EM 313 Dynamics

Spring 2021

Description

Want to understand the performance of a car or send a rocket to Mars? Your intro into these skills is dynamics.

Prerequisites

EM 222 with minimum grade of C
MATH 331 (pre or co) C or better
PHYS 255 with minimum grade of C

Text

Vector Mechanics for Engineers: Dynamics, 12th Edition or later by Beer J.

ISBN 978-1-259-97730-5

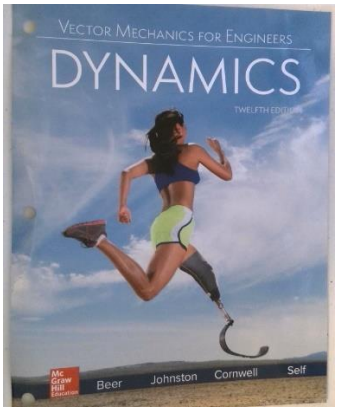
Instructor

Warren Campbell, Ph.D., P.E., CFM
warren.campbell@wku.edu

Office Hours Via Zoom (links will be provided)
MW 1:00 – 2:30
Tues 1:00 – 2:00

Before Class

Watch the video lecture for that day's class and formulate a question or questions that were triggered by watching the video.



Typical Class

1. **Call roll**
2. **Answer questions**
3. **Go over the quiz for the last class**
4. **Follow up questions and discussion**

Questions

Submit group questions before class (the sooner the better) via Blackboard assignments along with the names of individuals formulating the questions. HOT (Higher Order Thinking) questions are preferred and encouraged.

During class, questions and discussion are encouraged at any time. Unmute in Zoom and fire away.

Zoom

I will always have my video on. Please turn yours on if you have a computer camera. You do not have to go out and buy one if you do not.

Grading

This course is run like a game. You accumulate eXperience Points (XPs) and level up to improve your grade. Mess up on an exam? All is not lost. You can perform optional quests to recover. See below for more information. Turn in your optional quests before class on Monday, April 12 to receive your extra credit.

Type	Quests	Max XPs
Required	**Exam 1**	**400**
	Exam 2	**400**
	Final Exam	**725**
	Attendance	**130**
	Questions	**115**
	Quizzes	**230**
Optional	Select your avatar (Geezer is taken)	20
	Read *Humble Pi: When Math Goes Wrong in the Real World* and take quiz	100
	Attend Bell Lecture (virtually)	20
	Attend ASCE, IEEE, or ASME meeting	10
	Find the optimal angle for soft touch in basketball	100
	Read an approved book and write a book report	TBA
	Bonus Points for whole class - Everyone makes a C or better on Exam 1	100
	Bonus Points for whole class - Everyone makes a C or better on Exam 2	100
	Bonus Points for whole class - Everyone makes a C or better on the Final Exam	200

Deadline for Optional Quests

So that I have time to grade your optional quests, I must have your submissions prior to class on April 15.

Levels	Min XP	Grade
Level 5 - Dynamics Demigod	3000	A+
Level 4 - Dynamics Wizard	1850	A
Level 3 - Dynamics Warrior	1650	B
Level 2 - Dynamics Journeyman	1450	C
Level 1 - Dynamics Wannabe	1250	D
Level 0 - Dynamics Potential so far unrealized	0	F

Course Outcomes

1. Derive, understand, and convert expressions for position, velocity, and acceleration in appropriate coordinate systems.
2. Find velocities and accelerations using translating and rotating reference frames.
3. Solve particle motion problems using Newton's 2nd law, work-energy, and impulse-momentum.
4. Express kinematic relations between translational and angular quantities for rigid bodies.
5. Analyze the motion of translating and rotating rigid bodies using Euler's equations and work-energy.
6. Analyze particle and rigid body free and damped vibration.

Special Assistance

In compliance with University policy, students with disabilities who require academic and/or auxiliary accommodations for this course must contact the Student Accessibility Resource Center located in Downing Student Union, room 1074 of the Student Success Center. The phone number is 270.745.5004. or email at sarc.connect@wku.edu. Please do not request accommodations directly from the professor or instructor without a letter of accommodation from The Student Accessibility Resource Center.

About Me

I began my professional life as a co-op at Marshall Space Flight Center during the Apollo Program. There I worked on the Space Shuttle environmental impact statement, microgravity fluids experiments and the Space Shuttle Main Engine redesign. Later I was the City Hydrologist for Huntsville, Alabama. When I am not working, I am likely to be gaming with my son and grandson.

Title IX Discrimination and Harassment

Western Kentucky University (WKU) is committed to supporting faculty, staff and students by upholding WKU's Title IX Sexual Misconduct/Assault Policy (#0.2070) and Discrimination and Harassment Policy (#0.2040). Under these policies, discrimination, harassment and/or sexual misconduct based on sex/gender are prohibited. If you experience an incident of sex/gender-based discrimination, harassment and/or sexual misconduct, you are encouraged to report it to the Title IX Coordinator, Andrea Anderson, 270-745-5398 or Title IX Investigators, Michael Crowe, 270-745-5429 or Joshua Hayes, 270-5121.Please note that while you may report an incident of sex/gender based discrimination, harassment and/or sexual misconduct to a faculty member, WKU faculty are "Responsible Employees" of the University and MUST report what you share to WKU's Title IX Coordinator or Title IX Investigator. If you would like to speak with someone who may be able to afford you confidentiality, you may contact WKU's Counseling and Testing Center at 270-745-3159.

Tentative Schedule – Firm but may be changed for snow days or other unforeseen events

Date	Day	Lessons	Video Lecture	Reading
19-Jan	Tues	1	Syllabus, rectilinear motion	11.1
21-Jan	Thurs	2	Relative motion	11.2
26-Jan	Tues	3	Curvilinear motion	11.4
28-Jan	Thurs	4	Nonrectangular components	11.5
2-Feb	Tues	5	Newton' 2nd Law	12.1
4-Feb	Thurs	6	Angular momentum and orbits	12.2
9-Feb	Tues	7	Work and energy	13.1
11-Feb	Thurs	8	Conservation of Energy	13.2
16-Feb	Tues	9	Impulse and momentum	13.3
18-Feb	Thurs	10	Impacts	13.4
23-Feb	Tues	11	Newton's 2nd law for systems of particles	14.1
25-Feb	Thurs	12	Energy and momentum for systems of particles	14.2
2-Mar	Tues		Exam 1 Review	
4-Mar	Thurs		Exam 1	
9-Mar	Tues	13	Rigid body kinematics, translation & rotation	15.1
11-Mar	Thurs	14	General plane motion	15.2
16-Mar	Tues	15	Instantaneous center of rotation	15.3
18-Mar	Thurs	16	General plane motion: acceleration	15.4
23-Mar	Tues	17	Motion relative to a rotating frame	15.5
25-Mar	Thurs	18	Kinetics of a rigid body	16.1
30-Mar	Tues	19	Constrained plane motion	16.2
1-Apr	Thurs	20	Rigid body energy methods	17.1
6-Apr	Tues	21	Rigid body momentum methods	17.2
8-Apr	Thurs	22	Rigid body eccentric impact	17.3
13-Apr	Tues		Exam 2 Review	
15-Apr	Thurs		Exam 2	
20-Apr	Tues	23	3D Energy and momentum	18.1
22-Apr	Thurs		Final Exam Review	
27-Apr	Tues		Final Exam 8:00 AM – 10:00 AM	