free space loss at frequency of
          6 GHz.

30147 ( M.Tech )                              [ Turn over

f) Define frame efficiency.

g) What is PDOP ?

h) Why uplink frequency is more than downlink frequency in satellite communication ?

i) The earth rotates once per sidereal day of 23 h 56 min. 4·09 sec. Calculate the radius of the GEO satellite.

j) What do you mean by link design ? Write Link budget equation.

2. a) Define the following parameters with diagram :

   i) Line of apsides

   ii) Line of nodes

   iii) Argument of Perigee. 9

   b) A satellite is in an elliptical orbit with a perigee of 1500 km and an apogee of 4500 km.

   Calculate the following :

   i) The period of the orbit

   ii) The eccentricity of the orbit.

   Give, Kepler's constant : $3·986 \times 10^5$ $km^3/s^2$, Average radius Earth : 6378 km 3 + 2

3. a) Explain look angles and subsatellite point with diagram. 6 + 1

   b) What is the limitation of central angular separation between the earth station and the subsatellite point ? Explain with diagram. 3
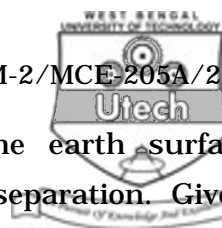
   c) A satellite is at 250 km above the earth surface. Calculate maximum central angular separation. Given, average radius of Earth : 6378 km.     3

   d) What is zenith location ?     1

4. a) Explain the effects of Earth's oblateness and atmospheric drag on satellite motion.     2 + 2

   b) What is the function of AKM ?     4

   c) How 'command word' is originated in TTC and M system ?     1

   d) Explain how the risk of erroneous commands can be minimized.     3

   e) What is low noise block amplifier ?     2

5. a) Derive general link equations. Find out expressions for C/N and G/T ratio.     3 + 2 + 2

   b) An earth station antenna has a diameter of 30 m, has an overall efficiency of 68% and is used to receive a signal at 4150 MHz. At this frequency, the system noise temperature is 79 K, when the antenna points at the sat at an elevation angle of 28°.

     i) What is the earth station G/T ratio under these conditions ?     4

     ii) If heavy rain causes the sky temperature to increase so that the system noise temperature rises to 88 K, what is the new G/T value ?     3

6. a) What is an intermodulation noise ? Derive the expression of it and explain. What precaution will you take to avoid intermodulation noise ?     2 + 6 + 3

   b) Draw the neat block diagram of bent type transponder. 3

7. a) What are VSATs ? What are the applications of VSATs ? Discuss components of its indoor and outdoor units. Discus its strength and its drawbacks.     2 + 3 + 6

   b) The earth station antenna is fed from a power amplifier producing 2 KW at its output. If the waveguide joining the amplifier output and the antenna input has a loss of 2 dB and the antenna has a gain of 51 dB at the operating uplink frequency, find EIRP of the antenna.   3

8. Write short notes on any *two* of the following :     2 × 7

   a) GPS

   b) MSAT

   c) SPADE

   d) Satellite in eclipse

   e) Attitude and obital control in TTC and M system.

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