MEC 262: Engineering Dynamics
Department of Mechanical Engineering
Spring 2020

1. Teaching Team

Instructor:

Prof. Lifeng Wang
Office: 141 Light Engineering
Office Hours: 10-11:30am Wednesday & Thursday
Phone: (631) 632-1182
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Teaching Assistants:

1. Xihang Jiang (Xihang.Jiang@stonybrook.edu)
2. Huan Liu (Huan.Liu.1@stonybrook.edu)

2. Scheduled Class Meeting Times

Lecture: MWF 9:00AM – 9:53AM, Javits Lecture Hall 110
Recitations: R01- Mo 4:00PM – 4:53PM, Melville Library W4540 (Xihang)
R02- Mo 1:00PM – 1:53PM, Melville Library E4320 (Huan)
R03- We 4:00PM – 4:53PM, Melville Library W4540 (Xihang) → Merged into R01- Mo 4:00PM – 4:53PM, Melville Library W4540
We 1:00PM – 3:00PM, TA Lounge Light Engineering 158 (Office Hours by TA)

3. Course Description

This Engineering Dynamics (MEC262) class focuses on the vectorial kinematics and dynamics of particles and rigid bodies. The students learn to represent and compute displacement, velocity, and acceleration of particles and rigid bodies in different coordinate systems. Further upon, they learn to relate forces and motions of particles and rigid bodies using Newton's laws and Newton-Euler equations. Free, forced, and damped vibrations of particles and rigid bodies are presented in the end.

4. Course Purpose

MEC 262, offered in the spring and the summer semesters at Stony Brook University 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. Engineering Statics (MEC260) with a grade of C or higher is a pre-requisite for 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, which helps students learn that every problem does not require a different approach to solving problems. 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.

5. Course Learning Outcomes (CLO)

Upon completion of this course, students will be able to:

CLO 1. Determine the position, velocity and acceleration of a particle and system of particles in Cartesian, Polar as well as Normal and Tangential coordinate systems.
CLO 2. Draw Free Body Diagrams and apply Newton's laws of motion to calculate (1) the displacement, velocity, and acceleration of a particle system caused by given forces, and (2) the forces needed for a particle system to move in a prescribed way.
CLO 3. Compute work, potential energy and kinetic energy for particle(s), and apply work-energy approach to problems where forces and acceleration are not primary quantities of interest and to use these principles to obtain velocity, displacement, and the work done by external forces
CLO 4. Compute Momentum and Impulse of particle(s) and apply Momentum-Impulse approach to problems where velocity, time, and forces are related in a more natural way.
CLO 5. Determine the velocity and acceleration components of a system of connected rigid bodies with pinned, sliding and rolling connections.
CLO 6. Draw Free Body Diagram and apply Newton-Euler equations to relate forces and moments acting on rigid bodies in planar motion with their linear and angular acceleration.
CLO 7. Compute potential- and kinetic-energy for a system of interconnected rigid bodies moving in a plane, and apply work-energy principle to the problems where forces and acceleration are not primary quantities of interest and to use these principles to obtain velocity, displacement, and the work done by external forces.
CLO 8. Derive and solve differential equation of motions for particles and rigid bodies under free, forced, and damped vibrations.

6. Assessment and ABET Student Outcomes

The relevant ABET Student Outcomes are

1. **An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.**

(1a) Select appropriate model for the problem.
(1b) Prepare a solution that exhibits logical sequence of steps that are consistent with the model.
(1c) Demonstrate a correct solution to the problem.
(1d) Present solution in appropriate format.

Performance Indicator	5=Exemplary	4=Good	3=Adequate	2=Marginal	1=Unacceptable
Appropriate Model	Best model is selected for the problem.	A correct model is selected.	A correct model is chosen, but there are some conceptual errors.	Incorrect model is selected for the problem.	No model is selected for the problem.

Logically Consistent Solution	There is a complete and detailed sequence of steps to the solution.	There is a complete sequence of steps to the solution.	There is a correct sequence of steps to the solution.	There is a partially correct sequence of steps to the solution.	There is no logical sequence of steps to the solution.
Correct Solution	The solution is conceptually correct, with no procedural errors.	The solution is conceptually correct, with only minor procedural errors.	The solution is conceptually correct, but contains procedural errors.	The solution contains several conceptual or procedural errors.	The solution contains major conceptual or procedural errors.
Present Result	Presentation of results is detailed, well organized, and clear. All intermediate steps are shown.	Presentation of results is detailed and clear. All intermediate steps are shown.	Presentation is clear. All intermediate steps are shown.	Presentation is neat, but not all intermediate steps are shown.	Presentation is sloppy. Intermediate steps are not shown. Illegible.

7. Tentative Schedule

Week	Contents
1	Chapter 1: *Introduction to Dynamics*
2	Chapter 2: *Particle Kinematics*
3	Chapter 2: *Particle Kinematics*
4	Chapter 3: *Force and Acceleration Methods for Particles*
5	Chapter 3: *Force and Acceleration Methods for Particles*
6	Chapter 4: *Energy Methods for Particles* (Midterm I, Chapters 1-3)
7	Chapter 5: *Momentum Methods for Particles*
8	Spring Recess (3/16-3/20)
9	Chapter 6: *Planar Rigid Body Kinematics*
10	Chapter 6: *Planar Rigid Body Kinematics*
11	Chapter 7: *Newton-Euler Equations for Planar Rigid Body Motion* (Midterm II, Chapters 4-6)

12	Chapter 7: *Newton-Euler Equations for Planar Rigid Body Motion*
13	Chapter 8: *Energy and Momentum Methods for Rigid Bodies*
14	Chapter 9: *Mechanical Vibrations*
15	Review
	Final Exam (8am-10:45am, 5/20, Comprehensive)

8. Math and Statics Pre-Requisites

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 vectors, Dot and Cross products, etc.)
3. Free Body Diagram (FBD)
4. Differential and Integral Calculus

9. Technologies and Tools

1. **Computer and Internet Connection**: You will need to have access to computer and internet to using Blackboard.

2. **Blackboard**: The Stony Brook University uses Blackboard (Bb) course management system for all course-related management. The Bb site for this class will be the central online location for posting all class-related materials, announcements, calendar, etc.

3. **McGraw Hill Connect:** The Connect is an online learning platform from McGraw Hill, which you would use for submitting your HW assignments. See the *Required Course Textbooks* section below on details on how to purchase an access.

4. **Calculators**: Only an approved NCEES allowed calculator will be permissible to use during quizzes and exams. Please see the *Calculator Policy* section below on details.

10. Communication

You must have an active Stony Brook University e-mail account and access to the Internet. All instructor correspondence will be sent to your SBU e-mail account listed in Blackboard. Please plan on checking Blackborad and your SBU email account regularly for course related messages. To log in to Stony Brook Google Mail, go to http://www.stonybrook.edu/mycloud and sign in with your

NetID and password.

This course uses Bb for the facilitation of communications between faculty and students, submission of assignments, and posting of grades. The Bb Course Site can be accessed at https://blackboard.stonybrook.edu

11. Required Course Textbooks

For this course you will be required to purchase McGraw-Hill Education Connect® access for Connect-Semester Online Access or Access Card for **Engineering Dynamics, 2nd edition by Gray, Costanzo, and Plesha.** The Connect Access includes eBook. You are not required to have a print text and please be aware if you purchase a used textbook you will still need to purchase Connect access.

Connect codes are available for purchase at the SBU Online bookstore or through Connect directly. Additionally, if you would like a print version of the text to accompany the eBook in Connect, a print-upgrade option is available via Connect once you log on to the Connect web site.

Details on how both can be obtained are below:

Title: Engineering Dynamics: Dynamics (USCS edition) + Connect Access Card for Dynamics
Authors: Gary Gray; Francesco Costanzo; Michael Plesha
Edition: 2nd
ISBN: 9781259877162 (this ISBN is for our book store only and is not searchable on the internet.)
Publisher: McGraw-Hill Higher Education

Here are a couple of options for purchasing the Connect code that includes an e-book; second option could be cheaper.

1. Go to the SBU Online Bookstore to purchase a Connect access card. Follow the prompts to purchase an e-book with the Connect Access. Please note that if you are purchasing an access card through the bookstore, please purchase in advance of classes, as the card will need to be shipped to you. You can utilize the 2-week Connect Courtesy access to enable access to all materials within Connect until your access card is delivered.

2. You can buy them from the Publisher directly as well. To get started, sign into Blackboard and click on McGraw Hill Tools from the left menu. Under McGraw Hill Connect, click on Go to My Connect Section. Next, you will need to enter your email address and click Submit. If you already have a Connect Registration Code (purchased at the bookstore), enter the code and click Submit. If you don't have a Registration Code, you can buy access during this registration process. Complete the remaining steps to finish registering for Connect. If you don't see this price, please choose "Start Courtesy Access" for two-weeks. Remember to buy the access before the two weeks expire

12. Calculator Policy

Effective Spring, 2009 only the following calculators are being 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) Fundamentals 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 Nov 2011:

- 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 in its model name.

The NCEES policy on calculators can be found here: http://www.ncees.org/Exams/Exam-day_policies/Calculator_policy.php

13. Grading

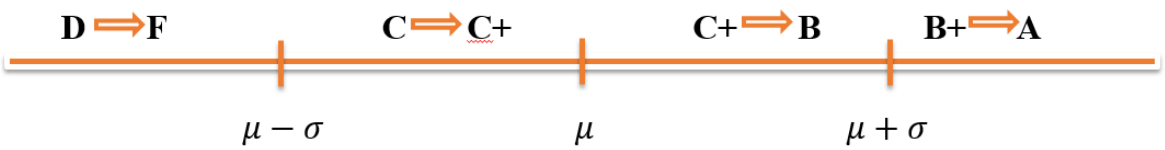
On-line Homework 20% (assigned through McGraw Hill Connect platform or Blackboard)

Midterm1 20% (In class, Chapters 1-3)

Midterm2 20% (In class, Chapters 4-6)

Final Exam 40% (Comprehensive)

Your final letter grade will be decided based on the above weights and your relative placement in the class. The following scale shows roughly what your final letter grade range might look like, where μ is the average, and σ is the standard deviation.



14. Homework (online)

Homework will be assigned and posted on blackboard system approximately every module and will be due in one week. Homework must be turned in on the specified due date. No late homework will be accepted.

15. Exams

Midterm exams and quizzes will be given in class during the lecture hours while the final exam will be given during the final exam week.

The exams are closed book/notes. If you miss an exam due to unforeseen events, you will have to contact Office of Dean of Students to send me an official notification before I will give you a makeup exam. There will be no make-up exams for reasons that are within your control. Thus, this rules out reasons such as pre-arranged vacation, travel, conflict with other exams, or other engagements.
Make-up exam policy is consistent with university policy on:
1. Student Participation in University Sponsored Events
http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/policies_expectations/participation_univsponsered_activities.php
2. University policy on Final Exams:
http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/records_registration/final_examinations.php
3. New York State Education Law regarding Equivalent Opportunity and Religious Absences
http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/policies_expectations/equivopportunity_religiousabsences.php

16. Academic Policies

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. 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.
University Student Conduct Code can be found at (check for most current version)
http://studentaffairs.stonybrook.edu/ucs/docs/universitystudentconductcode.pdf

ADA & Disability Support Services (DSS) Statement: The Rehabilitation Act of 1973 – Section 504 applies to all postsecondary educational programs that receive federal assistance. Reasonable accommodations and academic assistance are provided to students with disabilities registered with the 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. For procedures and information go to the following website: http://www.stonybrook.edu/ehs/fire/disabilities

Course Materials and Copyright Statement: Course material accessed from Bb, SB Connect, SB Capture or a Stony Brook Course website is for the exclusive use of students who are currently enrolled in the course. Content from these systems cannot be reused or distributed without written permission of the instructor and/or the copyright holder. Duplication of materials protected by copyright, without permission of the copyright holder is a violation of the Federal copyright law, as well as a violation of Stony Brook's Academic Integrity and Student Conduct Codes.

Getting Technical Help

Getting Help with Bb Learning Management System (LMS)
Students that need help with Bb can contact the TLT Student Help Desk by calling (631) 632-9602, emailing helpme@stonybrook.edu; more information is available via Stony Brook IT: http://it.stonybrook.edu/services/blackboard#section-6706
Frequently ask questions about the Bb LMS along with tutorials are available here: http://it.stonybrook.edu/services/blackboard/navigate-manage

17. Subject to Change Notice

All material, assignments, and deadlines are subject to change with prior notice. It is your responsibility to stay in touch with your instructor, review the course site regularly, or communicate with other students, to adjust as needed if assignments or due dates change.

18. Syllabus Disclaimer

The instructor views the course syllabus as an educational understanding between the instructor and students. Every effort will be made to avoid changing the course schedule but the possibility exists that unforeseen events will make syllabus changes necessary. The instructor reserves the right to make changes to the syllabus as deemed necessary. Students will be notified in a timely manner of any syllabus changes via email or in the course site Announcements. Please remember to check your SBU email and the course site Announcements often.