

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: Hainsworth Shin

Email: hy.shin@uky.edu

Phone: 859-257-3783

Responsible Faculty ID (if different from Contact)

Name:

Email:

Phone:

1d. Requested Effective Date: Specific Term/Year¹ Fall 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 508

2c. Full Title: Cell Mechanics and Mechanobiology

2d. Transcript Title: Cell Mechanics and Mechanobiology

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?

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2j. Course Description for Bulletin: This course will serve as an introduction to cell and tissue level mechanobiology with focus on human physiological and disease processes. The primary focus is to introduce principles of cell-level mechanics in the context of the biology of living organisms, what we term mechanobiology. In effect, we treat biological processes and regulation as another variable(s) that must be accounted for when modeling the mechanical/physical behavior of human tissues. A large amount of the basic principles in this field of study arose as a result of the intense research in the cardiovascular field. We will draw many examples of mechanobiological principles as it relates to the circulatory system. Despite our cardiovascular focus, the basic principles can be applied to the whole range of mechanobiological research conducted in other applications (orthopedics, urological, pulmonary, etc.).

2k. Prerequisites, if any: EM302 and/or CME/ME 330 (or equivalent fluid mechanics course); 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: Fall,

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 508 NEW Dept Review|20140225

SIGNATURE|BJSTOK0|Barbara J Brandenburg|BME 508 NEW College Review|20140909

SIGNATURE|JMETT2|Joanie Ett-Mims|BME 508 NEW Undergrad Council Review|20150205

SIGNATURE|ZNNIKO0|Roshan Nikou|BME 508 NEW Graduate Council Review|20150226

Courses	Request Tracking
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New Course Form

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

Open in full window to print or save

Generate R

Attachments:

Upload File

ID	Attachment
Delete 3712	BME 508 UGC Review Checklist.docx
Delete 4366	BME 508 Cell Mechanics and Mechanobiology rev 1-14

1

Select saved project to retrieve...

(*denotes required fields)

1. General Information

- a. * Submitted by the College of: Submission Date:
- b. * Department/Division:
- c. * Contact Person Name: Email: Phone:
 * Responsible Faculty ID (if different from Contact): Email: Phone:
- d. * Requested Effective Date: Semester following approval OR Specific Term/Year ¹
- 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 ⁴ No
- b. * Prefix and Number:
- c. * Full Title:
- d. Transcript Title (if full title is more than 40 characters):
- 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 hours³ for each meeting pattern type.
- | | | | |
|----------------------------------------|--------------------------------------------------|-------------------------------------|-------------------------------------|
| <input type="text" value="3"/> Lecture | <input type="checkbox"/> Laboratory ¹ | <input type="checkbox"/> Recitation | <input type="checkbox"/> Discussion |
| <input type="checkbox"/> Indep. Study | <input type="checkbox"/> Clinical | <input type="checkbox"/> Colloquium | <input type="checkbox"/> Practicum |
| <input type="checkbox"/> Research | <input type="checkbox"/> Residency | <input type="checkbox"/> Seminar | <input type="checkbox"/> Studio |
| <input type="checkbox"/> Other | If Other, Please explain: <input type="text"/> | | |
- 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:
- 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:

This course will serve as an introduction to cell and tissue level mechanobiology with focus on human physiological and disease processes. The primary focus is to introduce principles of cell-level mechanics in the context of the biology of living organisms, what we term mechanobiology. In effect, we treat biological processes and regulation as another variable(s) that must be accounted for when modeling the mechanical/physical behavior of human tissues. A large amount of the basic principles in this field of study arose as a result of the intense research in the cardiovascular field. We will draw many examples of mechanobiological principles as it relates to the circulatory system. Despite our cardiovascular focus, the basic principles can be applied to the whole range of mechanobiological research conducted in other applications (orthopedics, urological, pulmonary, etc.).

k. Prerequisites, if any:

EM302 and/or CME/ME 330 (or equivalent fluid mechanics course); or consent of instructor

l. Supplementary teaching component, if any: Community-Based Experience Service Learning Both3. * 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 program? 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 requirement⁵ for ANY program? Yes No

If YES⁵, 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) identify 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 applicable 10.a above) are attached.

⁵ Courses are typically made effective for the semester following approval. No course will be made effective until all approvals are received.
⁶ The chair of the cross-listing department must sign off on the Signature Routing Log.

⚠ 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, is two hours per week for a semester for one credit hour. (from SR 8.2.1)
⚠ You must also submit the Distance Learning Form in order for the proposed course to be considered for DL delivery.
⚠ In order to change a program, a program change form must also be submitted.

Rev 8/09

Submit as New Proposal Save Current Changes

General Course Information

- Full and accurate title of the course
- Departmental and college prefix
- Course prefix, number and section number
- Scheduled meeting day(s), time and place

Instructor Contact Information (if specific details are unknown, "TBA" is acceptable for one or more fields)

- Instructor name
- Contact information for teaching/graduate assistant, etc.
- Preferred method for reaching instructor
- Office phone number
- Office address
- UK email address
- Times of regularly scheduled office hours and if prior appointment is required

Course Description

- Reasonably detailed overview of the course
- Student learning outcomes
- Course goals/objectives
- Required materials (textbook, lab materials, etc.)
- Outline of the content, which must conform to the Bulletin description
- Summary description of the components that contribute to the determination of course grade
- Tentative course schedule that clarifies topics, specifies assignment due dates, examination date(s)
- Final examination information: date, time, duration and location
- For 100-, 200-, 300-, 400-, 400G- and 500-level courses, numerical grading scale and relationship to letter grades for undergraduate students
- For 400G-, 500-, 600- and 700-level courses, numerical grading scale and relationship to letter grades for graduate students. (Graduate students cannot receive a "D" grade.)
- Relative value given to each activity in the calculation of course grades (Midterm=30%; Term Project=20%, etc.)
- Note that undergraduate students will be provided with a Midterm Evaluation (by the midterm date) of course performance based on criteria in syllabus
- Policy on academic accommodations due to disability. Standard language is below:
 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.

Course Policies

- Attendance
- Excused absences
- Make-up opportunities
- Verification of absences
- Submission of assignments
- Academic integrity, cheating & plagiarism
- Classroom behavior, decorum and civility
- Professional preparations
- Group work & student collaboration

<p>UGE Review (9/16/14)</p> <ul style="list-style-type: none"> - Should also include graduate grading scale. - Undergraduate grading scale contains 'E' rather than 'F'.
<p>Committee Review ()</p> <p>Comments</p>

BME 508 Cell Mechanics and Mechanobiology
Syllabus
Spring 2015

INSTRUCTOR: Hainsworth Shin **EMAIL:** hy.shin@uky.edu
OFFICE: 213 Wenner-Gren **OFFICE HOURS:** T-TH 1:00 pm –2:00 pm
PHONE: 257-3783 (or by appointment).

PREREQUISITES: EM302 and/or CME/ME 302 (or equivalent fluid mechanics course) or consent of instructor

COURSE DESCRIPTION: This course will serve as an introduction to cell and tissue level mechanobiology with focus on human physiological and disease processes. The primary focus is to introduce principles of cell-level mechanics in the context of the biology of living organisms, what we term mechanobiology. In effect, we treat biological processes and regulation as another variable(s) that must be accounted for when modeling the mechanical/physical behavior of human tissues. A large amount of the basic principles in this field of study arose as a result of the intense research in the cardiovascular field. We will draw many examples of mechanobiological principles as it relates to the circulatory system. Despite our cardiovascular focus, the basic principles can be applied to the whole range of mechanobiological research conducted in other applications (orthopedics, urological, pulmonary, etc.).

Topics to be covered include the following:

- a. Mechanics Primer
 1. Fluid mechanics
 2. Solid mechanics
 3. Statistical mechanics
- b. Cell biology primer
- c. Mechanical engineering analyses of the behavior of living tissues
- d. Mechanical stimulation of cells
- e. Functional responses of cells to mechanical stimulation
- f. Protein expression responses to mechanical stimulation
- g. Mechanoreception and signaling pathways
- h. Techniques in the mechanobiological study of tissues
- i. Tissue engineering
- j. Cell mechanics and mechanobiology in the pathogenesis of human disease

COURSE OBJECTIVES/EXPECTED STUDENT OUTCOMES: By the end of this course, each student should be able to:

1. display basic working understanding of cell biology.
2. have a basic understanding of cellular and tissue-level processes governing the relationship between mechanical forces and human physiology
3. apply sound mechanical engineering analytical approaches in conjunction with fundamental cell biological concepts to model components of physiological systems (e.g., the circulatory system) in their natural state, as well as under pathological, conditions.

4. acquire an ability to understand the mechanotransduction literature relevant to their field
5. analyze, interpret, and synthesize results from the literature related to mechanotransduction.

ATTENDANCE POLICY: Attendance is recommended and will be considered when deciding borderline final grades.

EXCUSED ABSENCES: 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.

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.

TEXTBOOK:

Introduction to Cell Mechanics and Mechanobiology By Christopher Jacobs, Hayden, Huang, and Ronald Kwon, ©2013 by Garland Science, Taylor & Francis Group, LLC, New York, NY

SUGGESTED SUPPLEMENTARY TEXTBOOKS:

Fundamentals of Biomechanics, by Nihat Özkaya, Margaret Nordin, David Goldsheyder, Dawn Leger, ©2012 by Springer Science + Business Media LLC, New York, NY

Essential Cell Biology 3rd Edition, by Bruce Alberts, Dennis Bray, Karen Hopkin, Alexander D. Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Waiter, ©2009 by Garland Science, Taylor & Francis Group, LLC, New York, NY

This class will also rely on class notes and peer-reviewed articles available through www.pubmed.com and electronic journals accessible from the University of Kentucky Library Services. Articles will be assigned by providing the PubMed Identification number PMID. By going to the PubMed website, type the PMID in the search dialog box. An abstract of the journal article will be provided along with a link to an electronic copy at the publisher's website.

EVALUATION CRITERIA AND COURSE POLICY: Student learning and performance will be assessed by class-related activities as described in the following table:

LEARNING/PERFORMANCE ASSESSMENTS		POINTS ⁵
I	4 Homeworks ^{1, 2, 3} a. Assigned intermittently throughout course b. Due 2 weeks after date of assignment	40 pts (10 pts ea)
II	1 Midterm Quiz ^{1, 4} a. Possible in-class problem solving activities b. Possible short answer, true/false, multiple choice, match, etc. c. To be offered typically within the first two weeks of October depending on the progress of the class. Students will be given at least 1 ½ weeks prior notice for the exact scheduling of the Midterm Quiz.	20 pts
III	1 Final Quiz (Comprehensive) ^{1, 4, 5} a. Possible in-class problem solving activities b. Possible short answer, true/false, multiple choice, match, etc. c. Test knowledge of topics not covered by previous tests d. To be administered during Finals Week (Dec. 14 – 18) at the prescribed time scheduled by the Registrar.	20 pts
IV	Class Project (GRADUATE STUDENTS ONLY) ⁵ a. Choose, in consultation with the instructor, an area of interest related to cell mechanics/mechanobiology b. Utilize up to 30 – 40 mins of 1 class period to cover the topic i. Physiological scenario ii. Cell mechanics principles iii. Mechanobiological concepts iv. Critical evaluation of experimental models v. Provide a write up of your presentation as a reading supplement for the students. (more information regarding the write-up will be forthcoming during class).	20 pts

Footnotes

1. Grading for each homework assignment or exam will be graded according to a 1 – 100 pts scale. These scores will then be weighted as described above.
2. Homework assignments will be due 2 wks after they are distributed.
3. Any late homework assignments will be given a 24 hour grace period, after which 5 points will be deducted from the assignment score for each additional late day.
4. Make-up exams will not be given unless the student gives a valid excuse (as defined above) for missing the test.
5. Undergraduate grades will be based on 80 total points. Graduate student grades will be based on 100 total points.

Points will be totaled from those earned for each performance assessment criteria. Undergraduate grades will be determined based on 80 total points. Final letter grades will then be assigned using the following standard grading scale: A=90%-100%; B=80%-89% pts; C=70%-79% pts; D=60%-69% pts; E=0%-59% pts. Final letter grades will be assigned based on the grade scale noted above.

A curve based upon the distribution of final scores may be applied to adjust final grades. If used, the curve will make only small adjustments based upon the statistical distribution of overall scores. Scores grouped near the top will get A's, the next major grouping gets B's, etc. If anything, the curve will only raise your grade; a curve will never lower a grade. For example, the lowest grade an 89% overall score can get is B, but if there is a curve, it might be worth an A. Finally, consideration of a student's

performance for grade adjustments based on curving depends on satisfactory completion of ALL assigned activities. Failure of the student to complete any of the assigned activities will forfeit that student's qualification to be considered for grade curving. A distribution of grades earned by all undergraduates in the class will be used to determine the application of a grading curve.

Graduate student grades will be determined based on 100 total points. Final letter grades will then be assigned using the following standard grading scale: A=90%-100%; B=80%-89% pts; C=70%-79% pts; E=0%-59% pts. A distribution of grades earned by all graduate students in the class will be used to determine the application of a grading curve as described in the prior paragraph.

MID-TERM GRADES: Mid-term grades will be posted in myUK by the deadline established in the Academic Calendar (<http://www.uky.edu/Registrar/AcademicCalendar.htm>).

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 is available at <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 (<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 plagiarism.

Written assignments you turn in may be submitted to SafeAssign via Blackboard for comparison with a collection of other previously submitted works and those available on public web sites.

ACCOMODATIONS 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.

CLASSROOM BEHAVIOR: Please assist in creating a good learning environment free of distractions. Use of cell phones, including text messaging, is not permitted during class.