

Course Section: 001
Meeting Time and Place: 9:50AM – 11:05AM | TR | [Online](#)
Course Credit Hours: 3

**FACULTY CONTACT
INFORMATION**

Jeff Reinbolt
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**TEACHING ASSISTANT CONTACT
INFORMATION**

Not applicable

- 1. COURSE DESCRIPTION.** Applications of biomechanics to the industrial and orthopedic area. Design of orthopedic implant devices; biomechanics of injury and protection.

*(Registrar Enforced) Prerequisite(s): BIOL 160 or 168, BME 205, and ME 231.
(Department Enforced) Prerequisite(s): EF 230 and BME 201.*

The goal of this course is to teach you the fundamental concepts of movement biomechanics with an emphasis on how muscles produce movement.

- 2. COURSE OBJECTIVES.** The objectives of this course are to teach you: the biological, mechanical, and neurological mechanisms by which muscles produce movement; identify and use engineering tools to study movement; write and solve equations of motion for simple models of human movement; and apply biomechanics principles to “real-world” clinical and biomechanical research.
- 3. TEXTS/MATERIALS/RESOURCES FOR THE COURSE.** Course Reader (available online)

NOT required: *Orthopaedic Biomechanics: Mechanics and Design in Musculoskeletal Systems*, D. L. Bartel, D. T. Davy, and T. M. Keaveny, 2007. ISBN: 978- 0130089090

Online resources: <https://utk.instructure.com/courses/103807>

- 4. INFORMATION LITERACY/TECHNOLOGICAL RESOURCES.** Online@UT

5. TEACHING APPROACH.

Methods of Instruction. To learn the fundamental concepts of movement biomechanics, we will use activities in lectures and student research papers/presentations, through homework and simulation exercises, and during office hours.

Lectures. We will cover all of the material in the *Course Reader* handout and more. I do not anticipate these lectures being a one-way communication without your participation. To learn, you will need to think and respond to questions and ask your own questions for clarification.

Class Collaboration and Peer-to-Peer Teaching. You are encouraged to become part of a study group early on in the course, as this will greatly facilitate your ability to learn from one another as well as to complete the homework assignments.

Homework. No solutions or grading will be provided to homework problems. You are encouraged to work together to figure out the *solution process* for homework problems. However, each student must write out his or her own final solutions, and direct copying of another student's solutions will be considered a violation of the University Honor Statement. You are welcome to use office hours to check your solutions.

Role of the Student. The role of the student is that of a learner, a collaborator, and a team member. You should be disciplined and motivated to follow the course schedule and complete assignments. If you have questions, it will be your responsibility to meet during office hours to receive additional assistance. You will be required to play an active role in identifying your learning issues and needs.

Role of the Instructor. The role of the instructor is that of a tutor, a mentor, and a resource. I should effectively organize, plan, and teach the curriculum. If you need additional assistance, I will provide support and encouragement to address your learning needs.

Class Expectations. To maintain a high-quality learning environment, the following standards will be followed:

- Professional courtesy and respect for others
- You are responsible for your own work
- You should show up on-time and be prepared for lectures
- Cell phones, iPods, audio players, and other distracting devices will *not* be used
- Disruptive behavior will *not* take place
- The University Honor Statement will *not* be violated

6. COURSE REQUIREMENTS, ASSESSMENT, AND EVALUATION METHODS.

Attendance Policy. Attendance is not required except for exams. However, it will be extremely difficult to pass the course unless you regularly attend lectures.

Tardiness Policy. Arriving late (or leaving early) is disruptive and does not meet the Class Expectations standards nor suggestions for How to be Successful in this Class. Since difficult days will arise during the semester, you will be permitted the occasional late arrival. If tardiness becomes a problem, I will meet with you individually to discuss your issues and possible consequences.

Homework. Homework assignments will involve the completion of problems discussed in class and available online. See the *Homework Assignments* handout for details on problems assigned.

Exams. Exams will be in-class proctored via Zoom and they will be closed-book, closed notes, but you will be allowed to use one sheet of 8.5"x11" letter-sized paper (front and back) with as much material on it as you want. Exam problems may be taken directly from the lecture and homework problems with some modifications. If you do not agree with the grading of a particular exam problem, you will have one week from the date the exam is returned to submit a written explanation of why you think the grade should be higher. However, the final decision will remain the instructor's.

Make-up Exam Policy. No make-up exams will be given. If you miss an exam without my prior consent, you will receive a grade of zero for that exam.

Course Project. The semester-long project will involve you and a teammate together surveying the literature on a specific topic in the field of movement biomechanics. In a project report and presentation to the class, each team will describe the current state-of-the-art and suggest areas that require further research; moreover, your team will briefly describe how you would investigate a specific problem yourself. See the *Course Project* handout for more details.

Honors Student Policy. Honor students (registered for BME 477) are expected to perform additional, graded work beyond the BME 473 class. Common additional undertakings include extra labs, research papers, and class presentations. Each student must select one of the following assignments:

- **Homework.** Complete the OpenSim Dynamic Simulation of Jumping Lab. The purpose of this lab is to give you experience with a complex, dynamic model of the human musculoskeletal system. In the course of this lab, you will:
 - Determine excitations to produce a jump
 - Study actions produced by muscles
 - Compare simulation to experimental data
 - Quantify the magnitude of the hip forces

- Examine quad force over simulation
- *Project.* Complete an additional project outline different from your team's course project. The written outline should include the following sections:
 - Introduction & Background briefly describing your topic and why it is important.
 - Previous Investigations listing several sources that relate to your topic. For each paper state the following:
 - Goal(s) of the previous paper
 - How it relates to your topic
 - Major conclusions
 - Major shortcomings
 - The next step in this research
 - References listing at least ten references that relate to your topic and formatted in the style of the *Journal of Biomechanics*.
- *Presentation.* Give a single class lecture using the instructor's material selected from the special topics (e.g., neuromuscular overview, lower-limb anatomy) in the *Lecture Schedule* handout.

Grading System. The final course grade, g , will be assessed based on the following percentages, including one percentage (x) you choose at the final exam:

| Assessment | Percent (%) |
|----------------------|--------------------|
| Engagement (e) | 5 |
| Midterm 1 (m_1) | 20 |
| Midterm 2 (m_2) | 20 |
| Outline (o) | 5 |
| Presentation (p) | 10 |
| Report (r) | 15 |
| Final Exam (f) | $0 \leq x \leq 25$ |

$$g(x) = \frac{(0.05e + 0.20m_1 + 0.20m_2 + 0.05o + 0.10p + 0.15r + xf)}{(0.05 + 0.20 + 0.20 + 0.05 + 0.10 + 0.15 + x)}$$

You will earn your own final course grade, g , based on the percentages and formula above. If you are afraid that you are not performing well enough during the semester, come see me early to have enough time to get back on track.

Grading Scale. Assessed grades will use the following divisions that are linearly related to the University's quality point scale:

| Grade | Quality Points (x) | Percentage ($10x+50$) |
|-------|------------------------|-------------------------|
| A | 4.0 | $90\% \leq g$ |
| A- | 3.7 | $87 \leq g < 90\%$ |
| B+ | 3.3 | $83 \leq g < 87\%$ |
| B | 3.0 | $80 \leq g < 83\%$ |

| | | |
|----|-----|--------------------|
| B- | 2.7 | $77 \leq g < 80\%$ |
| C+ | 2.3 | $73 \leq g < 77\%$ |
| C | 2.0 | $70 \leq g < 73\%$ |
| C- | 1.7 | $67 \leq g < 70\%$ |
| D+ | 1.3 | $63 \leq g < 67\%$ |
| D | 1.0 | $60 \leq g < 63\%$ |
| D- | 0.7 | $57 \leq g < 60\%$ |
| F | 0.0 | $g < 57\%$ |

Honor Statement Policy. See the University Policies section below.

7. COURSE OUTLINE/ASSIGNMENT/UNITS OF INSTRUCTION. See the *Lecture Schedule* handout for a day-by-day outline of the following general topics we will cover:

- Introduction to Movement Biomechanics
- Locomotion
- Muscle Structure and Function
- Neuromuscular Overview
- Motion Tracking Techniques
- Inverse Dynamics
- Equations of Motion
- Advanced Biomechanics Techniques

See the *Homework Assignments* handout for details on problems assigned. Homework will generally be one week after the corresponding materials are covered in lecture.

8. HOW TO BE SUCCESSFUL IN THIS CLASS. In addition to fully engaging online, completing the homework assignments, exams, and course project, general guidelines for improving your performance are as follows:

- Attend every class and be on time
- Bring documents from *Course Reader* handout, printouts of web documents, notebook, and pen/pencil to class
- Take notes and go over them before the next class
- Read the assigned documents before each class.
- In class, we may complete examples as a group exercise. However, if you are unable to complete an example in class, you should do so on your own. The examples will not be graded, but they are designed to teach you the skills you need to do the assignments and exams that will be graded.
- Take advantage of office hours for extra help whenever you need it!

- Use the resources and documents from *Course Reader* handout and course website!
- Ask questions!
- Do your own work!

9. **COURSE FEEDBACK.** In addition to formative feedback opportunities during office hours, by appointment, or via email, you will be given the opportunity to provide this feedback in writing after each exam. For anonymous feedback, you may complete a *Feedback Form* online at any time:

<http://rrg.utk.edu/resources/BME473/feedback.html>

10. UNIVERSITY POLICIES.

Freedom to Learn. The responsibility to secure and to respect general conditions conducive to the freedom to learn is shared by all members of the academic community. The university welcomes and honors people of all races, creeds, cultures, and sexual orientations, and values intellectual curiosity, pursuit of knowledge, and academic freedom and integrity.

Academic Integrity. The Honor Statement as printed in *Hilltopics* encourages each student to make a personal commitment to academic integrity:

"An essential feature of the University of Tennessee is a commitment to maintaining an atmosphere of intellectual integrity and academic honesty. 'As a student of the University, I pledge that I will neither knowingly give nor receive any inappropriate assistance in academic work, thus affirming my own personal commitment to honor and integrity.'"

All students admitted to the University of Tennessee have signed and dated a pledge acknowledging their affirmation of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action.

Plagiarism. Students are also responsible for any acts of plagiarism that uses the intellectual property of someone else without giving proper credit. Plagiarism is a serious offense, subject to disciplinary action that may include failure in a course and/or dismissal from the university.

Final Exam Policy. Final exams must be given during the final exam period at the scheduled time, although alternative uses of the scheduled exam period may be designated by the instructor.

- Students are not required to take more than two written exams on any day. The instructor(s) of the last non-departmental exam(s) on that day must reschedule the student's exam during the exam period. It is the

obligation of students with such conflicts to make appropriate arrangements with the instructor at least two weeks prior to the end of classes.

- All final exams must be given during the final exam period at the scheduled time, although alternative uses of the scheduled exam period may be designated by the instructor.
- No in-class written quizzes or tests counting more than 10 percent of the semester grade may be given the last five calendar days prior to the study period.

11. STUDENTS WITH DISABILITIES POLICY. Any student who feels s/he may need an accommodation based on the impact of a disability should contact the instructor privately to discuss their specific needs. Students with documented disabilities should contact the Office of Disability Services for assistance with appropriate accommodations at (865) 974-6087 or ods@tennessee.edu.

12. IMPORTANT DATES IN THE ACADEMIC CALENDAR.

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|------------------------------------|----------------------|
| Labor Day (instructional day) | September 7, 2020 |
| Last Day of Classes | November 24, 2019 |
| Thanksgiving Holiday (no classes) | November 25-27, 2019 |
| Final Exam (9:50-11:05AM TR Class) | TBD |

13. SYLLABUS CHANGES. I reserve and likely will exercise the right to revise, alter, and/or amend this syllabus as necessary. You will be notified of any such changes. You should check the course web site on a regular basis for up-to-date course information.