GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3170114
Semester –VII
Subject Name: Space Flight Mechanics

Type of course: Engineering Science

Prerequisite: Mechanics, Physics

Rationale: Exposure to basic aspects of Space Flight would be an advantage to the students of aeronautical engineering who want to pursue their further studies or career in the field of aerospace.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	**Introduction** Definition of Space, Types of Space Vehicles, Newton's law of Gravitation, Gravitational potential energy	6
2	**Particle Dynamics** Force and Momentum, Work and Energy, The Two-body problem, Central Force motion, Mechanics of Circular Orbits, Orbit equation, Geometry of Conic Sections, Kepler's laws, Energy balance in orbits, The Hohmann Transfer	12
3	**Attitude Dynamics** Introduction, Rigid body dynamics, Dual Spin Satellite, Attitude Control	12
4	**Reentry Dynamics** Introduction, Types of Entry Paths, Equation of Motion for Atmospheric entry, Application to Ballistic entry, Entry Heating, Lifting reentry with application to Space shuttle	12

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
35%	**25%**	**20%**	**15%**	**5%**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Kaplan, Marshall H., Modern Spacecraft Dynamics and Control, JohnWiely & Sons, New York.
2. Wiesel, William E., Spaceflight Dynamics, Tata McGraw Hill Publishing Company Limited, New Delhi.
3. Thomson, William T., Introduction to Space Dynamics, Dover Publication,Inc. New York.
4. Sidi, Marcel J., Spacecraft Dynamics and Control, Cambridge University Press, U.K.

Course Outcomes:
After completion of this course students shall be able to

Sr. No.	CO statement	Marks % weightage
1	Understand the basics of Orbital Mechanics	10
2	Full understanding of conic sections and fundamental orbit equations of motion	30
3	Understanding of the fundamentals of spacecraft attitude dynamics	30
4	Interpret re-entry of space flight vehicles.	30

List of Open Source Software/learning website: https://nptel.ac.in/course.php