

AE 2221 – 3D Dynamics

HOURS: 1-0-1

CATALOG DESCRIPTION:

Kinematics and kinetics of rigid bodies in three-dimensional motion.

PREREQUISITES:

COE 2001 with minimum grade of C

CEE 2040 with minimum grade of C

With concurrency:

Math (2552 or 2562 or 25x2 or 2403 or 2413 or 24x3) with minimum grade of C

TEXTBOOKS:

Engineering Mechanics: Introduction to Dynamics, McGill and King, Tichenor, 4th edition, 2003.

COURSE OBJECTIVES:

This course introduces students to the kinematics and dynamics of rigid bodies in 3-D motion as a fundamental discipline necessary for aerospace engineers to master understanding of flight mechanics of aircraft or spacecraft, mechanical vibrations, structural dynamics and aeroelasticity.

This is a bridge course to meet the AE 2220 (Dynamics) requirement for AE majors who either transferred from outside Georgia Tech or changed majors into AE, and have already received credit for CEE 2040 (planar dynamics). The course is taught in conjunction (cross-listed) with AE 2220; students are required to attend lectures primarily during the final one-third of the semester.

LEARNING OUTCOMES:

Students will gain a master level understanding of:

1. Kinematics of rigid bodies in three-dimensional motion, including a treatment of Euler-type orientation angles
2. Solving problems related to the kinetics of rigid bodies in three-dimensional motion

LEARNING ACCOMMODATIONS:

If needed, we will make classroom accommodations for students with documented disabilities. These accommodations must be arranged in advance and in accordance with the Office of Disability Services (<http://disabilityservices.gatech.edu>).

ACADEMIC INTEGRITY:

Academic dishonesty is not tolerated. This includes cheating, lying about course matters, plagiarism, or helping others commit a violation of the Honor Code. Plagiarism includes reproducing the words or visual/graphical expressions of others without clear attribution and citation. Students are reminded of the obligations and expectations associated with the Georgia Tech Academic Honor Code, available online at <http://osi.gatech.edu/content/honor-code>.

TOPICAL OUTLINE:

Topic	Lecture Hours
1. Kinematics of a rigid body in three-dimensional motion	1
2. Relation between derivatives; the angular velocity vector	8
a. Properties of angular velocity	
b. The angular acceleration vector	
c. Velocity and acceleration in moving frames of reference	
d. The earth as a moving frame	
e. Velocity and acceleration equations for two points of the same rigid body	
f. Describing the orientation of a rigid body	
g. Rotation matrices	
3. Kinetics of a rigid body in general motion	4
a. Moment of momentum (angular momentum) in three dimensions	
b. Transformations of inertia properties	
c. Principal axes and principal moments of inertia	
d. The moment equation governing rotational motion	
e. Gyroscopes	
Tests/Exams/Reviews	1
Total	14