



School of Electronics Engineering

CAT-1, Fall Semester 2024-25

B.Tech (Electronics and Communication Engineering)

Course Name : Satellite Communication

Duration : 90 Min.

Course Code : BECE310L

Max. Marks : 50

Faculty Name : Dr.T. Shankar

Slot : F2

Answer ALL Question

1. Assume any missing data, appropriately. 2. Provide illustration, wherever necessary.

Q. No.	Question Text	Marks
1.	A Satellite has an inclination of 90° and an eccentricity of 0.1. At epoch, which corresponds to time of perigee passage, the perigee height is 2643.24 km directly over the north pole. Determine (i) the satellite mean motion for 1 day after epoch (ii) the true anomaly, (iii) the magnitude of the radius vector to the satellite (iv) the latitude of the subsatellite point	10
2.	a) Sum and difference of semi-major and semi-minor axes of an elliptical satellite orbit are 45000 km and 5000 km, respectively. Determine the following orbital parameters. (i) Eccentricity (ii) Apogee distance (iii) Perigee distance (iv) Orbital period. b) A satellite is orbiting earth in a uniform circular orbit at a height of 630 km from the surface of earth.. Determine the velocity of the satellite. Assume earth radius = 6378 km, earth mass 5.98×10^{24} kg, gravitational constant $G = 6.67 \times 10^{-11} \text{ Nm}^2 / \text{kg}^2$	[6] [4]
3.	a) An Earth station is located at 30° W longitude and 60° N latitude. Determine the Earth station's azimuth and elevation angles with respect to a geostationary satellite located at 50° W longitude. The orbital radius is 42164 km. Assume radius of Earth to be 6378 km b) Two different geostationary satellites in INSAT- series are located 74° E and 94° E. Determine the line-of-sight distance between the two satellites orbiting the Earth at a height of about 36000 km above surface of the Earth. Assume radius of Earth to be 6378 km.	[6] [4]
4.	A low earth orbit satellite is in a circular polar orbit with an altitude of 1000 km. A transmitter on the satellite has a frequency of 2.65 GHz, Find, (i) The Velocity of the satellite in orbit. (ii) The component of velocity towards an observer at an earth station as the satellite appears over the horizon for an observer who is in the plane of the satellite orbit. (iii) Find the Doppler shift of the received signal at the earth station use a mean earth radius value of 6378 km. (iv) The satellite also carries a Ka band transmitter at 20GHz. Find the Doppler shift for this signal when it is received by the same observer.	10
5.	(i) List the various Launch vehicle selection factors and compare the performance of Expandable Launch vehicles with Reusable Launch Vehicles. (ii) A certain satellite is moving in a circular orbit with an altitude of 500 km. The altitude is intended to be increased to 800 km. Suggest a suitable maneuver to do the same and calculate the magnitudes of the thrusts required. Take the value of constant μ as $39.8 \times 10^{13} \text{ Nm}^2 / \text{kg}$	[4] [6]