MEC 262 Engineering Dynamics

Spring 2018

Instructor:	**Prof. Cindy Chang** email: qing.chang@stonybrook.edu
	Light Engineering, Room 163; Phone (631)632-8329
Office Hours:	MF: 12:30-3:30PM & other time by appointment
Lecture:	MWF 9:00AM – 9:53AM in JAVITS LECTR 110
Recitations:	R01- Mo 4:00PM – 4:53PM Earth&Space 131; **Jiayin Xie**
	R02- Mo 1:00PM – 1:53PM Earch&Space 131; **Jing Huang**
	R03- We 4:00PM – 4:53PM Melville LBR E4320; **Jiayin Xie**
TA:	**Jing Huang** email: jing.huang.3@stonybrook.edu Office Hours: Monday 2:00 – 3:30pm, Friday 2:00 – 3:30 pm, HE-101 **Jiayin Xie** email: jiayin.xie@stonybrook.edu Office Hours:
Course Description:	Engineering dynamics (MEC262) focuses on vectorial kinematics and dynamics of particles and rigid bodies in space. The students learn to represent and compute displacement, velocity, and acceleration of particles, systems of particles, and rigid bodies in various coordinate systems. The class builds upon Kinematics to include Dynamics of particles and the systems of particles, equation of motion, energy and momentum methods and collisions. In the end, Free, forced, and damped vibrations of particles and rigid bodies are covered.
Course Purpose:	MEC 262, offered in Spring and Summer, is a core, required undergraduate class in the Mechanical Engineering department that students have to pass with a grade of C or better to advance further in the major. The goal of the course is to introduce the physical principles to the analysis of particle and rigid-body motion problems. Engineering Statics (MEC260) with a grade of C or higher is a pre-requisite of this class. The class deals with kinematics and kinetics of particles and rigid bodies and advocates and rigorously enforces a vector based systematic approach to problem solving. The class prepares students to take junior-level Kinematics of Machinery, Machine Design, and Senior Design classes, wherein a solid theoretical and analytical foundation in Engineering Dynamics is must.
Textbook:	Engineering Mechanics: Dynamics, 2nd Edition by Gary Gray, Francesco Costanzo, Michael Plesha, McGraw-Hill

Grading:	Homework assignments: 20% Exam 1 (Chapters 1-3): 20% Exam 2 (Chapters 4-6): 20% Exam 3 (Final comprehensive): 40% Extra credits/Bonus: 5% (in-class quizzes, attendance, class participation, etc)
Grading Scale:	A: 100 – 92 A-: 91 – 89 B+: 88 – 86 B: 85 – 82 B-: 81 – 79 C+: 78 – 75 C: 74 – 70 C-: 69 – 66 D+: 65 – 63 D: 62 – 60 F: < 59
Exams:	All exams are closed book and closed notes. You may bring one 8.5 × 11 inch sheet with handwritten notes. **IMPROTANT: NO make-up exams unless in extreme scenarios with Doctor's notes, police reports.**
Homework:	1. Homework will be assigned weekly and will be due in one week at the start of class 2. Late homework will not be accepted 3. All homework assignments are individual, unless otherwise specified 4. Homework problems should be neat, professional and well organized 5. Homework will be accepted only during class or via blackboard. Please put our handwritten homework on the professor's desk before the lecture starts or submit a scanned copy via blackboard. IMPORTANT: NO ASSIGNMENT SUBMITTED AFTER THE SUBMISSION DEADLINE WILL BE GRADED
Communication:	You are required to use the Internet to access Blackboard and online information for important announcements, homework/handouts, and supplementary materials of the course. You can access blackboard at: http://blackboard.stonybrook.edu Please note that you have to use your NetID to login to the blackboard system.
Fundamentals:	From your pre-requisite classes, you should have acquired a working knowledge of 1. Basic Trigonometry (sines, cosines, basic trigonometry formula, etc.) and Geometry 2. Vector Calculus (differentiating and integrating vector functions) and Vector Algebra (adding two vector, Dot and Cross products, etc.) 3. Free Body Diagram (FBD) 4. Differential and Integral Calculus
Calculator Policy:	Effective Spring, 2009 only the following calculators will be permitted to be used on all midterm and final exams in the Department of Mechanical

	Engineering. There will be no exceptions. This list of calculators is identical to that allowed for the National Council for Examiners for Engineering and Surveying (NCEES) Fundamental of Engineering (FE) exam that many of you will take in your senior year as well as the Professional Engineering (PE) exam that you may take several years from now. The sooner you become comfortable on one of these calculators, the better. NCEES Allowed calculators as of 2012: - Casio: All fx-115 models. Any Casio calculator must contain fx-115 in its model name. - Hewlett Packard: The HP 33s and HP 35s models, but no others - Texas Instruments: All TI-30X and TI-36X models. Any Texas instruments calculator must contain either TI-30X or TI-36X inits model name - The NCESS policy on calculators can be found here: https://ncees.org/2012-approved-calculator-list-announced/

Student Outcome (SO's) of this course:

a. The ability to apply knowledge of mathematics, science, and engineering to mechanical engineering problem,
b. The ability to design and conduct experiments, as well as to analyze and interpret data.
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability,
e. The ability to identify, formulate, and solve engineering problems.
g. An ability to communicate effectively
h. The broad education necessary to understand the impact of engineering solutions in a global and societal context.
j. A knowledge of contemporary issues.
k. The ability to use modern engineering techniques, skills, and computing tools necessary for engineering practice.

Course Learning Objectives (CLO's) and Assessment Tools:

COURSE LEARNING OBJECTIVES (CLOs)	SOs	ASSESSMENT TOOLS
1. Represent and determine the position, velocity and acceleration vectors of a particle and system of particles in Cartesian, Polar as well as normal and tangential coordinate systems	a, e	Exams
2. Use vector algebra to represent and analyze the velocity and acceleration components of a system of connected rigid bodies with pinned, sliding and rolling connections	a, e	Exams

3. Apply Newton's laws of motion and draw Free Body Diagrams to calculate (1) the motion of a particle system caused by given forces and (2) the forces needed for a particle system to move in a prescribed way	a, e	Exams
4. Compute work, potential energy and kinetic energy for particle(s), and apply work-energy principles to obtain velocity, position and the work done by external forces	a, e	Exams
5. Compute Momentum and Impulse of particles(s) and apply Momentum-Impulse approach to problems where velocity, time, and forces are related in a more natural way	a, e	Exams
6. Apply Newton-Euler equations and draw FBDs to relate forces and moments on rigid bodies in planar motion with their linear and angular acceleration	a, e	Exams
7. Compute potential energy and kinetic energy for a system of interconnected rigid bodies moving in a plane, and apply work-energy principle to obtain velocity, position and the work done by external forces	a, e	Exams
8. Derive and solve equation of motions for particles and rigid bodies under free, forced, and damped vibrations	a, e	Exams

STUDENT OUTCOMES SUPPORTED (Scale 1-3)	a	b	c	d	e	f	g	h	i	j	k	l	m	n
	3				3									
	3 – Strongly supported 2 – Supported 1 – Minimally supported													

COURSE TOPICS	1. Kinematics of a Particle 2. Kinetics of a Particle: Forces, Acceleration, work, Energy, Impulse and Momentum 3. Planar Kinematics of a Rigid Body 4. Rigid body Force, Accel, Work, Energy, Impulse and Momentum 5. Introduction to Mechanical Vibrations

Course Outline:

		Content	
22-Jan	1	Introduction to Dynamics I	Section 1_1
24-Jan		Fundamentals	Section 1_2
26-Jan		Particle kineamatics - I: position, velocity, acceleration, cartesian co	Section 2_1
29-Jan	2	Particle kineamatics - I: position, velocity, acceleration, cartesian co	Section 2_2
31-Jan		Particle kineamatics - II: Elementary Motions	Section 2_2
2-Feb		Particle kineamatics - III: Projectile motion	Section 2_3
5-Feb	3	Particle kineamatics - IV: time derivative of vector	Section 2_3
7-Feb		Particle kineamatics - IV: time derivative of vector	Section 2_4
9-Feb		Particle kineamatics - V: Planar Motion: normal tangential coordina	Section 2_5
12-Feb	4	Particle kineamatics - VI: Planar Motion: polar coordinates	Section 2_6
14-Feb		Particle kineamatics - VII: relative motion	Section 2_7
16-Feb		Particle kineamatics - VIII: motion in 3D	Section 2_8
19-Feb	5	Review Particle kineamatics	
21-Feb		Force and acceleration for particles - Rectilinear motion	Section 3_1
23-Feb		Force and acceleration for particles - Rectilinear motion	Section 3_1, 3_2
26-Feb	6	Force and acceleration for particles - Curvilinear motion	Section 3_2, 3_3
28-Feb		Force and acceleration for particles - systems of particles	Section 3_3
2-Mar		Review Force and acceleration for particles	
5-Mar	7	Exam 1: Ch 1-3	Exam 1: Ch 1-3
7-Mar		Energy methods for particles: Work-energy principle	Section 4_1
9-Mar		Energy methods for particles: Conservative forces and potential ene	Secttion 4_2
12-Mar	8	spring recess	
14-Mar			
16-Mar			
19-Mar	9	Energy methods for particles: system of particles	Section 4_3
21-Mar		Energy methods for particles: power and efficiency	Section 4_4
23-Mar		Review Energy for particles	
26-Mar	10	Momentum methods for particles: Momentum and impulse	Section 5_1
28-Mar		Momentum methods for particles: Impact	Section 5_2
30-Mar		Momentum methods for particles: angular momentum	Section 5_3
2-Apr	11	Review Momentum for particles	
4-Apr		Planar rigid body kinematics - translation, rotation	Section 6_1
6-Apr		Planar rigid body kinematics - velocity	Section 6_2
9-Apr	12	Planar rigid body kinematics - acceleration	Section 6_3
11-Apr		Planar rigid body kinematics - rotating reference frames	Section 6_4
13-Apr		Review rigid body kinematics	
16-Apr	13	Exam 2: Ch 4-6	
18-Apr		Newton-Euler equations: translation	Section 7_1, 7-2
20-Apr		Newton-Euler equations: Rotation	Section 7_3
23-Apr	14	Newton-Euler equations: general plane motion	Section 7_4
25-Apr		Work-Energy for Rigid bodies: Energy and Momentum	Section 8_1, 8_2
27-Apr		Work-Energy for Rigid bodies: Energy and Momentum	Section 8_1, 8_2
30-Apr	15	Mechanical Vibrations: undamped free vibration	Section 9_1, 9_2
2-May		Mechanical Vibrations: undamped forced vibration; damped vibrati	Section 9_2, 9_3
4-May		Review	

DISABILITY SUPPORT SERVICES (DSS) STATEMENT

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website: http://www.stonybrook.edu/ehs/fire/disabilities]

ACADEMIC INTEGRITY STATEMENT

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

CRITICAL INCIDENT MANAGEMENT

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.