MECH 102 – Dynamics

Fall 2018

Course Information and Policy Document

Instructor: Subhrajit Bhattacharya (sub216)
Lectures: MWF, 10:10am-11:00am; Lewis Lab (LL) 316

Course Catalog Description:
Particle dynamics, work-energy, impulse-momentum, impact, systems of particles; kinematics of rigid bodies, kinetics of rigid bodies in plane motion, energy, momentum, eccentric impact.
Prerequisites: Engineering Mechanics (MECH 002 / 003) and Calculus III (MATH 023 / 033).

Text and Syllabus:

Beer, Johnston, and Cornwell, *Vector Mechanics for Engineers: Dynamics*, 11th Ed., 2016.

You need to have access to a copy of the text book. The 10th Ed. should be fine, but it has the sections numbered differently. In this course we will cover chapters 11 to 19 of the book.

Grading:

- The final letter grade for the class will be primarily based on the following: Homeworks & Projects (15%), Midterm 1 (25%), Midterm 2 (25%) and Final exam (35%).
- The final letter grades will be computed relative to the entire class (using a "curve") based on the total score from homeworks, projects and the exams: Top 20% students get A's (A / A-), next 30% get B's (B+ / B / B-), the next 30% students get C's (C+ / C / C-), etc.
- There will be a bonus 10% on surprise quizzes given during lectures. After your letter grade is computed as above, the bonus score from the surprise quizzes will be used to determine if you qualify for an increase in your letter grade.

Homeworks:

- Weekly homeworks will be assigned on Fridays and will be due on the following Fridays at the beginning of the class.
- No late submission will be accepted. Submissions made after the class hour on Friday or left in the mailbox of the instructor/TA without prior permission will not be graded.
- The homework submissions should be your own individual work. You can discuss a problem with your class-mates before you start working on it. But you should work out the problems by your own self, and submissions must be your own original work.
- The problems given in the surprise quizzes *may* be selected from the homework problems, as well as one problem in each of the exams will be from the homeworks. So, it is to your advantage that you work out the homework problems by your own selves.

Projects:
There will be two to three projects assigned during the semester. A project will consist of a relatively long problem, possibly with some MATLAB programming components to it.

Exams:
The two midterm exams will be in-class exams and their syllabus will not be cumulative (*i.e.*, midterm 2 will be on the topics covered after midterm 1). The final exam will be comprehensive, covering all the material in the course (including topics covered on the midterms). The difficulty level of the questions in the exam will be similar to those of the homeworks and quizzes.

Surprise Quizzes for Bonus Points:
- There will be about four surprise quizzes during the lectures.
- The problems in the surprise quizzes will be selected either from the problems worked out in class or the ones assigned in the homeworks.
- The quizzes will count towards 10% bonus points in determining your final letter grade: After your letter grade is computed using a *curve* based on your homework, project and exam scores, the score from the quizzes will be used to determine if you qualify for an increase in your final letter grade.
- One lowest score out of the surprise quizzes will be dropped. So, if you miss one quiz you will be fine. But missing more than one will start effecting your bonus points.

Preparation for Class and Participation in Class:
- Before every class, you are expected to read the sections from the tentative schedule (see the schedule document) that appear after the topics that were covered in the previous class.
- Class participation (in terms of responding to questions asked by the instructor and asking questions during the lecture) is expected and encouraged.
- If you miss a lecture, it is your responsibility to catch up with the class by talking to your classmates or reading the textbook.

Office Hours:
I will have my usual office hours on Wednesdays 11:30am-12:30pm in my office (Packard Lab room 562). However, if this time does not work for you, please email me to schedule a meeting by appointment. The TA office hours will be announced on the course site.

Makeup Quizzes / Exams and Late Homework Submissions
No make-ups will be given and no late homework submission will be accepted, except in documented extenuating circumstances (*e.g.*, family or personal emergency) with permission from the instructor. The student should provide the instructor an advance notice of his/her absence in order to be able to take a makeup exam/quiz, and provide valid documentation issued by the university. If approved, the assignment must be completed within one week of the original date of the assignment.

Electronic Devices:
- All cell phones, PDAs, tablets, smart watches and the like should be silenced/turned off and stowed off and out of sight during class.
- No such devices may be used or be within your view during tests.
- Only “Departmental Approved” calculators will be permitted during quizzes or exams (see Department policy and list of approved calculators posted on Course Site). You are responsible for bringing a functioning calculator to all tests. No cell phones, iPhones, Blackberries or other PDAs or devices with internet or communication capabilities will be allowed to be used as a calculator. If you need to know what time it is, please bring a

watch without communication capabilities.

Academic Integrity:
Students are expected to be familiar with all the academic integrity principles of Lehigh University. Please visit the Academic Integrity Resources page for details: https://citl.lehigh.edu/academic-integrity-resources

Accommodations for Students with Disabilities
If you have a disability for which you are or may be requesting accommodations, please contact both your instructor and the *Office of Academic Support Services, Williams Hall, Suite 301* (610-758-4152) as early as possible in the semester. You must have documentation from the Academic Support Services office before accommodations can be granted.

The Principles of Our Equitable Community
Lehigh University endorses The Principles of Our Equitable Community (http://www.lehigh.edu/~inprv/initiatives/PrinciplesEquity_Sheet_v2_032212.pdf). We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom.

Learning Objectives
Mech 102 : Dynamics
Fall 2018

Upon completion of this course, students should be able to do the following:

1. Represent position, velocity, and acceleration as vectors in rectangular coordinates , polar coordinates and tangential-normal coordinates, and work out kinematics problems using such representations.
2. Carry out dynamic analyses of particles using Newton's laws and free-body & kinetic diagrams.
3. Understand the fundamentals of impulse-momentum method, the conditions under which linear momentum is conserved, and carry out dynamic analyses of particles and system of particles using impulse-momentum methods.
4. Carry out analysis of impacts between particles using conservation of linear momentum and understand coefficient of restitution.
5. Understand angular impulse, angular momentum and central forces, and use these concepts to solve problems using angular impulse-momentum methods.
6. Understand work-energy principle, distinguish between conservative & non-conservative forces, and identify conditions under which kinetic and total energy are conserved. Solve problems using these methods.
7. Analyze relations between position, velocity and acceleration of fixed points on rotating and translating rigid bodies.
8. Analyze relations between position, velocity and acceleration of moving points on rotating and translating rigid bodies (motion with respect to a rotating frame).
9. Understand angular momentum in context of rigid bodies and carry out dynamic analyses of rigid bodies using Newton's laws (including free-body & kinetic diagrams of rigid bodies) and angular impulse-momentum methods.
10. Understand kinetic energy in context of rigid bodies and use work-energy principle for solving dynamics problems involving rigid bodies.
11. Carry out analyses of particles and rigid bodies subjected to free (unforced) vibration.
12. Carry out analyses of particles and rigid bodies subjected to forced vibration, hence understand the phenomenon of resonance.