Course Title	**Advanced Dynamics and Applications**				
Course Code	**MME 421**				
Course Type	Elective				
Level	Undergraduate				
Year / Semester	4th Year / 7th or 8th Semester				
Teacher's Name	Loucas Louca				
ECTS	6	Lectures / week	3+1 hours	Laboratories / week	0
Course Purpose and Objectives	The purpose of the course is to introduce formal approaches for performing kinematic and dynamic analysis of rigid bodies moving in space. Newton-Euler and Lagrangian formulations for three-dimensional motion of particles and rigid bodies is used. By the end of the course students will be able to model and analyze multi-degree of freedom rigid body systems.				
Learning Outcomes	• Formulate the Newton/Euler equations of motion for systems of particles and rigid bodies in three-dimensions. • Calculate inertia properties and angular velocity of rigid bodies. • Identify constraints and degrees-of-freedom for dynamical systems. • Formulate Lagrange's equations of motion for particles and rigid bodies. • Analyze the kinematics of linkage mechanisms. • Analyze kinematics and dynamics of rigid-body systems through computational approaches using Matlab and SolidWorks.				
Prerequisites	MME 225	Required	None		
Course Content	The course focuses on the motion of rigid bodies in three-dimensional space. Kinematics and dynamics of rigid bodies are studied in order to derive the equations of motion using various modern approaches. Topics taught include inertia properties and angular velocity; Newton-Euler equations of motion; degrees-of-freedom and constraints; kinetic/potential energy and virtual work; Lagrange's equations for holonomic systems; numerical analysis of derived equations of motion. The formulations are applied to various multi-body dynamics problems that arise in mechanical and aerospace engineering, and the special case of planar mechanisms is also studied. Students use generalized and specialized software, like Matlab and SolidWorks, to analyze rigid-body systems.				
Teaching Methodology	• Lectures • Homework • Recitation for solving sample problems • Computer lab for solving three-dimensional dynamics • Office hours • During the first week of the semester the students receive the course syllabus, which includes the course content, bibliography, learning outcomes, assessment and office hours.				

Bibliography	• Greenwood, D.T., *Advanced Dynamics*. Cambridge University Press, ISBN 978-0-521-02993-3. • Jazar, R.J, *Advanced Dynamics Rigid Body, Multibody, and Aerospace Applications*. John Wiley & Sons, ISBN 978-0-470-39835-7. • Norton, R.L., *Design of Machinery: An introduction to the Synthesis and Analysis of Mechanisms and Machines*. McGraw-Hill, ISBN 978-0-07-312158-1.
Assessment	• Homework 20% • Midterm Exam 35% • Final Exam 45%
Language	Greek