TEXTBOOK: Engineering Mechanics: Dynamics, Volume 2, Sixth Edition (2007), by J. L. Meriam and L. G. Kraige

PREREQUISITE: ESM 2104 – Statics

COREQUISITE: MATH 2214 – Differential Equations

CONCEPTS TO BE INTRODUCED:

Position Vector	Work	Linear Impulse	General Plane Motion
Velocity	Kinetic Energy	Angular Impulse	Mass Moment of Inertia
Acceleration	Power	Impacts	Radius of Gyration
Projectile Motion	Potential Energy	Angular Velocity	Parallel-Axis Theorem
Relative Motion	Linear Momentum	Angular Acceleration	Center of Percussion
Newton's Laws	Angular Momentum	Instantaneous Center	Rotating Frames

MAJOR LEARNING OBJECTIVES:

1) Determine the kinematic relationships among position, velocity, and acceleration in rectangular, normal-tangential, and polar coordinates, including the concepts of relative and constrained motion, for particles.
2) Analyze the kinetics of particle motion via Newton's Laws in rectangular, normal-tangential, and polar coordinate systems, energy methods, and impulse-momentum methods.
3) Determine the kinematic relationships among linear and angular position, linear and angular velocity, and linear and angular acceleration for the plane motion of rigid bodies.
4) Analyze the motion of bodies relative to rotating coordinate frames and determine Coriolis accelerations.
5) Determine the mass moment of inertia for a rigid body.
6) Analyze the kinetics of rigid-body motion via Newton's Laws in rectangular, normal-tangential, and polar coordinate systems, energy methods, and impulse-momentum methods.

IN ADDITION TO THE ABOVE LEARNING OBJECTIVES, THE STUDENT SHALL BE ABLE TO:

1) Define, use, and give the dimensions of all the above concepts.
2) Draw an appropriate free-body diagram for each solution method.
3) Decide in any given problem which solution method is most appropriate.
4) Use a combination of solution methods if necessary.
5) Check all equations for dimensional homogeneity.
6) Work all problems in either SI or U.S. customary units.

COURSE MATERIALS & SOFTWARE

Class materials will be posted on the BlackBoard site dedicated to this section of dynamics. You may access the website from the following link: https://learn.vt.edu/. Any material related to the course will be posted in the Course Documents section of BlackBoard and will usually be in the form of PDF files. You are advised to check this section frequently for additional help on past homework sets or study materials. Additionally, we might use the Discussion Board feature from time to time if numerous students are having particular difficulties with a certain homework set or lecture topic.

NOTE ON TEXTBOOKS

It is strongly suggested that engineering students keep important textbooks for later reference, both during college and subsequently during professional career opportunities. Books such as those for mathematics, physics, and mechanics courses prove to be particularly useful throughout one's engineering career. For example, the ESM 2304 textbook will be useful for reference in later courses such as AOE 3034, AOE 3104, ESM 3124, ME 3504, ME 3514, and ME 3604.

COURSE OUTLINE AND SUGGESTED HOMEWORK PROBLEMS

Lecture	Date	Article(s)	Topic	Suggested Problems
	M, 1/18	**NO CLASS – MARTIN LUTHER KING DAY**		
1	W, 1/20	1/1-7	Introduction	1/1, 3, 5, 12, 13, 14
2	F, 1/22	2/1-2	Rectilinear Motion	2/2, 5, 6, 7, 35
3	M, 1/25	2/1-2	Rectilinear Motion	2/14, 23, 32, 40, 59
4	W, 1/27	2/3-4	Rectangular Coordinates	2/63, 76, 83, 84, 90
5	F, 1/29	2/5	Normal and Tangential Coordinates	2/105, 111, 125
6	M, 2/1	2/6	Polar Coordinates	2/147, 155, 168
7	W, 2/3	2/8	Relative Motion	2/192, 195, 203
8	F, 2/5	2/9	Constrained Motion	2/214, 224, 228
9	M, 2/8	1/1 – 2/6, 2/8 – 9	Test 1 Review	
10	W, 2/10	**Nominal Day for Test 1 (See Below for Actual Dates)**		
11	F, 2/12	3/1-4	Newton's 2nd Law (Rectangular Coordinates)	3/3, 12, 21, 24
12	M, 2/15	3/5	Newton's 2nd Law (Normal & Tangential Coordinates)	3/51, 62, 84
13	W, 2/17	3/5	Newton's 2nd Law (Polar Coordinates)	3/58, 75, 97
14	F, 2/19	3/6	Work-Kinetic Energy	3/106, 110, 126
15	M, 2/22	3/6	Work-Kinetic Energy, Power & Efficiency	3/114, 118, 140
16	W, 2/24	3/7	Potential Energy	3/149, 151, 164
17	F, 2/26	3/8-9	Linear Impulse-Momentum	3/188, 202, 223
18	M, 3/1	3/10	Angular Impulse-Momentum	3/229, 230, 240, 244
19	W, 3/3	3/11-12	Impacts (Direct & Oblique)	3/255, 259, 270
20	F, 3/5	3/12	Combination Problems	3/248, 275, 354
	3/6 – 3/14	**NO CLASS – SPRING BREAK**		
21	M, 3/15	3/1 – 3/12	Test 2 Review	
22	W, 3/17	**Nominal Day for Test 2**		
23	F, 3/19	5/1-2	Rotation	5/1, 12, 18, 20
24	M, 3/22	5/3	Parametric (Absolute) Motion	5/29, 39, 46
25	W, 3/24	5/4	Relative Velocity	5/60, 72, 88
26	F, 3/26	5/5	Instantaneous Center of Rotation	5/94, 102, 109, 118
27	M, 3/29	5/6	Relative Acceleration	5/127, 141, 153
28	W, 3/31	5/7	Rotating Frames	5/160, 170, 180, 183
29	F, 4/2	5/7	Rotating Frames, Test 3 Review	
30	M, 4/5	**Nominal Day for Test 3**		
31	W, 4/7	B/1	Mass Moment of Inertia by Integration	B/6, 30, 33, 37
32	F, 4/9	B/1	Mass Moment of Inertia by Composite Bodies & Parallel-Axis Theorem	B/7, 14, 40, 49
33	M, 4/12	6/1-3	Translation	6/3, 21, 29
34	W, 4/14	6/4	Fixed-Axis Rotation	6/38, 45, 48, 57
	F, 4/16	**NO CLASS – UNIVERSITY REMEMBRANCE**		
35	M, 4/19	6/5	General Planar Motion	6/75, 87, 95
36	W, 4/21	6/5	General Planar Motion	6/90, 104, 112
37	F, 4/23	6/6	Work-Kinetic Energy (Rigid Bodies)	6/116, 125, 128
38	M, 4/26	6/6	Potential Energy & Power (Rigid Bodies)	6/117, 131, 143, 145
39	W, 4/28	B/1, 6/1 – 6/6	Test 4 Review	
40	F, 4/30	**Nominal Day for Test 4**		
41	M, 5/3	6/8	Impulse-Momentum (Rigid Bodies)	6/174, 177, 182, 190
42	W, 5/5	6/8	Impact & Combination Problems (Rigid Bodies)	6/202, 205, 207

Test Dates (all 7:00 PM to 8:30 PM in WHIT 300): Test 1: Thursday, 2/11 Test 2: Thursday, 3/18
Test 3: Tuesday, 4/6 Test 4: Thursday, 4/29

Common-Time Examination: 7:00 PM to 9:00 PM, Tuesday, May 11, 2010.