**Syllabus for EGRB 423: Rehabilitation Engineering and Prostheses Fall 2021**

Lecture: 3:30 - 4:45 p.m. T Th Engineering Building West 104

Instructor: Carrie Peterson, Ph.D.

Email: clpeterson@vcu.edu

Office hours: Fridays 3:00-5:00 pm or by appt, in person or Zoom

Office location: Biotech Eight Building, 737 N 5th Street, Room 421

https://vcu.zoom.us/j/2093767799

This course explores the principles and practices regarding the measurement and analysis of human movement towards the development of rehabilitation therapies, devices, and prostheses. The course will further address deficits in neuromuscular control that must be considered when developing devices and engineering solutions for individuals with different therapy and prosthetic needs. The course will also provide a general overview of current technologies and the engineering principles behind these designs.

Prior to taking this course students should have had previous experience with:

* Static and mechanics of materials
* Vector analysis, differential equations

Student Learning Outcomes

* Understanding of neuro-musculoskeletal system and human movement
* Understanding of rehabilitation approaches to treat sensorimotor disorders/injuries
* Apply engineering principles to design of prostheses for limb loss and/or neurologic disorders
* Ability to identify an appropriate research question or design need and address with engineering principles

Textbook: Biomechanics of Movement: The Science of Sports, Robotics, and Rehabilitation by Thomas K Uchida, Scott Delp, 2021.

Students are expected to have completed associated reading prior to coming to class.

**Grading:**

Homeworks 40%

In-Class Exam 25%

Participation (Attendance & Contribution) 10%

Rehabilitation Topic Review – Oral and Written 25%

The grading scale is as follows:

90-100 A

80-89 B

70-79 C

60-69 D

< 60 F

**Tentative course schedule:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Date:** | **Topics covered** | **Reading** | **Assessment** |
| 8/24  8/26 | Introduction, Scope of Rehabilitation in This Course  Why Study Human Movement |  | Homework 1 Assigned |
| 8/31  9/2 | Homework 1 presentations, Kinematics  Kinematics of Human Movement, Walking, Motion Capture | Chapter 1  Chapter 2 | **Homework 1 Due 8/31** |
| 9/7  9/9 | Quantifying Movement, Coordinate frames  Coordinate frames | Chapter 7 |  |
| 9/14  9/16 | Inverse Kinematics, Transformation matrices | Chapter 7 | Homework 2 Assigned |
| 9/21  9/23 | Muscle Biology and Force | Chapter 4 |  |
| 9/28  9/30 | Muscle Architecture and Dynamics | Chapter 5 | **Homework 2 Due 9/28** |
| 10/5  10/7 | Musculoskeletal Geometry | Chapter 6 |  |
| 10/12  10/14 | Inverse Dynamics | Chapter 8 | Homework 3 Assigned |
| 10/19  10/21 | Limb Loss Prosthetics Neuroprostheses | Supplemental | **Homework 3 Due 10/19** |
| 10/26  10/28 | Review  Exam |  |  |
| 11/2  11/4 | No Class  Discussion of Final Projects |  | **Homework 4** |
| 11/9  11/11 | Rehabilitation Robotics  Neuromodulation | Journal paper | **Homework 5** |
| 11/16  11/18 | Brain Computer Interfaces  Virtual Reality | Journal paper | **Homework 6** |
| 11/23  11/25 | Fall/Thanksgiving Break |  |  |
| 11/30  12/2 | Final Presentations  Final Presentations |  |  |
| 12/7  12/9 | Final Presentations  Final Presentations |  |  |

**Campus emergency information**  
Sign up to receive at [**alert.vcu.edu/signup/**](https://alert.vcu.edu/signup/). It is essential to keep your information up-to-date within VCU Alert and to keep your permanent address and emergency contact information current in eServices.

VCU uses a variety of communication methods to alert the campus community about emergency situations and safety threats. Learn more about types of alerts at [**alert.vcu.edu/know/types-of-alerts/**](https://alert.vcu.edu/know/types-of-alerts/)

Know the emergency phone number for the VCU Police (828-1234), and report suspicious activities and objects.

**Class registration required for attendance**  
Students may attend only those classes for which they have registered. Faculty may not add students to class rosters. If students are attending a class for which they have not registered, they must stop attending.

**Honor System: upholding academic integrity**  
The VCU Honor System policy describes the responsibilities of students, faculty and administration in upholding academic integrity. According to this policy, "Members of the academic community are required to conduct themselves in accordance with the highest standards of academic honesty, ethics and integrity at all times." Students are expected to read the policy in full and learn about requirements here: [**http://conduct.students.vcu.edu/vcu-honor-system/**](http://conduct.students.vcu.edu/vcu-honor-system/)

**Computer and network use**  
All students are expected to know and comply with VCU's Computer and Network Use policy, which can be reviewed at [**policy.vcu.edu/universitywide-policies/policies/computer-and-network-resources-use.html.**](https://policy.vcu.edu/universitywide-policies/policies/computer-and-network-resources-use.html)

**Important dates**  
Important dates for the semester are listed in the VCU Academic Calendar: [**https://academiccalendars.vcu.edu/**](https://academiccalendars.vcu.edu/)

**Reading Days**  
No classes or exams are held on these days except in instances where a student is involved in clinical and field placements, practica, co-ops, internships and other work-related experiential learning activities. Faculty may not give an examination or an assignment on those days. Instead, students are encouraged to use these days for relaxation, study and/or review of class materials.

**We care about your success!**  
Virginia Commonwealth University has launched an Early Alert initiative to support student success. As your professor, if I am concerned about your academic performance in the first few weeks of this class, you and your academic advisor may receive a Progress Report email with links to appropriate academic support resources. You are encouraged to reach out to me after class or during my office hours for additional support. Your academic advisor, the Writing Center, and the Campus Learning Center may also follow up to provide additional layers of support to you.

**Attendance and consequences of poor attendance**  
The instructional programs at VCU are based upon a series of class meetings involving lectures, discussions, field experiences, special readings and reporting assignments. Therefore it is important for each student to be in attendance on a regular basis. A student who misses a class session is responsible for completing all material covered or assignments made during the absence.

Students having attendance problems should contact their instructor to explain the reasons for nonattendance and to discuss the feasibility of continuing in the course. If the student has fallen so far behind that the successful completion of the course is impossible, the student should withdraw from the course before the end of the first 10 weeks of classes.

If the student continues to miss class and does not officially withdraw from the course, the instructor may withdraw the student for nonattendance with a mark of W before the end of the first 10 weeks of classes or may assign an academic grade at the end. Withdrawals are not permitted after the end of the first 10 weeks of classes. For classes that do not conform to the semester calendar, the final withdrawal date occurs when half of the course has been completed.

**Career Services**  
Looking for ways to tie what you are learning in your class to your future career or professional goals? VCU Career Services provides career planning services for all current VCU students and alumni. Career Services can help students with finding a work-study job on/off campus, resume writing, internship development, interviewing, preparing for graduate school, networking, or job searching,. Students are invited to attend career events and workshops, and schedule individualized career advising appointments. For more information and to make a career advising appointment, [**visit the VCU Career Services website**](http://www.careers.vcu.edu/).

**Managing stress**  
Students may experience situations or challenges that can interfere with learning and interpersonal functioning including stress, anxiety, depression, alcohol and/or other drug use, concern for a friend or family member, loss, sleep difficulties, feeling hopeless or relationship problems. There are numerous campus resources available to students including University Counseling Services (804-828-6200 MPC Campus, 804-828-3964 MCV Campus) which provides brief therapy treatment, University Student Health Services (MPC 804 828-8828, MCV Campus 804 828-9220) and the Health Promotion and Well-Being Center [The Well] (804-828-9355). 24 hour emergency mental health support is available by calling (804) 828-6200 or utilizing the National Suicide Prevention Lifeline (1-800-784-2433).

**Mandatory responsibility of faculty members to report incidents of sexual misconduct**  
All employees, including faculty, department chairs and deans, are required to report any incidents of sexual assault, sexual exploitation and partner or relationship violence to the university's Title IX Coordinator.

Confidential offices which can provide support at VCU are: University Counseling Services, (804) 828-6200

For more information about Title IX, please visit [**https://equity.vcu.edu/**](https://equity.vcu.edu/).

**Military short-term training or deployment**  
If military students receive orders for short-term training or for deployment/mobilization, they should inform and present their orders to Military Student Services and to their professor(s). For further information on policies and procedures contact Military Student Services at 828-5993 or access the corresponding policies.

**Student email standard**  
Email is considered an official method for communication at VCU. Students are expected to check their official VCU email on a frequent and consistent basis (the university recommends daily) in order to remain informed of university-related communications. Students are responsible for the consequences of not reading, in a timely fashion, university-related communications sent to their official VCU student email account. Mail sent to the VCU email address may include notification of university-related actions, including disciplinary action. Students must read this standard in its entirety at [**https://ts.vcu.edu/media/technology-services/content-assets/university-resources/ts-groups/information-security/StudentEmailStandard.pdf**](https://ts.vcu.edu/media/technology-services/content-assets/university-resources/ts-groups/information-security/StudentEmailStandard.pdf)

**Student financial responsibility**  
Students assume the responsibility of full payment of tuition and fees generated from their registration, all charges for housing and dining services and other applicable miscellaneous charges. Students are ultimately responsible for any unpaid balance on their account as a result of the University Financial Aid Office or their third party sponsor canceling or reducing their award(s).

**Students representing the university – excused absences**  
Students who represent the university (athletes and others) do not choose their schedules. All student athletes should provide their schedules to their instructors at the beginning of the semester. The Intercollegiate Athletic Council strongly encourages faculty to treat missed classes or exams (because of a scheduling conflict) as excused absences and urges faculty to work with the students to make up the work or exam.

**Students with disabilities**  
Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, as amended, require that VCU provide "academic adjustments" or "reasonable accommodations" to any student who has a physical or mental impairment that substantially limits a major life activity. To receive accommodations, students must register with the Office of Student Accessibility and Educational Opportunity on the Monroe Park Campus (828-2253) or the Division for Academic Success on the MCV campus (828-9782). Please also visit the Student Accessibility and Educational Opportunity website via [**https://saeo.vcu.edu/**](https://saeo.vcu.edu/) and/or the Division for Academic Success website via [**https://das.vcu.edu/**](https://das.vcu.edu/) for additional information.

Once students have completed the registration process, they should schedule a meeting with their instructor (s) and provide their instructor (s) with an official accommodation letter. Students should follow this procedure for all courses in the academic semester.

**Withdrawal from classes**  
Before withdrawing from classes, students should consult their instructor as well as other appropriate university offices. Withdrawing from classes may negatively impact a student’s financial aid award and his or her semester charges. To discuss financial aid and the student bill, contact the [**Student Financial Management Center (RAMQ)**](https://sfmc.vcu.edu/contactsfmc/ramq/) regarding the impact on your financial aid.

**Faculty communication about students**  
VCU instructional faculty, administrators and staff maintain confidentiality of student records and disclose information in accordance with the Family Educational Rights and Privacy Act (FERPA). This means that VCU officials may disclose student record information without the consent of the student in certain situations. To support university operations, for example, VCU officials share information about students with other educational officials as necessary to perform their job duties. FERPA permits this disclosure to school officials who have a legitimate educational interest in the student information. In addition, VCU officials have obligations to report information shared by a student depending on the content of that information, for example, in compliance with VCU’s policy on the duty to report. Unless FERPA permits a certain disclosure, VCU generally requires consent from a student to disclose information from their education record to another individual. You may find additional information on the VCU FERPA website: [**http://rar.vcu.edu/records/family-educational-rights-and-privacy-act/**](http://rar.vcu.edu/records/family-educational-rights-and-privacy-act/).