<table>
<tr><td>Course Number</td><td>ME 452</td></tr>
<tr><td>Course Title</td><td>Dynamics of Space Flight</td></tr>
<tr><td>Course Structure</td><td>(3-0-3) (lecture hr/wk - lab hr/wk – course credits)</td></tr>
<tr><td>Course Coordinator</td><td>A.D. Rosato</td></tr>
<tr><td>Course Description</td><td>An introduction to the mechanics of space flight. After a brief introduction to the physics of the solar system, the dynamics of space flight are developed from the Newtonian viewpoint. Covers the performance and propulsion methods of rocketry.</td></tr>
<tr><td>Prerequisite(s)</td><td>Mech 236 – Dynamics; Math 222 – Differential Equations</td></tr>
<tr><td>Corequisite(s)</td><td>None</td></tr>
<tr><td>Required, Elective or Selected Elective</td><td>Elective</td></tr>
<tr><td>Required Materials</td><td>H. D. Curtis, Orbital Mechanics for Engineering Students (2nd edition), Elsevier 2010</td></tr>
<tr><td>Other supplemental materials (not Required)</td><td>Supplemental materials and notes e-mailed to students</td></tr>
<tr><td>Computer Usage</td><td>None</td></tr>
<tr><td>Course Learning Outcomes/ expected performance criteria:</td><td>
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<tr><td>Course Learning Outcomes</td><td>SOs*</td><td>Expected Performance Criteria</td></tr>
<tr><td>1 explain the equations for central force motion</td><td>a,e</td><td>Homework Problem (80% of the students will earn a grade of 75% or better on this problem)</td></tr>
<tr><td>2. explain the two-body problem and restricted three-body problem</td><td>a, c, e</td><td>Homework Problem (80% of the students will earn a grade of 75% or better on this problem)</td></tr>
<tr><td>3. describe Kepler’s Laws of planetary motion</td><td>a</td><td>Exam Question (80% of the students will earn a grade of 75% or better on this question)</td></tr>
<tr><td>4. solve problems involving circular, elliptic, parabolic and hyperbolic orbit trajectories</td><td>a, e, k</td><td>Homework Problem (80% of the students will earn a grade of 75% or better on this problem)</td></tr>
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	5. **solve** problems involving Kepler's equation in terms of universal variables	a, e, k	**Exam Question** (80% of the students will earn a grade of 75% or better on this question)
	6. **explain** the orbital elements in terms of the state vector	a, e	**Exam Question** (80% of the students will earn a grade of 75% or better on this question)
	7. **solve** problems to determine an orbit in 3 dimensions using orbital elements	a, c, k	**Exam Question** (80% of the students will earn a grade of 75% or better on this question)

Class Topics

1. Review of dynamics (linear and angular momentum, kinematics of a point mass).
2. Motion equations in an inertial frame.
3. Two-body problem & orbit equations derivation.
4. Circular, parabolic, elliptic and hyperbolic orbits.
5. Perifocal frame and restricted 3-body problem.
6. Orbital position as a function of time.
7. State vector and the geocentric frame – orbital elements.
8. Transformation from geocentric equatorial to perifocal frame.
9. Gibbs' method and Lambert's problem.

Student Outcomes (Scale: 1-3)

a	b	c	d	e	f	g	h	i	j	k
3		3		2						2

3 – Strongly supported 2 – Supported 1 – Minimally supported

* Student Outcomes