PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION,
OR REVISION OF AN UNDERGRADUATE COURSE
(10000-40000 LEVEL)
EPD
Effective Session: Spring 2011

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

1. New course with supporting documents
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 (department head signature only)
8. Change in instructional hours
9. Change in course description
10. Change in course prerequisites
11. Change in semesters offered (department head signature only)
12. Transfer from one department to another

PROPOSED:
Subject Abbreviation: BME
Course Number: 25600
Long Title: Physiological Modeling in Human Health
Short Title: Physiological Modeling

EXISTING:
Subject Abbreviation
Course Number
Long Title
Short Title

TERMS OFFERED: Check All That Apply:
- [ ] Summer
- [ ] Fall
- [x] Spring

CAMPUS(ES) INVOLVED
- [ ] Calumet
- [ ] Cont Ed
- [ ] Ft. Wayne
- [ ] Tech Statewide
- [x] Indianapolis
- [x] W. Lafayette

Credit Type:
1. Fixed Credit: Cr. Hrs.: [3]
2. Variable Credit Range: Minimum Cr. Hrs. [ ]
   (Check One) To [ ]
   Maximum Cr. Hrs. [ ]
   Equivalent Credit: Yes [ ]

Course Attributes: Check All That Apply
1. Pass/Not Pass Only
2. Satisfactory/Unsatisfactory Only
3. Repeatable
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):
Major Restriction: BME Only. Prerequisites: BIOL 23000 and CS 15600 and (PHYS 24100 or PHYS 27200). Concurrent Prerequisites: MA 26200 or MA 26800.
Introduction to the physiology and medicine underlying practical problems in biomedical engineering, especially with respect to medical device development. Engineering skills taught and practiced within the context of human diseases, injury, and illness on extended problem sets which include mathematical modeling and problem solving with appropriate documentation. Main physiological systems of focus are cardiovascular, pulmonary, and renal, and common afflictions thereof.

Course Learning Outcomes:
1. Students will understand the physiology and medicine underlying practical problems in biomedical engineering, especially with respect to medical device development.
2. Students will understand the process of mathematical modeling of human anatomy and physiology, including technical description of objectives, methods, results, and conclusions from modeling exercises.

OFFICE OF THE REGISTRAR
PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION,
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(10000-40000 LEVEL)

DEPARTMENT: Biomedical Engineering
EFFECTIVE SESSION: Spring 2011

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

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PROPOSED:

Subject Abbreviation: BME
Course Number: 25500
Long Title: Physiological Modeling in Human Health

EXISTING:

Subject Abbreviation
Course Number
Long Title
Short Title

TERMS OFFERED: Check All That Apply

- Summer
- Fall
- Spring

CAMPUS(ES) INVOLVED

- Calumet
- Cont Ed
- Ft. Wayne
- Tech Statewide
- Indianapolis
- W. Lafayette

Abbreviated title will be entered by the Office of the Registrar if omitted. (20 CHARACTERS ONLY)

CREDIT TYPE

1. Fixed Credit: Cr. Hrs. 3
2. Variable Credit Range:
   Minimum Cr. Hrs. (Check One)
   Or
   Maximum Cr. Hrs.
3. Equivalent Credit: Yes □ No □

COURSE ATTRIBUTES: Check All That Apply

1. Pass/Not Pass Only
2. Satisfactory/Unsatisfactory Only
3. Repeatable
4. Credit by Examination
5. Special Fees
6. Registration Approval Type
   Department
   Instructor
7. Variable Title
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10. Off Campus Experience

Schedule Type

Lecture
Presentation
Laboratory
Lab Prep
Studio
Distance
Clinic
Experiential
Research
Ind. Study
Pract/Observe

Minutes Per Mtg 350 3
Meetings Per Week 3
Weeks Offered 18
% of Credit Allocated

Cross-Listed Courses

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):

Major Restriction: BME Only. Prerequisites: BIOL 23000 and CS 16900 and (PHYS 24100 or PHYS 27200). Concurrent Prerequisites: MA 26200 or MA 26600.
Introduction to the physiology and medicine underlying practical problems in biomedical engineering, especially with respect to medical device development. Engineering skills taught and practiced within the context of human disease, injury, and illness on extended problem sets which include mathematical modeling and problem solving with appropriate documentation. Main physiological systems of focus are cardiovascular, pulmonary, and renal, and common afflictions thereof.

COURSE LEARNING OUTCOMES:
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Calumet Department Head Date
Calumet School Dean Date

Fort Wayne Department Head Date
Fort Wayne School Dean Date

Indianapolis Department Head Date
Indianapolis School Dean Date

With Central Department Head Date
North Central Chancell Date

West Lafayette Department Head Date
West Lafayette College/School Dean Date
West Lafayette Registrar Date
TO: The Faculty of the College of Engineering
FROM: The Faculty of the School of Biomedical Engineering
RE: New Undergraduate Course, BME 25600, Physiological Modeling in Human Health

The Faculty of the School of Biomedical Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

BME 25600  Physiological Modeling in Human Health
Term offered: Spring, Lecture 3, Cr. 3
Restriction: Must be enrolled in the School of Biomedical Engineering (BME)
Prerequisites: BIOL 23000 and CS 15900 and (PHYS 24100 or PHYS 27200)
Concurrent Prerequisites: MA 26200 or MA 26600

Description: Introduction to the physiology and medicine underlying practical problems in biomedical engineering, especially with respect to medical device development. Engineering skills taught and practiced within the context of human disease, injury, and illness on extended problem sets which include mathematical modeling and problem solving with appropriate documentation. Main physiological systems of focus are cardiovascular, pulmonary, and renal, and common affictions thereof.

Reason: This course teaches physiology and introduces modeling as a problem solving tool within the context of current medical device and treatment challenges. This course will become a required course for the undergraduate curriculum in the Weldon School of Biomedical Engineering (BME) beginning Fall 2011 (see EF D 28-11). We feel it addresses a current weakness within the currently approved BME curriculum. This course will serve as a cornerstone on physiology supporting our overall biomedical engineering curriculum. Other organ systems, especially neuro-musculo-skeletal systems are dealt with elsewhere in the BME curriculum, including BME 204, Biomechanics of Hard and Soft Tissues, and BME 301, Bioelectricity. Currently there are no existing competing courses at Purdue that address this topic.

The course has been taught 3 times previously as an experimental course and has been a recommended part of the curriculum for all BME sophomores. The course evaluations for this course have been overwhelmingly positive.

George R. Wodicka, Professor and Head
Weldon School of Biomedical Engineering
BME 25600  Physiological Modeling in Human Health
(Offered as temporary course BME 29500 Human Physiology for Biomedical Engineers)

Instructors: Charles F. Babbs, MD, PhD and Willis A. Tacker, MD, PhD

Level: Undergraduate - Second semester sophomore

Credit: 3

Class: Typically meets 3 times per week for 16 weeks for 50 minutes.

Course Objectives:
(1) Students will understand the physiology and medicine underlying practical problems in biomedical engineering, especially with respect to medical device development
(2) Students will understand the process of mathematical modeling of human anatomy and physiology, including technical description of objectives, methods, results, and conclusions from modeling exercises
(3) To put more biology and medicine into the biomedical engineering curriculum.

Course climate:
"Show up on time. Do your best." – Gene Keedy
(If you prefer to sleep or read newspapers, do not come to class.)
Respectful feedback is welcomed.

Course requirements and assignments:
- Lectures and whole class discussion
- Reading and Web study
- Problem sets (due 1 week prior to exams, grade penalty for lateness or sloppiness)
- Exams (3 unit examinations plus one final)

Textbooks: Boron WF and Boulpaep EL, Medical Physiology, Elsevier Sanders, 2005.
National Library of Medicine medical encyclopedia and dictionary online:
www.nlm.nih.gov/medlineplus/encyclopedia
www.nlm.nih.gov/medlineplus/mplusdictionary

Reading assignments: Distributed in class.

Problem set work groups:
- Modified random assignment of group members (see handouts)
- Practice "teaming"
- Solutions, not answers required (see style guide)
- All group members must sign off on solutions
- Single group grade for all members on problem sets
- Group studying for exams is encouraged
**Group dynamics:** try hard to contribute equally and to resolve differences. Talk with staff if major problems arise. Encourage more quiet or shy members to contribute.

Happiness is keeping up and not procrastinating or cramming.

**Grade composition (subject to change with notice):**
- 3 closed-book exams, 50%
- Problem sets, 30%
- Comprehensive final closed-book exam 20%

**Calendar for Spring 2009**

<table>
<thead>
<tr>
<th>Date</th>
<th>Instructor</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mon Jan 12</td>
<td>Babbs &amp; Staff</td>
<td>Course introduction and overview of body systems</td>
</tr>
<tr>
<td>Wed Jan 14</td>
<td>Tacker</td>
<td>Vascular anatomy and composition</td>
</tr>
<tr>
<td>Fri Jan 16</td>
<td>Tacker</td>
<td>Vascular anatomy and composition</td>
</tr>
<tr>
<td>Mon Jan 19</td>
<td>MLK</td>
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<tr>
<td>Wed Jan 21</td>
<td>Babbs</td>
<td>Atherosclerosis</td>
</tr>
<tr>
<td>Fri Jan 23</td>
<td>Babbs</td>
<td>Atherosclerosis and stents</td>
</tr>
<tr>
<td>Mon Jan 26</td>
<td>Babbs</td>
<td>Hemostasis and anticoagulants</td>
</tr>
<tr>
<td>Wed Jan 28</td>
<td>Babbs</td>
<td>Hemostasis and anticoagulants</td>
</tr>
<tr>
<td>Fri Jan 30</td>
<td>Babbs</td>
<td>Renovascular disease and stents</td>
</tr>
<tr>
<td>Mon Feb 2</td>
<td>Babbs</td>
<td>Renovascular disease</td>
</tr>
<tr>
<td>Wed Feb 4</td>
<td>Babbs</td>
<td>Restenosis after angioplasty</td>
</tr>
<tr>
<td>Fri Feb 6</td>
<td>Babbs</td>
<td>Restenosis after angioplasty</td>
</tr>
<tr>
<td>Mon Feb 9</td>
<td>Staff</td>
<td>Exam 1</td>
</tr>
<tr>
<td>Wed Feb 11</td>
<td>Tacker</td>
<td>Aneurysms</td>
</tr>
<tr>
<td>Fri Feb 13</td>
<td>Tacker</td>
<td>Aneurysms and endovascular devices</td>
</tr>
<tr>
<td>Mon Feb 16</td>
<td>Babbs</td>
<td>The heart as a pump</td>
</tr>
<tr>
<td>Wed Feb 18</td>
<td>Babbs</td>
<td>The heart as a pump</td>
</tr>
<tr>
<td>Fri Feb 20</td>
<td>Babbs</td>
<td>Congestive heart failure</td>
</tr>
<tr>
<td>Mon Feb 23</td>
<td>Tacker</td>
<td>Myocardial ischemia and infarction</td>
</tr>
</tbody>
</table>

**Problem set #1 due, in which students develop geometric and algebraic models to characterize properties of the vascular system, oxygen delivery during CPR, shock strength for heart defibrillation, or finger pulse amplitude.**

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<td>Wed Jan 28</td>
<td>Babbs</td>
<td>Hemostasis and anticoagulants</td>
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<tr>
<td>Fri Jan 30</td>
<td>Babbs</td>
<td>Renovascular disease and stents</td>
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<tr>
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<td>Tacker</td>
<td>Aneurysms</td>
</tr>
<tr>
<td>Fri Feb 13</td>
<td>Tacker</td>
<td>Aneurysms and endovascular devices</td>
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<tr>
<td>Mon Feb 16</td>
<td>Babbs</td>
<td>The heart as a pump</td>
</tr>
<tr>
<td>Wed Feb 18</td>
<td>Babbs</td>
<td>The heart as a pump</td>
</tr>
<tr>
<td>Fri Feb 20</td>
<td>Babbs</td>
<td>Congestive heart failure</td>
</tr>
<tr>
<td>Mon Feb 23</td>
<td>Tacker</td>
<td>Myocardial ischemia and infarction</td>
</tr>
</tbody>
</table>

**Problem set #2 due, in which students solve a second order ordinary differential equations describe the resonant frequency of the second heart sound as a function of aortic pressure, oscillations of blood columns in the aorta, or novel resuscitation techniques.**
### Calendar for Spring 2009 (cont.)

<table>
<thead>
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<tbody>
<tr>
<td>Wed Feb 25</td>
<td>Tacker</td>
<td>Myocardial ischemia and infarction</td>
</tr>
<tr>
<td>Fri Feb 27</td>
<td>Tacker</td>
<td>Peripheral vascular disease</td>
</tr>
<tr>
<td>Mon Mar 2</td>
<td>Tacker</td>
<td>Peripheral vascular disease and devices</td>
</tr>
<tr>
<td>Wed Mar 4</td>
<td>Babbs</td>
<td>Adult onset diabetes pathophysiology</td>
</tr>
<tr>
<td>Fri Mar 6</td>
<td>Babbs</td>
<td>Adult onset diabetes treatment options</td>
</tr>
<tr>
<td>Mon Mar 9</td>
<td>Staff</td>
<td>Exam 2</td>
</tr>
<tr>
<td>Wed Mar 11</td>
<td>Babbs</td>
<td>Stroke I</td>
</tr>
<tr>
<td>Fri Mar 13</td>
<td>Babbs</td>
<td>Stroke interventions</td>
</tr>
<tr>
<td>Mon Mar 16</td>
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<td>Spring break</td>
</tr>
<tr>
<td>Wed Mar 18</td>
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<td>Spring break</td>
</tr>
<tr>
<td>Fri Mar 20</td>
<td></td>
<td>Spring break</td>
</tr>
<tr>
<td>Mon Mar 23</td>
<td>Babbs</td>
<td>Carotid artery disease and distal protection devices</td>
</tr>
<tr>
<td>Wed Mar 25</td>
<td>Tacker</td>
<td>Aortic dissections</td>
</tr>
<tr>
<td>Fri Mar 27</td>
<td>Tacker</td>
<td>Skin, burns, barriers, and grafts</td>
</tr>
<tr>
<td>Mon Mar 30</td>
<td>Babbs</td>
<td>Shock I</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Problem set #3 due, in which students develop systems of partial linear differential equations to create a multi-compartment models of the circulatory system in to test the effectiveness of a new forms of CPR, represent glucose and insulin kinetics, or describe the performance of a novel left ventricular assist device or an exercise responsive pacemaker.</strong></td>
</tr>
<tr>
<td>Wed Apr 1</td>
<td>Babbs</td>
<td>Shock II</td>
</tr>
<tr>
<td>Fri Apr 3</td>
<td>Babbs</td>
<td>Ventricular assist devices</td>
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<td>Mon Apr 6</td>
<td>Babbs</td>
<td>Ventricular assist devices</td>
</tr>
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<td>Wed Apr 8</td>
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<td>Exam 3</td>
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<tr>
<td>Fri April 10</td>
<td>Hiles</td>
<td>Tissue engineering</td>
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<tr>
<td>Mon April 13</td>
<td>Babbs</td>
<td>Pulmonary physiology Part I</td>
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<tr>
<td>Wed Apr 15</td>
<td>Babbs</td>
<td>Pulmonary physiology Part II</td>
</tr>
<tr>
<td>Fri Apr 17</td>
<td>Babbs</td>
<td>Kidney and urinary tract Part I</td>
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<tr>
<td>Mon Apr 20</td>
<td>Babbs</td>
<td>Kidney and urinary tract Part II</td>
</tr>
<tr>
<td>Wed Apr 22</td>
<td>Babbs</td>
<td>Kidney and urinary tract pathology Part III</td>
</tr>
<tr>
<td>Fri Apr 24</td>
<td>Babbs</td>
<td>Renal failure and dialysis</td>
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<tr>
<td>Mon Apr 27</td>
<td>Tacker</td>
<td>Benign prostatic hyperplasia: diagnosis and imaging</td>
</tr>
<tr>
<td>Wed Apr 29</td>
<td>Tacker</td>
<td>Benign prostatic hyperplasia: therapeutic systems</td>
</tr>
<tr>
<td>Fri May 1</td>
<td>Tacker</td>
<td>Dental and GI</td>
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<td></td>
<td><strong>Problem set #4 due, in which students create finite element models of the arm to optimize design of a blood pressure cuff for accurate readings or of the brain to optimize performance of electrodes for deep brain stimulation and solve the models using simulated annealing.</strong></td>
</tr>
<tr>
<td>Final Exam</td>
<td>Staff</td>
<td>TBA</td>
</tr>
</tbody>
</table>