MECH 7610 – ADVANCED DYNAMICS

SPRING 2020

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Textbook: Ginsberg, Jerry H., "Engineering Dynamics,"

Second Edition, Cambridge University Press, 2008

Goals: The objective of this course is to extend the concepts of fundamental dynamics and to develop the ability of students to apply these principles to solve a variety of engineering problems. The material covered in this course will include a discussion of Lagrange's equations, Hamilton's Principle, the Gibbs-Appell equations, Newtonian kinetics in three dimensions, and gyroscopic motion.

Pre-Requisites:

MECH 3140

Grading Policy:

1.	3 semester exams (3 X 165 points)	495
2.	Homework	200
3.	Final Exam (Comprehensive)	305
	Total	1000

Scale:

900-1000 - A

800-899 - B

700-799 - C

600-699 - D

Below 600 - F

Tentative Schedule for Exams:

Exam #1 - February 11, 2020

Exam #2 - March 5, 2020

Exam #3 - April 7, 2020

Final Exam - April 28, 2020

Topic Outline

Class Days	*Topic*
1	**Chapter 1: Basic Considerations**
1	**Introduction to Chapter 6:** Newtonian Kinetics of a Rigid Body and **Chapter 7:** Introduction to Analytical Mechanics
3	**Chapter 2: Particle Kinematics** (path variables, rectangular Cartesian coordinates, orthogonal curvilinear coordinates)
3	**Chapter 3: Relative Motion** (rotation transformations, finite rotations, angular velocity and derivatives of rotating vectors, angular acceleration, derivatives of an arbitrary vector, velocity and acceleration using a moving reference frame)
4	**Chapter 4: Kinematics of Constrained Rigid Bodies** (general equations, Eulerian angles, interconnections, rolling)
3	**Chapter 5: Inertial Effects of a Rigid Body** (linear and angular momentum, inertia properties, rate of change of angular momentum)
5	**Chapter 6: Newtonian Kinetics of a Rigid Body** (fundamental equations, planar motion, Newton-Euler equations, momentum and energy principles)
5	**Chapter 7: Introduction to Analytical Mechanics** (virtual work, generalized coordinates, virtual displacements, generalized forces, Lagrange's equations)
4	**Chapter 8: Constrained Generalized coordinates** (Lagrange's equations – constrained case, computational methods)
4	**Chapter 9: Alternative Formulations** (Hamilton's principle, generalized momentum principles, formulation with quasi-coordinates)
2	**Chapter 10: Gyroscopic Effects** (free motion, spinning top, gyroscopes for inertial guidance)
1	**Review**