SEMESTER S8

ORBITAL MECHANICS

Course Code	OEAOT834	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	NIL	Course Type	Theory

Course Objectives:

1. Student should be able to explain and use basic theorems in orbital mechanics, Sketch the orbit with the data of orbital elements.
2. Student should be able to transform the object from one orbit to another orbit.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Solar system: Reference frames and coordinate systems, Celestial sphere- The ecliptic- Motion of vernal equinox, Sidereal time Solar time, Standard time, Galilean transformation, Newton's law of gravitation Kepler's law, Estimation of orbital and escape velocity- Many body problem, Lagrange Jacobi Identity, Circular restricted three body problem. Liberation point, (Numerical problems)	9
2	Relative motion in the N-Body problem. Two body problem, Satellite orbit relation between position and time Perifocal frame, Lagrange coefficients and points, coordinate transformation, transformation between geocentric equatorial and Perifocal frames, Orbital position as function of time –, Gibbs method of orbit determination from three position vector, Lambert's problem, orbit determination, Orbit determination by Gauss's method, (Numerical problems).	9
3	Orbital manoeuvres: - Hohmann Transfer and non-Hohmann transfer, Chase and phasing maneuverer, Interplanetary Hohmann transfer, rendezvous opportunities, sphere of influence, Method of patched conics, planetary departure, Planetary rendezvous, flyby, Non Hohmann interplanetary trajectories (Numerical problems)	9

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4	Stage separation dynamics and separation techniques, aerodynamic jet control methods of rocket vehicles, performance at various altitudes, rocket dispersion-launching problems.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro project	Internal Examination-1 (Written)	Internal Examination, 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

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Part A	Part B	Total
• 1 Questions from each module. • Total of 4 Questions, each carrying 2 marks **(4x2 =8marks)**	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 subdivisions. Each question carries 8 marks. **(8x4 = 32 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Understand the concepts of effect many bodies under the influence of gravity,	**K2**
CO2	Understand the principles of orbit and determine its position.	**K3**
CO3	Understand the transformation techniques from one orbit to another without loss of much energy.	**K3**
CO4	Understand the different methods for stage separation and attitude control of rockets	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	-	-	-	-	-	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1.	Orbital Mechanics for Engineering Students	Howard D Curtis	Biddles Ltd	7th Edition
2.	Rocket Propulsion Elements	George P. Sutton	John Wiley & Sons	9th Edition
3.	Fundamentals of Astrodynamics	Roger R Bate Donald D. Mueller Jerry E. White	Dover Publications, Inc.	8th edition

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Reference Books				
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1.	Rocket Propulsion Elements	George P. Sutton	John Wiley & Sons	9th Edition
2.	Fundamentals of Astrodynamics	Roger R Bate Donald D. Mueller Jerry E. White	Dover Publications, Inc.	8th edition