Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

Online End Semester Examination, May 2021

Programme Name: B. Tech ASE+AVE — **Semester : VIII**
Course Name : Satellite System Engineering — **Time : 3 Hours**
Course Code : AVEG 4004 — **Max. Marks: 100**

Instructions: The Question paper has three sections such as Section A, B and C Section. Section A (Type the Answer) Section (B & C) – Scan and upload. Make use of *sketches/plots (Part B & Part C Section)* to elaborate your answer. Brief and to the point, answers are expected.

SECTION A (6*5 =30 Marks)

S. No.	**Questions**	**Marks**	**CO**
Q 1	What do you mean by orbit path and orbit radius of a satellite system? Mention the orbit of a satellite between LEO, MEO, GEO and HEO.	**5**	**CO1**
Q 2	Define the satellite system engineering ? What are the satellite subsystem used in small satellite design?	**5**	**CO1**
Q 3	What are the orbital parameters required to determine a satellite orbit? Name and explain them.	**5**	**CO2**
Q 4	Discuss about the Van Allen Radiation Belts and Roche Limits	**5**	**CO3**
Q 5	Explain the following i) Astronomical Unit ii) One Light Year iii) Parsec	**5**	**CO3**
Q 6	Discuss about NASA's Goddard Space Flight Center use a common bus for several satellites which is attained by 1553 and 1773 buses	**5**	**CO4**

SECTION B (5*10 =50 Marks)

S. No.	Questions	Marks	CO
Q 7	a) Calculate the velocity of an artificial satellite orbiting the Earth in a circular orbit at an altitude of 200 km above the Earth's surface b) A satellite in earth orbit has s semi major axis of 6750 km and an eccentricity of 0.017. Calculate the satellite's altitude at both perigee and apogee.	**10**	**CO1**

Q 8	a) A satellite link operating at 14 GHz has receiver feeder losses of 1.5 dB and a freespace loss of 207 dB. The atmospheric absorption loss is 0.5 dB and the antenna pointing loss is 0.5 dB. EIRP = 60 dbW, Gain of the Antenna is 50dB. Depolarization losses may be neglected. Calculate the Received power and total loss for clear sky conditions. b) Draw and explain the operation of satellite communication system in details.	**10**	**CO4**
Q 9	A satellite is in an orbit with a semi-major axis of 7,500 km and an eccentricity of 0.1 Calculate the length of its i) Position vector, ii) Flight-path angle, iii) Velocity when the satellite's true anomaly is 225 degrees.	**10**	**CO2**
Q 10	a) A spacecraft is in a circular parking orbit with an altitude of 500 km. Calculate the velocity change required to perform a Hohmann transfer to a circular orbit at geosynchronous altitude b) Design the satellite attitude determination and control system with suitable equations.	**10**	**CO4**
Q 11	Calculate the perturbations in longitude of the ascending node and argument of perigee caused by the Moon and Sun for the International Space Station orbiting at an altitude of 400 km, an inclination of 51.6 degrees, and with an orbital period of 92.6 minutes. **(Or)** A satellite is in an orbit with a semi-major axis of 7,500 km, an inclination of 28.5 degrees, and an eccentricity of 0.1. Calculate the J2 perturbations in longitude of the ascending node and argument of perigee.	**10**	**CO2**
SECTION-C (1*20 = 20 Marks)			
Q 12	A satellite is in a circular Earth orbit at an altitude of 400 km. The satellite has a cylindrical shape 2 m in diameter by 4 m long and has a mass of 1,000 kg. The satellite is traveling with its long axis perpendicular to the velocity vector and it's drag coefficient is 2.67. Calculate the perturbations due to atmospheric drag and estimate the satellite's lifetime. Also, Discuss the orbital perturbation in details. **(Or)** a) At the end of a rocket launch of a space vehicle from earth, the burnout velocity is 13km/s in a direction due south and 10^0 above the local horizontal. The burnout point is directly over the equator at an altitude of 400 mi above the sea level. Calculate the trajectory of the space vehicle. Discuss the Size and Shape of the orbits. b) If satellite is revolving around earth in a circular orbit at a distance r from the center of earth. Find the extra energy that must be provided to the satellite to escape from earth's gravitational field?	**20**	**CO3**