

10AE763

Seventh Semester B.E. Degree Examination, Aug./Sept.2020
Space Mechanics and Launch Vehicles

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.

PART - A

- 1 a. Explain Inertial and earth fixed co-ordinate reference frames? (04 Marks)
- b. Show that the transformation of fixed co-ordinate system to moving co-ordinate system is the inverse of transformation. (06 Marks)
- c. Describe construction of Euler's angles and derive expression for Euler rates? (10 Marks)
- 2 a. Assume that ratio of the mass of the moon to that of the moon plus earth is known as $\mu = \frac{m_2}{m_1 + m_2}$. By observation relative to the fixed stars, the angular velocity 'w' of the line joining the centers of the earth and moon can be measured as $w = 2.66 \times 10^{-6}$ rad/sec. show that the distance between the two bodies is $D^3 = \frac{9R^2}{W^2(1-\mu)}$ by referring Fig Q2(a). (10 Marks)

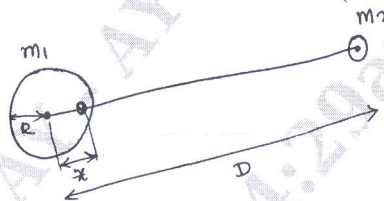


Fig Q2(a)

- b. Derive well known Kepler's all three equation for planetary motion. (10 Marks)
- 3 a. Develop the general perturbation equations using Cowell's method. (12 Marks)
- b. What are sun synchronous and geosynchronous orbits? (08 Marks)
- 4 a. Determine satellite rectangular co-ordinates from orbital elements. (10 Marks)
- b. What is Hohmann transfer? Explain with the help of not sketch and mention required expressions. (06 Marks)
- c. Write short notes on geosynchronous and geostationary satellites. (04 Marks)

PART - B

- 5 a. Compare solid, liquid and hybrid rocket propellants and mention two examples each. (10 Marks)
- b. Write any five performance parameters and explain. (10 Marks)
- 6 a. Derive Tsolil Kovsky rocket equation in free space. (08 Marks)
- b. Describe vertical, included and gravity turn trajectories. (06 Marks)
- c. Show that velocity is a function of mass ratio ' μ ', thrust to weight ratio ' ψ ' and specific impulse ' I_{sp} '. (06 Marks)
- 7 a. Explain multistage Rocket definition. (05 Marks)
- b. Describe optimal multistage Rocket staging. (15 Marks)
- 8 a. Explain preliminary spacecraft design concepts. (10 Marks)
- b. What are desired structural and thermal characteristics for spacecrafts? (10 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42-8 = 50, will be treated as malpractice.