Student Outcomes

Old (2013)	New (from 2019
(a) An ability to apply knowledge of mathematics, science, and engineering (e) An ability to identify, formulate, and solve engineering problems	1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
c) An ability to design a system, component or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability and sustainability	2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
g) An ability to communicate effectively	3) an ability to communicate effectively with a range of audiences
(f) An understanding of professional and ethical responsibility (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (j) A knowledge of contemporary issues	4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
d) An ability to function on multi-disciplinary teams	5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
b) An ability to design and conduct experiments, as well as to analyze and interpret data	6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
i) A recognition of the need for, and an ability to engage in life-long learning	7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	Implied in 1, 2, and 6

COURSE NUMBER	**ME 452**
COURSE TITLE	**Dynamics of Space Flight**
COURSE STRUCTURE	(3-0-3) (lecture hr/wk - lab hr/wk – course credits)
COURSE COORDINATOR	A.D. Rosato
COURSE DESCRIPTION	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.
PREREQUISITE(S)	Mech 236 – Dynamics; Math 222 – Differential Equations
COREQUISITE(S)	None
REQUIRED MATERIALS	H. D. Curtis, Orbital Mechanics for Engineering Students (2nd edition), Elsevier 2010
Other supplemental materials (not Required)	Supplemental materials and notes e-mailed to students
COMPUTER USAGE	None

COURSE LEARNING OUTCOMES/ EXPECTED PERFORMANCE CRETERIA**:**

Course Learning Outcomes	SOs*	Expected Performance Criteria
1. **Explain** the equations for central force motion	1,2	**Exam Question** (70% of the students will earn a grade of 70% or better on this question)
2. **Explain** the two-body problem and restricted three-body problem	1,2	**Exam Question** (70% of the students will earn a grade of 70% or better on this question
3. **Describe** Kepler's Laws of planetary motion	1,2	**Exam Question** (same as 1)
4. **Solve** problems involving circular, elliptic, parabolic and hyperbolic orbit trajectories	1,2	**Exam Question** (same as 1)
5. **Solve** problems involving Kepler's equation in terms of universal variables	1	**Exam Question** (same as 1)
6. **Explain** the orbital elements in terms of the state vector	1	**Exam Question** (same as 1)
7. **Solve** problems to determine an orbit in 3 dimensions using orbital	1,2,5	**Exam Question** (same as 1)

	elements		
	8. **Solve** problems to transform from the Geocentric Equatorial to the Perifocal Orbital Plane	1,2,5	**Exam Question** (same as 1)
	9. **Solve** preliminary orbit problems using Gibbs method	1,2,5	**Exam Question** (same as 1)

CLASS TOPICS

1. Review of dynamics (linear and angular momentum, kinematics of a point mass) (3 hrs)
2. Motion equations in an inertial frame (3 hours)
3. Two-body problem & orbit equations derivation (3 hrs)
4. Circular, parabolic, elliptic and hyperbolic orbits (3 hrs)
5. Perifocal frame and restricted 3-body problem (3 hrs)
6. Orbital position as a function of time (4.5 hrs)
7. State vector and the geocentric frame – orbital elements (4.5 hrs)
8. Transformation from geocentric equatorial to perifocal frame (3 hrs)
9. Gibbs' method and Lambert's problem (6 hrs)

STUDENT OUTCOMES (SCALE: 1-3)

1	**2**	**3**	**4**	**5**	**6**	**7**
3	3			3		

3 – Strongly supported 2 – Supported 1 – Minimally supported

* Students Outcome