

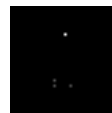
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[Full Marks : 70

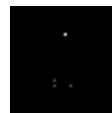
No additional sheets are to be used and no loose paper will be provided

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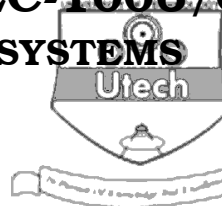
44003 (06/07)



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CS / M.TECH (ECE) / SEM-2 / EC-1006 / 09
SATELLITE COMMUNICATION SYSTEMS
SEMESTER – 2



Time : 3 Hours]

[Full Marks : 70

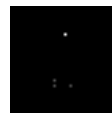
The figures in the margin indicate full marks.

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

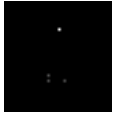
Answer any *five* questions.

5 × 14 = 70

1. a) What are the different factors which cause orbital perturbations of the satellite ? 4
- b) What is the effect of non-perfectly circular shape of earth in the equatorial plane ? 6
- c) A satellite is in an elliptical orbit with a perigee of 500 km and an apogee of 4500 km, using a mean earth radius of 6370 km, find the period of the orbit and eccentricity of the orbit . $\mu = 3.98 \times 10^5 \text{ km}^3/\text{s}^2$. 4
2. a) What is attitude ? Define satellite's attitude in terms of three axes. 6
- b) What are the different methods adopted for attitude control ? Discuss briefly about one of them. 8
3. a) Draw the block diagram of a Telemetry, Tracking, Command and Monitoring system. 2
- b) Discuss briefly the basic functions of TTC & M system of a satellite. 12



4. a) Draw and explain a single conversion transponder for 6/4 GHz band. 4
- b) Why double frequency conversion scheme is normally used in 14/11 GHz band ?
Draw and explain it. 6
- c) A geostationary satellite provides service to a region which can be covered by the beam of an antenna on the satellite with a beam width of 18° . The satellite carries transponders for C-band with separate antennas for transmit and receive. For centre frequency at 6/4 GHz find the diameters and gain of both transmitting and receiving antenna. 4
5. a) Deduce Friis transmission equation and obtain an expression of power received by an earth station from a satellite transmitter in terms of EIRP of satellite, receiving antenna gain and path loss. 10
- b) A satellite at a distance of 40,000 km from a point on the earth's surface radiates a power of 2 watt from an antenna with a gain of 17 dB in the direction of the observer. Find the flux density at the receiving point and the power received by the antenna with an effective area of 10 m^2 . 4
6. a) Deduce an expression for system noise temperature of a satellite communication receiver (consists of RF amplifier, mixer, IF amplifier) in terms of noise temperature of the different stages. 7



- b) Suppose you have a 4 GHz receiver with the following gains and noise temperatures. Calculate the system noise temperature.



$$T_{in} = 50 \text{ k}$$

$$T_{RF} = 50 \text{ k}, G_{RF} = 23 \text{ dB}$$

$$T_m = 500 \text{ k}, G_m = 0 \text{ dB}$$

$$T_{IF} = 1000 \text{ k}, G_{IF} = 30 \text{ dB}.$$

4

- c) What is the G/T ratio of an earth station ?

3

7. Draw the block diagram of a general earth station of a satellite communication system.

Describe the main blocks in brief.

14

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

 2×7

- a) CDMA
- b) Narrow band TDMA
- c) Satellite station keeping.

END