1. General Information

1a. Submitted by the College of: ENGINEERING

Date Submitted: 2/25/2014

1b. Department/Division: Department of Biomedical Engineering

1c. Contact Person

Name: Babak Bazrgari

Email: babak.bazrgari@uky.edu

Phone: 859-257-1379

Responsible Faculty ID (if different from Contact)

Name:

Email:

Phone:

1d. Requested Effective Date: Specific Term/Year [1]   Spring 2015

1e. Should this course be a UK Core Course?   No

2. Designation and Description of Proposed Course

2a. Will this course also be offered through Distance Learning?:   No

2b. Prefix and Number: BME 540

2c. Full Title: MECHANICAL MODELING OF HUMAN MOTION

2d. Transcript Title: MECHANICAL MODELING OF HUMAN MOTION

2e. Cross-listing:

2f. Meeting Patterns

LECTURE: 3

2g. Grading System: Letter (A, B, C, etc.)

2h. Number of credit hours: 3

2i. Is this course repeatable for additional credit?   No

If Yes: Maximum number of credit hours:

If Yes: Will this course allow multiple registrations during the same semester?

2j. Course Description for Bulletin: An introduction to mechanical modeling of human motion (lectures) along with application of computational software to model and estimates internal tissues responses to physical demands of several different activities/tasks (lab activities).

2k. Prerequisites, if any: EM 221, EM 313; or consent of instructor

2l. Supplementary Teaching Component:

3. Will this course taught off campus?   No

   If YES, enter the off campus address:

4. Frequency of Course Offering: Spring,

   Will the course be offered every year?:   Yes

   If No, explain:

5. Are facilities and personnel necessary for the proposed new course available?:   Yes

   If No, explain:

6. What enrollment (per section per semester) may reasonably be expected?: 20

7. Anticipated Student Demand

   Will this course serve students primarily within the degree program?:   No

   Will it be of interest to a significant number of students outside the degree pgm?:   Yes

   If Yes, explain: This course will be of interest to students in other engineer disciplines. It may be able to serve as a free or technical elective.

8. Check the category most applicable to this course: Relatively New – Now Being Widely Established,

   If No, explain:

9. Course Relationship to Program(s).

   a. Is this course part of a proposed new program?:   Yes

   If YES, name the proposed new program: Minor in Biomedical Engineering

   b. Will this course be a new requirement for ANY program?:   No

   If YES, list affected programs:

10. Information to be Placed on Syllabus.

   a. Is the course 400G or 500?:   Yes

   b. The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if applicable, from **10.a** above) are attached: Yes

Distance Learning Form

Instructor Name:

Instructor Email:

Internet/Web-based: No

Interactive Video: No

Hybrid: No

1.How does this course provide for timely and appropriate interaction between students and faculty and among students? Does the course syllabus conform to University Senate Syllabus Guidelines, specifically the Distance Learning Considerations?

2.How do you ensure that the experience for a DL student is comparable to that of a classroom-based student's experience? Aspects to explore: textbooks, course goals, assessment of student learning outcomes, etc.

3.How is the integrity of student work ensured? Please speak to aspects such as password-protected course portals, proctors for exams at interactive video sites; academic offense policy; etc.

4.Will offering this course via DL result in at least 25% or at least 50% (based on total credit hours required for completion) of a degree program being offered via any form of DL, as defined above?

If yes, which percentage, and which program(s)?

5.How are students taking the course via DL assured of equivalent access to student services, similar to that of a student taking the class in a traditional classroom setting?

6.How do course requirements ensure that students make appropriate use of learning resources?

7.Please explain specifically how access is provided to laboratories, facilities, and equipment appropriate to the course or program.

8.How are students informed of procedures for resolving technical complaints? Does the syllabus list the entities available to offer technical help with the delivery and/or receipt of the course, such as the Information Technology Customer Service Center (http://www.uky.edu/UKIT/)?

9.Will the course be delivered via services available through the Distance Learning Program (DLP) and the Academic Technology Group (ATL)?   NO

If no, explain how student enrolled in DL courses are able to use the technology employed, as well as how students will be provided with assistance in using said technology.

10.Does the syllabus contain all the required components?   NO

11.I, the instructor of record, have read and understood all of the university-level statements regarding DL.

   Instructor Name:

    SIGNATURE|PULEO|David A Puleo|BME 540 NEW Dept Review|20140225

    SIGNATURE|BJSTOK0|Barbara J Brandenburg|BME 540 NEW College Review|20140909

    SIGNATURE|JMETT2|Joanie Ett-Mims|BME 540 NEW Undergrad Council Review|20150203

    SIGNATURE|ZNNIKO0|Roshan Nikou|BME 540 NEW Graduate Council Review|20150226

Courses	Request Tracking

New Course Form

https://myuk.uky.edu/sap/bc/soap/rfc?services=

Open in full window to print or save

Attachments:

[Browse...]   Upload File

	ID	Attachment
Delete	4353	BME-540-Bazrgari rev 2-3-15.docx

[First] 1 [Last]

[Select saved project to retrieve...]   Get   New

(*denotes required fields)

1. **General Information**

    a. * Submitted by the College of: ENGINEERING [▼]   Submission Date: 2/25/2014

    b. * Department/Division: Department of Biomedical Engineering [▼]

    c.

       * Contact Person Name: Babak Bazrgari   Email: babak.bazrgari@uky.edu Phone: 859-257-1379

       * Responsible Faculty ID (if different from Contact)   Email: Phone:

    d. * Requested Effective Date: ○ Semester following approval OR ◉ Specific Term/Year [1] Spring 2015

    e.

       Should this course be a UK Core Course?   ○ Yes ◉ No

       If YES, check the areas that apply:

       ☐ Inquiry - Arts & Creativity   ☐ Composition & Communications - II

       ☐ Inquiry - Humanities   ☐ Quantitative Foundations

       ☐ Inquiry - Nat/Math/Phys Sci   ☐ Statistical Inferential Reasoning

       ☐ Inquiry - Social Sciences   ☐ U.S. Citizenship, Community, Diversity

       ☐ Composition & Communications - I   ☐ Global Dynamics

2. **Designation and Description of Proposed Course.**

    a. * Will this course also be offered through Distance Learning? ○ Yes [1] ◉ No

    b. * Prefix and Number: BME 540

    c. * Full Title: MECHANICAL MODELING OF HUMAN MOTION

    d. Transcript Title (if full title is more than 40 characters): MECHANICAL MODELING OF HUMAN MOTION

    e. To be Cross-Listed [2] with (Prefix and Number):

    f. * Courses must be described by at least one of the meeting patterns below. Include number of actual contact hours[3] for each meeting pattern type.

3	Lecture		Laboratory[1]		Recitation		Discussion
	Indep. Study		Clinical		Colloquium		Practicum
	Research		Residency		Seminar		Studio
	Other	If Other, Please explain:					

    g. * Identify a grading system:
       ◉ Letter (A, B, C, etc.)
       ○ Pass/Fail
       ○ Medicine Numeric Grade (Non-medical students will receive a letter grade)
       ○ Graduate School Grade Scale

    h. * Number of credits: 3

    i. * Is this course repeatable for additional credit?   ○ Yes ◉ No
       If YES: Maximum number of credit hours:
       If YES: Will this course allow multiple registrations during the same semester? ○ Yes ○ No

j. * Course Description for Bulletin:

An introduction to mechanical modeling of human motion (lectures) along with application of computational
software to model and estimates internal tissues responses to physical demands of several different
activities/tasks (lab activities).

k. Prerequisites, if any:

EM 221, EM 313; or consent of instructor

l. Supplementary teaching component, if any: ○ Community-Based Experience ○ Service Learning ○ Both

3. *** Will this course be taught off campus?**   ○ Yes ◉ No

   If YES, enter the off campus address:

4. **Frequency of Course Offering.**

   a. * Course will be offered (check all that apply):   ☐ Fall   ☑ Spring   ☐ Summer   ☐ Winter

   b. * Will the course be offered every year?   ◉ Yes ○ No

      If No, explain:

5. *** Are facilities and personnel necessary for the proposed new course available?**   ◉ Yes ○ No

   If No, explain:

6. *** What enrollment (per section per semester) may reasonably be expected?** 20

7. **Anticipated Student Demand.**

   a. * Will this course serve students primarily within the degree program?   ○ Yes ◉ No

   b. * Will it be of interest to a significant number of students outside the degree pgm?   ◉ Yes ○ No

      If YES, explain:

      This course will be of interest to students in other engineer disciplines. It may be able to serve as a free or
      technical elective.

8. *** Check the category most applicable to this course:**

   ☐ Traditional -- Offered in Corresponding Departments at Universities Elsewhere
   ☑ Relatively New -- Now Being Widely Established
   ☐ Not Yet Found in Many (or Any) Other Universities

9. **Course Relationship to Program(s).**

   a. * Is this course part of a proposed new program?   ◉ Yes ○ No

      If YES, name the proposed new program:

      Minor in Biomedical Engineering

   b. * Will this course be a new requirement [5] for ANY program?   ○ Yes ◉ No

      If YES [5], list affected programs::

10. **Information to be Placed on Syllabus.**

    a. * Is the course 400G or 500?   ◉ Yes ○ No

       If YES, the *differentiation for undergraduate and graduate students must be included* in the information required in 10.b. You must include: (i) identi
       additional assignments by the graduate students; and/or (ii) establishment of different grading criteria in the course for graduate students. (See SR

    b. ☑ * The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if appl
       10.a above) are attached.

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[1] Courses are typically made effective for the semester following approval. No course will be made effective until all approvals are received.
[2] The chair of the cross-listing department must sign off on the Signature Routing Log.

[1] In general, undergraduate courses are developed on the principle that one semester hour of credit represents one hour of classroom meeting per week for a semester, exclusive of any laboratory meeting. Laboratory meeting, generally, re
two hours per week for a semester for one credit hour. (from SR 5.2.1)
[1] You must also submit the Distance Learning Form in order for the proposed course to be considered for DL delivery.
[3] In order to change a program, a program change form must also be submitted.

Rev 8/09

Submit as New Proposal   Save Current Changes

MECHANICAL MODELING OF HUMAN MOTION
BME 540 - Spring ---

Tuesdays and Thursdays; ----- in -----

Instructor

Babak Bazrgari, PhD, Assistant Professor in DBME
Office: RMB-514E
Office Phone: 257-1379
Office Hours: Tuesdays Thursday ----- or email for appointment
Email: babak.bazrgari@uky.edu
Website: http://hmbl.engineering.uky.edu/

> Note: Other than scheduled office hours, drop-ins often cannot be accommodated. The best way to meet with me is to email me with a couple of times you are available, and I will let you know when I am free.

Course description
An introduction to mechanical modeling of human motion (lectures) along with application of computational software to model and estimates internal tissues responses to physical demands of several different activities/tasks (lab activities).

Prerequisites
EM 221, EM 313 or consent of instructor

Student Outcomes
Having successfully completed this course, the student should be able to:
- Demonstrate knowledge of computational modeling of human motion.
- Develop computational models to estimate 3D physical demands of an activity/task on different joints within the human body.
- Analyze relative active and passive contributions of joint's tissues to physical demands of task.
- Independently build upon course material by solving relevant research problems.

Required Materials
Reading material will be distributed as pdf files during the semester. Students also are required to obtain a student license for Matlab software

Course Activities and Assignments

Course Requirement	Percent	
	Graduate	Undergraduate
Mid-term Exams	25%	30%
Lab assignments	32% (4 @ 8% each)	40% (4 @ 10% each)
Final Exam	25%	30%
Final project and presentation	18%	0

Examinations

Two exams (mid-term and final) will be given. The exams are prescheduled and rarely deviate from the course schedule; therefore, students should plan accordingly. The format of the examinations will be closed book and closed notes unless otherwise stated.

Course Project

Each graduate student will individually complete and present a project wherein material covered in the class are applied to develop a musculoskeletal model and to simulate muscle forces and joint loads during a dynamic physical activity. The computational component of the project should include the development of a model that estimates internal and external forces at a joint of interest. Formal project reports as well as an in-class presentation are also required. Details of project will be discussed on the ----- and you will have two weeks to decide about your project topic with my consent. Students' presentation will be held ------ with written reports due on last session of the class.

Grading

Points in each category will be totaled and weighted as described above to arrive at a final grade using the standard grading scale (Undergraduate students: A=90-100%; B=80-89%; C=70-79%; D=60-69%; E=0-59%; Graduate students: A=90-100%; B=80-89%; C=70-79% and E=0-69%).

Course Polices:

Make-up/alternate exams

A make-up/alternate test will be given for excused absences when arrangements are made in advance or for medical reasons. If you miss a test due to an unexpected situation, you must contact me with a written official excuse **within a week** of the missed test.

Lab assignments/Homework

Throughout the semester, a series of computer-based activity will be assigned. These assignments will be due at the beginning of the class period on their respective due date. Note that a **grade of zero** will be assigned for late or un-submitted assignment. If you miss an assignment deadline due to an excused absence, you must contact me with a written official excuse to arrange for a new deadline for your assignment.

Concerns regarding grade

If you disagree with the grading on any coursework, you must discuss the concern with me within **one week** of receiving the graded work. I may ask you to submit a written document explaining your concern. I reserve the right to re-grade the entire work when reviewing the dispute. There is no guarantee that a grade adjustment will be made, however, I do make mistakes sometimes, so please do not hesitate to bring your concerns to my attention.

Attendance Policy

Class attendance is expected, and so is your attention. Regular class attendance and participation will help to ensure quality performance in this class.

Excused Absence

Students need to notify the professor of absences prior to class when possible. S.R. 5.2.4.2 defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness

or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit "reasonable cause for nonattendance" by the professor.

Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day in the semester to add a class. Information regarding dates of major religious holidays may be obtained through the religious liaison, Mr. Jake Karnes (859-257-2754).

Students are expected to withdraw from the class if more than 20% of the classes scheduled for the semester are missed (excused or unexcused) per university policy.

Verification of Absences
Students may be asked to verify their absences in order for them to be considered excused. Senate Rule 5.2.4.2 states that faculty have the right to request "appropriate verification" when students claim an excused absence because of illness or death in the family. Appropriate notification of absences due to university-related trips is required prior to the absence.

Academic Integrity
Per university policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the university may be imposed.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found at the following website: http://www.uky.edu/Ombud. A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty. It is important that you review this information as all ideas borrowed from others need to be properly credited.

Part II of Student Rights and Responsibilities (available online http://www.uky.edu/StudentAffairs/Code/part2.html) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about the question of plagiarism involving their own work, they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording or anything else from another source without appropriate acknowledgement of the fact, the students are guilty of plagiarism. Plagiarism includes reproducing someone else's work, whether it be a published article, chapter of a book, a paper from a friend or some file, or something similar to this. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work which a student submits as his/her own, whoever that other person may be.

Students may discuss assignments among themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student, and the student alone. When a student's assignment involves research in outside sources of information, the student must carefully acknowledge exactly what, where and how he/she employed them. If the words of someone else are used, the student must put quotation marks around the passage in question

and add an appropriate indication of its origin. Making simple changes while leaving the organization, content and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas which are so generally and freely circulated as to be a part of the public domain (Section 6.3.1).

Please note: Any assignment you turn in may be submitted to an electronic database to check for plagiarism.

Accommodations due to disability
If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (Room 2, Alumni Gym, 257-2754, email address: jkarnes@email.uky.edu) for coordination of campus disability services available to students with disabilities.

Other Policies:
- Honesty in your academic work will develop into professional integrity.
- Please show respect for your fellow classmates during lectures, class discussions, and while working on team assignments. As part of showing respect, please turn off all cell phones, PDAs, and messaging programs during class and group meetings.
- This is not just a computational course. Therefore, it will require each student to use, develop, and perfect their problem solving and critical thinking skills.
- All written assignments will be graded on the quality of the work. It is expected that each of you will provide me with well-written and defended solutions to the problems for this class.

Tentative Schedule

Week	Lecture	Lab	Note
1	Biomechanical modeling	Introduction to Matlab	
2	Musculoskeletal system	Introduction to Matlab	
3	Musculoskeletal system	Vector calculus	
4	Vector based kinematics	Vector calculus	
5	Vector based kinematics	Lab assignment-1	
6	3D dynamics of rigid bodies	Working with experimental data	
7	3D dynamics of rigid bodies	Working with experimental data	
8	Mid-term	Lab assignment-2	
9	Internal vs. external forces	Optimization	
10	Internal vs. external forces	Optimization	
11	Multi-segment models	Lab assignment-3	
12	Multi-segment models		
13	Multi-segment models		
14	Joint stiffness and damping	Lab assignment-4	
15	Lumped parameter models	System identification	
16	Presentations	Presentations	
17	Final		

i.