# MAE 2323 Dynamics

Spring 2015

- **Instructor**
  - Alan Bowling
    Office 315A Woolf Hall
    Phone: (817) 272-0206
    Email: bowling@uta.edu
    Profile: www.uta.edu/faculty/bowling
    Office Hours: Weds. 10:30-11:30am
    *or by appointment*
- **Teaching Assistant**
  -
    Office:
    Email:
    Office Hours:
- **Course Specifics**
  - MAE 2323-002 Dynamics
    T TH 5:30-6:50pm
    NH 111
    Web Site: elearn.uta.edu
- **Course Overview**

  Dynamics is the study of how to model and predict the effect of forces in the creation of motion. This course is intended to give students a clear understanding of how to use reference points, reference frames, and coordinates to develop coordinate systems in which two-dimensional, planar, motion can be described and analyzed. This description allows one to predict how the position of points comprising bodies move over time due to the influence of forces. The key mathematical tools involved in developing this description are vectors and matrices manipulated using techniques from linear algebra and vector calculus. These tools are used to develop the equations of motion for a system of particles or rigid bodies using vector mechanics and energy-based methods. The course also examines impulse-momentum principles that are often used to analyze collisions.
- **Course Content**

  Geometry of position and orientation, translational and rotational velocity and acceleration, mass and moments of inertia, equations of motion, Newton's laws, Euler's equations, Work-Energy theorem, impulse-momentum principles, vector and matrix algebra.
- **Student Learning Outcomes**

  By the end of this course students should be able to:
  - use reference points and frames to develop a position vector description of a point's position in a plane
  - express position vectors in different reference frames
  - differentiate position vectors to find velocity and acceleration
  - develop a particle's equations of motion using Newton's and Euler's laws
  - develop a description of the position and orientation of a rigid body
  - find translational and rotational velocities and accelerations for a rigid body
  - develop equations of motion for a rigid body
  - apply the Work-Energy theorem to analysis of particle and rigid body motion
  - apply the principles of Impulse and Momentum to analysis of particle and rigid body motion

- **Course Materials**
  - *Required* "Engineering Mechanics Dynamics", R. C. Hibbeler, Thriteenth Edition, Pearson Prentice Hall, 2012.
  - *Required* Class Notes, Available at Bird's Copies & Printing, 208 South East Street, Arlington, TX 76010-1110, (817) 459-1688, www.birdscopies.com

    The course is mainly taught from the class notes, and homework problems are taken from the Hibbeler textbook.

- **Examinations and Projects**

| | | |
|---|---|---|
| Test 1 | February 24 | 5:30-6:50pm |
| Test 2 | March 31 | 5:30-6:50pm |
| Test 3 | April 28 | 5:30-6:50pm |
| Final Exam | May 12 | 5:30-8:00pm |

  *The final exam date and time cannot be changed, except in very extreme cases.*

- **Grading Policy**
  1. Homework (20%)
  2. Test 1 (20%)
  3. Test 2 (20%)
  4. Test 3 (20%)
  5. Final exam (20%)

- **Expectations for Out-of-Class Study**

  Beyond the time required to attend each class meeting, students enrolled in this course should expect to spend a minimum of 9 hours per week of their own time in course-related activities, including reading required materials, completing assignments, preparing for exams, etc.

- **Homework Policy**

  Collaboration on homework is encouraged. You may consult outside reference materials, other students, the teaching assistants, and/or the instructor. However, all solutions that are handed in should reflect your understanding of the subject matter at the time of writing.

  The homework assignment and lecture schedule is posted on the course web site. Late homeworks will not be accepted.

- **Grade Grievances**

  Objections concerning the grading of homeworks and tests should be raised within one week after they are returned. After one week the grade is permanent. Questions about homework grading should be discussed with the TA first. If the problem cannot be resolved with the TA, then it can be brought to my attention.

- **Attendance Policy**

  Students are not penalized for not attending the lectures, but it is strongly advised that they do. Material is presented in the lectures which is not available in the textbook.

- **Code of Conduct**
  - No persistent talking during lecture.
  - No newspaper reading during lecture.
  - No laptops open during lecture unless specifically requested by instructor.

- **Drop Policy** Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. Students will not be automatically dropped for non-attendance. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/aao/fao/).

- **Americans with Disabilities Act**

  The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the Americans with Disabilities Act (ADA). All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

- **Academic Integrity**

  All students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

  *I pledge, on my honor, to uphold UT Arlington s tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*

  *I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

  UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System Regents Rule 50101, 2.2, suspected violations of university s standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student s suspension or expulsion from the University.

- **Student Support Services Available**

  UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at www.uta.edu/resources.

- **Electronic Communication Policy**

  UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at http://www.uta.edu/oit/cs/email/mavmail.php.

- **Student Feedback Survey**

  At the end of each term, students enrolled in classes categorized as lecture, seminar, or laboratory shall be directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term.

Each student s feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington s effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit http://www.uta.edu/sfs.

- **Final Review Week**

  A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week unless specified in the class syllabus. During Final Review Week, an instructor shall not give any examinations constituting 10of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

- **Emergency Exit Procedures**

  Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit. Exit either door and look to the West and there is a door opening onto Cooper street which can be used to exit the building. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist handicapped individuals.

- **Course Schedule**

| | | Lecture | Material | Assign | Due |
|---|---|---|---|---|---|
| T | Jan. 20 | Introduction, Tools of the trade | Bowling, Chs. 1-3 | | |
| H | Jan. 22 | Points, frames, directions, vectors | | | |
| T | Jan. 27 | Position/Orientation | | HW1 | |
| H | Jan. 29 | Constraints | | | |
| T | Feb. 3 | Constraints | | HW2 | HW1 |
| H | Feb. 5 | Velocity | Bowling, Ch. 4 | | |
| T | Feb. 10 | Velocity | | HW3 | HW2 |
| H | Feb. 12 | Velocity | | | |
| T | Feb. 17 | Acceleration | | | HW3 |
| H | Feb. 19 | Acceleration | | | |
| T | Feb. 24 | Test 1 | HW1-HW3 | HW4 | |
| H | Feb. 26 | Mass and Linear Momentum | Bowling, Ch. 5 | | |
| T | Mar. 3 | Inertia and Angular Momentum | | HW5 | HW4 |
| H | Mar. 5 | Mass, Inertia, and Kinetic Energy | | | |
| T | Mar. 17 | Forces and Moments | Bowling, Ch. 6 | HW6 | HW5 |
| H | Mar. 19 | Forces and Moments | | | |
| T | Mar. 24 | Force Potential Functions | | | HW6 |
| H | Mar. 26 | Conservation Laws | | | |
| T | Mar. 31 | Test 2 | HW4-HW6 | HW7 | |
| H | Apr. 2 | Conservation Laws | | | |
| T | Apr. 7 | Conservation Laws | | HW8 | HW7 |
| H | Apr. 9 | Eqns. of Motion: Vector Mechanics | Bowling, Ch. 7 | | |
| T | Apr. 14 | Eqns. of Motion: Vector Mechanics | | HW9 | HW8 |
| H | Apr. 16 | Eqns. of Motion: Vector Mechanics | | | |
| T | Apr. 21 | Eqns. of Motion: Impulse-Momentum Theory | | | HW9 |
| H | Apr. 23 | Eqns. of Motion: Impulse-Momentum Theory | | | |
| T | Apr. 28 | Test 3 | HW7-HW9 | HW10 | |
| H | Apr. 30 | Eqns. of Motion: Energy Methods | | | |
| T | May 5 | Thanksgiving | | | |
| H | May 7 | (Final Review Week) Eqns. of Motion: Energy Methods | | | HW10 |
| T | May 12 | Final Exam 5:30-8:00pm | | | |

As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course.

**This schedule is subject to change without notice.**