53 (EC 814) STCM

2013

(May)

SATELLITE COMMUNICATION

Paper : EC 814

Full Marks : 100

Pass Marks : 30

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* A satellite is in an elliptical orbit with a perigee of 1000km and an apogee of 4000 km. Using mean earth radius of 6378.14 km find the period of the orbit and eccentricity of the orbit. 5

(b) Explain how elevation and azimuth angle can be calculated. 10

(c) How a satellite can be located in the orbit? 5

2. (a) Explain the block diagram of a simple 6/4 GHz transponder. 6

(b) What is the role of TTC & M subsystem in satellite communication? 8

(c) What is redundancy ? What are different types of redundancy techniques? How reliability can be increased by redundancy? 6

3. (a) Explain the basic transmission theory used in satellite link design. 10

(b) A satelite at a distance of 40000 km from a point on the earth's surface radiates a power of $10W$ from an antenna with a gain of $17dB$ in the direction of the observer. Find the flux density at the receiving point and the power received by an antenna at this point with an effective area of $10m^2$. 5

(c) A $4GHz$ receiver has the following gains and noise temperatures–

$T_{in}=25K,\ T_{RF}=50K,\ T_{IF}=1000K,\ T_m=500K$

$G_m=23\,dB,\ G_{IF}=30\,dB$

Calculate the system noise temperature assuming that the mixer has as gain $Gm = 0\ dB$. Recalculate the system noise temperature when the mixer has a 10-dB loss. How can the noise temperature of the receiver be minimized when the mixer has a loss of $10dB$? 5

4. *(a)* When the intermodulation products are generated in satellite *FMDA* system ? Show how third order intermodulation products are generated. 10

(b) What are the advantages of *TDMA* over *FDMA* ? 4

(c) A *DS-SS CDMA* system has a number of earth stations sharing a single 54 MHz bandwidth Ka-band transponder. Each station has a different 1023 bit PN sequence which is used to spread the traffic bits into a bandwidth of 45 *MHz*. The transmitters and the receivers use RRC filters with $\alpha = 0.5$ and the chip rate is 30 *McPs*. Determine the number of earth stations that can be supported by the *CDMA* system if the correlated output *S/N=12dB*. 6

5. *(a)* Explain the configuration of an Earth station. 10

(b) What are the functions of an earth station tracking system? Explain the operation of the tracking system. 10

6. *(a)* What are the factors that influence the design of any satellite communication system ? Explain. 10

(b) How the coverage area of a satellite can be calculated ? 6

(c) What is the difference between total coverage and instantaneous coverage of a satellite? 4

7. *(a)* Explain the *GPS* positon location principle. 10

(b) Explain the block diagram of a *GPS* receiver. 6

(c) What are main sources of error in a *GPS* receiver ? 4
