PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION,
OR REVISION OF A GRADUATE COURSE
(50000-90000 LEVEL)

DEPARTMENT: Biology
EFFECTIVE SESSION: Fall 2012

INSTRUCTIONS: Please check the items below which describe the purpose of this request.

- 1. New course with supporting documents (complete proposal form)
- 2. Add existing course offered at another campus
- 3. Expiration of a course
- 4. Change in course number
- 5. Change in course title
- 6. Change in course credit/type
- 7. Change in course attributes
- 8. Change in instructional hours
- 9. Change in course description
- 10. Change in course requisites
- 11. Change in semesters offered
- 12. Transfer from one department to another

PROPOSED:
Subject Abbreviation: BIOL
Course Number: 52710
Long Title: Comparative Biomechanics
Short Title: Comparative Biomechanics

EXISTING:
Subject Abbreviation
Course Number
Long Title: Comparative Biomechanics
Short Title: Comparative Biomechanics

TERMS OFFERED
Check All That Apply:
- Fall
- Spring
- Summer

CAMPUS(ES) INVOLVED
- Calumet
- Cont Ed
- Ft. Wayne
- Indianapolis
- N. Central
- Tech Statewide
- W. Lafayette

Abbreviated title will be entered by the Office of the Registrar if omitted. (30 CHARACTERS ONLY)

CREDIT TYPE
- 1. Fixed Credit: Cr. Hrs. 3 cr
- 2. Variable Credit Range: Minimum Cr. Hrs. (Check One) Maximum Cr. Hrs. 3 Equivalent Credit: Yes
- 4. Thesis Credit: Yes

COURSE ATTRIBUTES: Check All That Apply
- 1. Pass/Not Pass Only
- 2. Satisfactory/Unsatisfactory Only
- 3. Repeatability
- 4. Credit by Examination
- 5. Special Fees
- 6. Registration Approval Type: Department Instructor
- 7. Variable Title
- 8. Honors
- 9. Full Time Privilege
- 10. Off Campus Experience

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):
BIOL 52710 Comparative Biomechanics Cr. 3. P: BIOL 21800 and PHY S 221 or permission of Instructor.
The study of how organisms function mechanically in their environment. Main focus is how the physical properties of solids and fluids govern form and function in plants, invertebrates, and vertebrates.

Cross-Listed Courses

Signed:
Calumet Department Head
Date
Calumet School Dean
Date
Calumet Undergraduate Curriculum Committee
Date
Calumet Chancellors
Date

Fort Wayne Department Head
Date
Fort Wayne School Dean
Date
Undergraduate Curriculum Committee
Date

North Central Department Head
Date
North Central School Dean
Date
Date Approved by Graduate Council

Indianapolis Department Head
Date
Indianapolis School Dean
Date
Graduate Council Secretary
Date

West Lafayette Department Head
Date
West Lafayette College/School Dean
Date
West Lafayette Registrar
Date

OFFICE OF THE REGISTRAR
Supporting Document of a New Graduate Course  
Jennifer Taylor, Fall 2012  
Proposed Course: BIOL 52710 Comparative Biomechanics

A. Justification for the course:

Students graduating with degrees in Biology are expected to have a solid understanding of plant and animal biology topics, such as, for example, how organisms move, breathe, feed, and defend themselves. Biology majors are also required to take a year-long course sequence of Physics. Rarely do students comprehend the fundamental link between physics and organismal biology. The laws of physics govern every aspect of organismal form and function, from how blood flows through tubes in the circulatory system to how the material properties of bone allow the vertebrate skeleton to provide support. Though plants and animals exhibit tremendous diversity in form and physiology, they are all bound by the same physical laws. It is, therefore, essential for all biologists to understand how the principles of physics constrain organisms and guide their behavior, ecology, and evolution. For many students, a Biomechanics course serves as an “eye-opener” for how physics and biology are inherently linked. This course will blend the worlds of biology and physics to provide an enhanced and integrated understanding of biology.

Biomechanics is a burgeoning field, with nearly endless opportunities for research niches for those students pursuing advanced degrees. The enhanced understanding of biology provided by this course will also better prepare students for all careers in biology, especially those that may involve, for example, biomimetics, human biomechanics and kinesiology, prosthetics, and dentistry.

This is a unique course, as currently there are no such offerings at any of the Purdue campuses. This course qualifies as a 500-level graduate course because it synthesizes concepts from biology and physics and delves deeply into the concepts of plant and animal physiology that are covered in Biology 219. This course focuses heavily on applications and problem-solving skills, both of which are advanced skills.

B. Learning Outcomes and Method of Evaluation or Assessment:

Course objectives:

- Describe the laws of static and flowing fluids
- Explain how the physics of fluids govern support and circulation in organisms
- Explain how animals move through fluids
- Describe the properties of biological materials
- Explain how plant and animal parts respond to external forces
- Explain how structural support systems of plants and animals work

Student Learning Outcomes:

- Knowledge of how the physical principles of fluids and solids apply to organism form and physiology
• Development of critical thinking skills through reviews of primary literature
• Development of written communication skills through critical reviews and homework assignments

Methods for Assessment

• Direct:
  o Written midterm and final exams
  o Written homework problem sets
  o Written reviews of scholarly articles
• Indirect:
  o In-class participation

Grading Criteria

• Exams: There will be 1 midterm and 1 final exam. The midterm will cover fluid mechanics and the final exam will cover solid mechanics
• Homework: Students will be given a series of homework problem sets that require them to understand and apply the concepts learned in lecture.
• Papers and Projects: Students will be given scholarly articles that employ techniques to study the concepts covered in lecture and will be asked to write critical reviews

Method of instruction

• Lecture

C. Prerequisite(s):

• Biology 219- Principles of Functional Biology
• Physics 221- General Physics

D. Course Instructor(s):

• Jennifer Taylor, Assistant Professor, Biology

E. Course Outline

• Fluid mechanics (First half of semester)
  o Fluids at rest (Buoyancy, pressure)
  o Patterns of flow (Reynolds number)
  o Life in the Boundary Layer
  o Internal flow (Circulation)
  o Lift and thrust (Swimming and Flying)
  o Life at the Air-water interface
• Solid mechanics (Second half of semester)
- Biological Materials
- Viscoelasticity
- Simple structures (Tubes and Shells)
- Complex structures (Articulated Skeletons)
- Hydrostatic Skeletal Systems
- Motility and Muscle
- Terrestrial Locomotion

F. Reading List (including course text):

- Primary list: "Comparative Biomechanics: Life's Physical World" by Steven Vogel
- Secondary list: Journal articles to be decided later.

G. Library Resources

- This course will require articles from sources such as: *Journal of Experimental Biology, Journal of Biomechanics, Acta Biomaterialia*, and *Journal of Comparative Physiology*, which are available through the Helmke library.

H. Example of a Course Syllabus

See attached.
Fall 2012

Biology 52710: Comparative Biomechanics

Instructor:
Dr. Jennifer Taylor
Assistant Professor, Department of Biology,
Telephone: (260) 481 6490
Email: taylorj@ipfw.edu

Office Hours (SB 342): Wednesdays 11:00-12:00, Thursdays 10:30-11:30, or by appointment

Class Schedule:
MWF 10:00-10:50

Course Objective:
The main goal of this course is to develop an understanding of the fundamental connections between the physical and biological world. This will be accomplished by learning the physical principles of fluids and solids that underlay the structure and physiology of all living things.

Textbook:

Blackboard:
Communication through Blackboard is vital to this course and you will be expected to check the Blackboard site regularly (www.ipfw.blackboard.com). All materials for the course, such as problem sets, will be posted on the site, as well as any announcements.

Course Requirements:
Exams: There will one mid-term exam covering fluid mechanics and one non-comprehensive final exam covering solid mechanics. Exams will consist of multiple choice, fill-in-the-blank, problem solving, and short answer questions. No make-up exams will be permitted.

Problems Sets: Throughout the semester you will be given 6 problem sets to complete as homework. Each problem set will consist of 6-10 questions that require you to apply the concepts covered in lecture and will consist of calculations and written answers. You will have 1 week to complete each problem set and they must be turned in at the beginning of lecture on the due date. The problem sets are not a group activity. You must complete them independently, without any discussion among your classmates. If you fail to abide by this rule, you will not receive credit for the homework.
Paper Reviews: You will be provided with 3 biomechanics research articles for which you will write a short, 1 page review. The review will consist of a brief summary of the paper and a critique of the methods and conclusions based on the concepts learned from lecture. Like the problem sets, these reviews are independent assignments and must be completed on your own to receive credit.

Grading:

<table>
<thead>
<tr>
<th></th>
<th>Points</th>
<th>Total</th>
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<tbody>
<tr>
<td>Exams</td>
<td>2 x 100</td>
<td>200</td>
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<tr>
<td>Problem Sets</td>
<td>6 x 20</td>
<td>120</td>
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<tr>
<td>Paper Reviews</td>
<td>3 x 20</td>
<td>60</td>
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<td><strong>Total</strong></td>
<td><strong>380 Points</strong></td>
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Grading Scale:

<table>
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<tr>
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</tr>
<tr>
<td>70-79%</td>
<td>C</td>
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<tr>
<td>60-69%</td>
<td>D</td>
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<tr>
<td>&lt;60%</td>
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Lecture Schedule:

The schedule below should be considered tentative, as the dates and topics may change as the class progresses.

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<tr>
<th>Week</th>
<th>Lecture Topic</th>
<th>Chapter</th>
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<tbody>
<tr>
<td>Aug. 20</td>
<td>Introduction, Size and Scale</td>
<td>3</td>
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<tr>
<td></td>
<td><strong>Part I: Fluid Mechanics</strong></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Fluids at Rest (buoyancy, pressure, surface tension)</td>
<td>5</td>
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<tr>
<td>Sep. 3</td>
<td>Viscosity and Patterns of Flow (Reynolds number, no-slip, streamlines)</td>
<td>6</td>
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<td>10</td>
<td>Forces of Flow (Power, propulsion, Bernoulli, drag)</td>
<td>7</td>
</tr>
<tr>
<td>17</td>
<td>Life in the boundary layer</td>
<td>8</td>
</tr>
<tr>
<td>24</td>
<td>Circulation</td>
<td>9,10</td>
</tr>
<tr>
<td>Date</td>
<td>Topic</td>
<td>Page(s)</td>
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<tr>
<td>--------</td>
<td>-------------------------------------------------</td>
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<tr>
<td>Oct. 1</td>
<td>Swimming and Flying</td>
<td>12,13</td>
</tr>
<tr>
<td>8</td>
<td>Life at the Air-Water Interface</td>
<td>14</td>
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<tr>
<td>15</td>
<td><strong>Exam 1</strong></td>
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**Part II: Solid Mechanics**

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<tr>
<th>Date</th>
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<tbody>
<tr>
<td>22</td>
<td>Biological materials</td>
<td>15</td>
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<tr>
<td>29</td>
<td>Viscoelasticity</td>
<td>17</td>
</tr>
<tr>
<td>Nov. 5</td>
<td>Simple Structures (shells and tubes)</td>
<td>18</td>
</tr>
<tr>
<td>12</td>
<td>Complex Structures (articulated skeletons)</td>
<td>19</td>
</tr>
<tr>
<td>19</td>
<td>Hydrostatic Structural Support Systems</td>
<td>20,21</td>
</tr>
<tr>
<td>26</td>
<td>Motility and Muscle</td>
<td>22,23</td>
</tr>
<tr>
<td>Dec. 3</td>
<td>Terrestrial Locomotion</td>
<td>24</td>
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<td></td>
<td><strong>Exam 2</strong></td>
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Supporting Document for a New Graduate Course

To: Purdue University Graduate Council
From: Faculty Member: Jennifer Taylor
Department: Biology
Campus: IPFW
Date: 12/14/11
Subject: Proposal for New Graduate Course-Documentation Required by the Graduate Council to Accompany Registrar's Form 40G

Contact for information if questions arise:
Name: Jennifer Taylor
Phone Number: 260-481-6490
E-mail: taylorj@ipfw.edu
Campus Address: SB342, 2101 E Coliseum Blvd, Fort Wayne, IN 46805

Course Subject Abbreviation and Number: BIOL 52710
Course Title: Comparative Biomechanics

A. Justification for the Course:

- Provide a complete and detailed explanation of the need for the course (e.g., in the preparation of students, in providing new knowledge/training in one or more topics, in meeting degree requirements, etc.), how the course contributes to existing fields of study and/or areas of specialization, and how the course relates to other graduate courses offered by the department, other departments, or interdisciplinary programs.

- Justify the level of the proposed graduate course (50000- or 60000-level) including statements on, but not limited to: (1) the target audience, including the anticipated number of undergraduate and graduate students who will enroll in the course; and (2) the rigor of the course.

B. Learning Outcomes and Method of Evaluation or Assessment:

- Describe the course objectives and student learning outcomes that address the objectives (i.e., knowledge, communication, critical thinking, ethical research, etc.).

- Describe the methods of evaluation or assessment of student learning outcomes. (Include evidence for both direct and indirect methods.)

- Grading criteria (select from dropdown box); include a statement describing the criteria that will be used to assess students and how the final grade will be determined.

Criteria: Exams and Quizzes
• Identify the method(s) of instruction (select from dropdown box) and describe how the methods promote the likely success of the desired student learning outcomes.

  **Method of Instruction** Lecture

C. Prerequisite(s):

  • List prerequisite courses by subject abbreviation, number, and title.

  • List other prerequisites and/or experiences/background required. If no prerequisites are indicated, provide an explanation for their absence.

D. Course Instructor(s):

  • Provide the name, rank, and department/program affiliation of the instructor(s).

  • Is the instructor currently a member of the Graduate Faculty?  
    × Yes   — No  
    (If the answer is no, indicate when it is expected that a request will be submitted.)

E. Course Outline:

  • Provide an outline of topics to be covered and indicate the relative amount of time or emphasis devoted to each topic. If laboratory or field experiences are used to supplement a lecture course, explain the value of the experience(s) to enhance the quality of the course and student learning. For special topics courses, include a sample outline of a course that would be offered under the proposed course.

F. Reading List (including course text):

  • A primary reading list or bibliography should be limited to material the students will be required to read in order to successfully complete the course. It should not be a compilation of general reference material.

  • A secondary reading list or bibliography should include material students may use as background information.

G. Library Resources

  • Describe the library resources that are currently available or the resources needed to support this proposed course.

H. Example of a Course Syllabus  (While not a necessary component of this supporting document, an example of a course syllabus is available, for information, by clicking on the link below, which goes to the Graduate School's Policies and Procedures Manual for Administering Graduate Student Programs. See Appendix K.)


(Revised and Approved by the Graduate Council 2/08)