

4th Semester	RAE4D001	Introduction to Space Technology	L-T-P 3-0-0	3 CREDITS
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MODULE – I (12 hrs)

Fundamentals of Rocket Propulsion and Trajectories: Space Mission- Types-Space environment-launch vehicle selection.; Introduction to rocket propulsion-fundamentals of solid propellant rockets- Fundamentals of liquid propellant rockets-Rocket equation, Two- dimensional trajectories of rockets and missiles-Multi-stage rockets-Vehicle sizing-Two multi-stage rockets-Trade-off ratios-Single stage to orbit-Sounding rocket-Aerospace plane- Gravity turn trajectories-Impact point calculation-Injection conditions-Flight dispersions

MODULE – II (08 hrs)

Atmospheric Re-entry: Introduction-Steep ballistic re-entry-Ballistic orbital re-entry-Skip re-entry-“Double- Dip” re-entry - Aero-braking - Lifting body re-entry

MODULE – III (10 hrs)

Fundamentals of Orbital Mechanics, Orbital Manoeuvres: Two-body motion-circular, elliptic, hyperbolic, and parabolic orbits-Basic orbital elements-Ground trace. In-Plane orbit changes-Hohmann transfer-Bi-elliptical transfer-Plane changes-Combined manoeuvres- Propulsion for manoeuvres.

MODULE – IV (08 hrs)

Satellite Attitude Dynamics: Torque free axisymmetric rigid body-Attitude control for spinning spacecraft - Attitude control for non-spinning spacecraft - The Yo-Yo mechanism – Gravity – Gradient satellite-Dual spin spacecraft-Attitude determination.

MODULE – V (07 hrs)

Space mission Operations: Supporting ground system architecture and team interfaces - Mission phases and core operations- Team responsibilities – Mission diversity – Standard operations practices.

Books:

- ‘Spaceflight Dynamics’, W.E. Wiesel, 3rd edition, McGraw-Hill, 2010
- ‘Rocket Propulsion and Space flight dynamics’, Cornelisse JW, Schoyer HFR, and Wakker KF, Pitman, 1984
- ‘Fundamentals of Space Systems’, Vincet L. Pisacane, Oxford University Press, 2005.
- ‘Understanding Space: An Introduction to Astronautics’, J. Sellers, 2nd edition, McGraw- Hill, 2004
- ‘Introduction to Space Flight’, Francis J Hale, Prentice-Hall, 1994
- ‘Spacecraft Mission Design’, Charles D. Brown, AIAA Education Series, 1998
- ‘Elements of Space Technology for Aerospace Engineers’, Meyer Rudolph X, Academic Press, 1999