

Name :
Roll No. :
Invigilator's Signature :

CS / M.TECH (ECE) / SEM-2 / MCE-205-A / 2011

2011

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 Question No. **1** and any *four* questions from the rest.

1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

- i) In a TDMA frame total frame length is 15 ms and overhead portion of the frame is 3 ms. Find the frame efficiency
 - a) 78 %
 - b) 80 %
 - c) 60 %
 - d) 70 %.
- ii) Satellites are always launched towards
 - a) east
 - b) west
 - c) north
 - d) south.
- iii) To make satellite visible from an earth station the maximum angular separation between the earth station & the sub-satellite point is limited by
 - a) $\gamma \leq \cos^{-1}(r_e / r_s)$
 - b) $\gamma > \cos^{-1}(r_e / r_s)$
 - c) $\gamma = \cos^{-1}(r_e / r_s)$
 - d) $\gamma \geq \cos^{-1}(r_e / r_s)$.

30078 (M.TECH)

[Turn over

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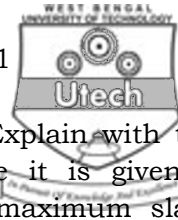
- xii) The range between a ground station and a satellite is 42000 km, the free space loss in dB at 6 GHz will be
 a) 200.4 dB b) 100 dB
 c) 104.2 dB d) 250 dB.
- xiii) Retrograde orbits have inclination angle
 a) 90 degree b) > 90 degree
 c) zero degree d) < 90 degree.
- xiv) Inter-modulation noise occurs in
 a) receiving antenna b) mixer circuit
 c) transponder circuit d) solar panels.
2. a) Discuss different types of satellites LEO, MEO, HEO and GEO. 12
 b) What is the difference between geostationary satellite and geosynchronous satellite ? 3
3. a) Derive general link equation. Find expressions for C/N and G/T ratio. 4 + 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 satellite at an elevation angle of 28°. What is the earth station G/T ratio under these conditions ? 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 ? What are your observations ? 3 + 3 + 1
4. State Kepler's law of planetary motion and explain them.

A satellite is in a 322 km high circular orbit. Determine

- a) Orbital velocity in meters per second
 b) The orbital period in minutes.

Given average radius of the earth is 6378 km and Kepler's constant has the value $3.986 \times 10^5 \text{ km}^3 / \text{s}^2$. 9 + 6

5. a) Explain look angles and sub-satellite point. 6 + 1
 b) Derive expression for elevation angle. 5



- c) What do you mean by slant range ? Explain with the help of diagram. For a GEO satellite it is given a minimum elevation angle of 5° , the maximum slant range $d = 41127 \text{ Km}$, $c = 3 \times 10^5 \text{ Km/s}$.
Find the satellite round trip delay. 3
6. a) Explain Transponder with the help of block diagram. How many types of transponders do you know ? Illustrate them. 3 + 4
- b) What is an inter-modulation noise ? Derive the expression for it. How can it be avoided ? 2 + 5 + 1
7. Write short notes on any three of the following : 3 × 5
- a) GPS
 - b) VSAT
 - c) MSAT
 - d) Satellite subsystems
 - e) Satellite launching techniques
 - f) TDMA burst structure.

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