15EC755

USN | | | | | | | | | |

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023
Satellite Communication

Time: 3 hrs.   Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1. a. With relevant mathematical expressions describe keplers three laws for the motion of artificial satellites around earth **(06 Marks)**
   b. Define the following parameters with reference to satellite orbits:
      i) Right aseension of ascending node.
      ii) Eccentricity.
      iii) Inclination.
      iv) Equinoxes and Solstices. **(04 Marks)**
   c. Satellite A is orbiting earth in a circular orbit of radius 7000km. Satellite B is orbiting earth in an elliptical orbit with its apogee and perigee distances of 47,000km and 7000km, respectively. Determine the velocities of the two satellites at point X.
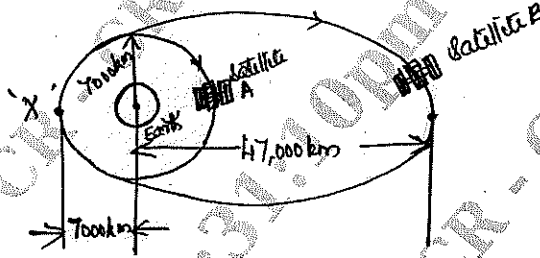   (Take $\mu = 39.8 \times 10^{13} Nm^2/kg$). **(06 Marks)**

Fig.Q.1(c)

OR

2. a. Compare and contrast spin stabilization and three-axis stabilization techniques of stabilizing the attitude of a satellite. **(04 Marks)**
   b. Define the three cosmic velocities and describe the nature of the orbit with respect to these velocities. **(06 Marks)**
   c. An earth station is located at 30°W longitude and 60°N latitude. Determine the earth stations azimuth and elevation angles with respect to a geostationary satellite located at 50°W longitude. The orbital radius is 42,164km. (Assume radius of earth to be 6378km). **(06 Marks)**

Module-2

3. a. With the help of neat block diagram, briefly describe the functions of the important Constituent parts of a typical large size earth station. **(06 Marks)**
   b. Write short notes on the different tracking methodologies that can be used for satellite tracking. **(06 Marks)**
   c. What are the different up/down conversion topologies used in satellite communications? **(04 Marks)**

OR

4 a. What are the typical subsystems found on board a satellite and briefly describe the primary function of each of these subsystems. **(06 Marks)**

b. What are the different components of satellites power supply subsystems and describe each one of them. **(06 Marks)**

c. An antenna designed for tracking applications produces a pencil like beam with both azimuth and elevation beam widths equal to 0.5° each. Determine the gain of the antenna in dB. Also determine the antenna aperture, if the operating frequency is 6GHz. **(04 Marks)**

Module-3

5 a. Describe the working principle of FDMA and distinguish between single channel per carrier and multi channel per carrier types of FDMA systems. **(06 Marks)**

b. Derive the expression for Friis transmission equation. **(04 Marks)**

c. With the help of block schematic representations briefly describe the operation of DS-CDMA system. **(06 Marks)**

OR

6 a. Define TDMA frame structure and describe each constituent of TDMA frame structure. **(06 Marks)**

b. Explain in detail the various parameters that affect propagation of electromagnetic waves from the transmitter to receiver in satellite communication link. **(06 Marks)**

c. Write short notes on space Domain Multiple Access and why is it considered more of a frequency re-use technique rather than a multiple access technique. **(04 Marks)**

Module-4

7 a. What is transponder and why is it referred to as the brain of a communication satellite? Also explain the various types of transponders. **(08 Marks)**

b. Write short notes on satellite TV networks. **(08 Marks)**

OR

8 a. What are regional satellite systems? Explain in detail the EUTELSAT and list the series of EUTELSAT satellites. **(08 Marks)**

b. Explain in detail about the services provided by satellite telephone networks. **(08 Marks)**

Module-5

9 a. Explain in detail the principle of operation of GPS system. **(08 Marks)**

b. Classify remote sensing system and briefly explain the types of images and image interpretation. **(08 Marks)**

OR

10 a. Explain in detail about the orbits of weather forecasting satellites. **(08 Marks)**

b. What are radiometers and what are the various types of radiometers used on weather satellites? Explain. **(08 Marks)**

* * * * *