Office of the Registrar
FORM 40 REV. 11/09

PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION,
OR REVISION OF AN UNDERGRADUATE COURSE
(10000-40000 LEVEL)

Print Form

FFD 76-10

DEPARTMENT Biomedical Engineering

EFFECTIVE SESSION Fall 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
- [x] 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
- [x] 9. Change in course description
- [x] 10. Change in course requisites
- [x] 11. Change in semesters offered (department head signature only)
- [ ] 12. Transfer from one department to another

PROPOSED:	EXISTING:
Subject Abbreviation	Subject Abbreviation BME
Course Number	Course Number 30400
Long Title Biomedical Transport Fundamentals	
Short Title Transport Fundamentals	

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

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

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

CREDIT TYPE
1. Fixed Credit: Cr. Hrs. 3
2. Variable Credit Range: Minimum Cr. Hrs
(Check One) To [ ] 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 [ ]
Maximum Repeatable Credit: [ ]
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 [ ]

ScheduleType	Minutes Per Mtg	Meetings Per Week	Weeks Offered	% of Credit Allocated
Lecture	50	3	16	
Recitation				
Presentation				
Laboratory				
Lab Prep				
Studio				
Distance				
Clinic				
Experiential				
Research				
Ind. Study				
Pract/Observ				

Cross-Listed Courses

RECEIVED
2011 AUG -9 AM 9:44
PURDUE UNIVERSITY

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):
Major Restriction: BME Only. Prerequisites: ME 20000 and (MA 26200 or MA 26600). Fundamental concepts and principles of momentum, heat, and mass transport phenomena in the context of biomedical applications. Integrated biological topics include transport of physiological fluids (e.g. blood), mass transport (e.g. oxygen and nutrients), forced convection (e.g. hemodialysis) and unsteady-state molecular diffusion (e.g. drug delivery mechanisms).

*COURSE LEARNING OUTCOMES:
- Understand, model, and solve problems using the principles of Conservation of Momentum, Mass, and energy
- Perform macroscopic and microscopic thermal energy, mass, and momentum, balances

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
North Central Department Head	Date	North Central Chancellor	Date
Douglas R. Wodicka 2/9/11		7/25/11	
West Lafayette Department Head	Date	West Lafayette College/School Dean	Date

Sandra Schaffer 8/10/11
West Lafayette Registrar — Date

OFFICE OF THE REGISTRAR

Engineering Faculty Document No. 76-10
April 14, 2010

TO: The Faculty of the College of Engineering

FROM: The Faculty of the School of Biomedical Engineering

RE: Changes in Undergraduate-Level Course, BME 30400 Biomedical Transport Fundamentals, requisites, term offered, name change, and course content.

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

From: **BME 30400 Bioheat and Mass Transfer**
Term offered: Spring, Lecture 3, Cr. 3
Prerequisite: ME 30900
Co-requisite: None
Description: Fundamentals of heat and mass transport concepts in the context of biomedical applications. Heat transfer concepts include: steady- and unsteady-state thermal conductivity, convection, radiation, and combined mechanisms of heat transfer. Mass transport concepts include: steady and unsteady-state molecular mass transfer, diffusion, interphase mass transport, and convective mass transport. Integrated biological topics include fluid and mass transport in the body, pathological conditions (such as fever and arteriosclerosis), forced convection (i.e., dialysis), radiation exposure to cells/tissues, unsteady-state molecular diffusion such as in drug delivery mechanisms.

To: **BME 30400 Biomedical Transport Fundamentals**
Term offered: Fall, Lecture 3, Cr. 3
Prerequisites: ME 20000 and (MA 26200 or MA 26600)
Restriction: Must be enrolled in the School of Biomedical Engineering
Description: Fundamental concepts and principles of momentum, heat, and mass transport phenomena in the context of biomedical applications. Integrated biological topics include transport of physiological fluids (e.g. blood), mass transport (e.g. oxygen and nutrients), forced convection (e.g. hemodialysis) and unsteady-state molecular diffusion (e.g. drug delivery mechanisms).

APPROVED FOR THE FACULTY
OF THE SCHOOLS OF ENGINEERING
BY THE ENGINEERING
CURRICULUM COMMITTEE

ECC Minutes #17

Date 4/20/11

Chairman ECC R. Cipra

Reason: ME 30900 was removed as a prerequisite course because it no longer will be required in the BME curriculum (see EFD 28-11). In addition to heat and mass transport, course content in BME 30400 will now include momentum transport in order to present all transport principles more efficiently and to integrate relevant biomedical applications more effectively. Furthermore, the introduction of momentum, heat, and mass transfer concepts within a single semester will facilitate examples and explanations of how physiological processes influence transport. The title and description changes are to provide more clarity and alignment with course content for the students. ME 20000 and MA 26600 (and its equivalents) were added as prerequisites because each contains information required to accomplish BME 30400. The semester was changed from Spring to Fall because theory presented in BME 30400 is a necessary prerequisite for students to understand the material in BME 30600 which is taught in the Spring.

George R. Wodicka

George R. Wodicka, Professor and Head
Weldon School of Biomedical Engineering

Proposed BME 30400 Syllabus, Fall 2011

BME 304: BIOMEDICAL ENGINEERING TRANSPORT PHENOMENA

Fall Semester, 2011
(3 credits)

Lecture: Monday, Wednesday, Friday 8:30-9:20 AM in MJIS 1001

Textbook: *Fundamentals of Momentum, Heat, and Mass Transfer, 5th edition.* J.R. Welty, C.E. Wicks, R.E. Wilson, and G.L. Rorrer. John Wiley & Sons. 2008.

Supplemental Textbooks: *Transport Phenomena in Biological Systems, 2nd edition.* G.A. Truskey, F. Yuan, and D.F. Katz. Pearson Prentice Hall. 2009.
Fundamentals of Heat and Mass Transfer, 6th edition. F.P. Incropera, D.P. DeWitt, T.L. Bergman, and A.S. Lavine. John Wiley & Sons, 2007.

Instructor: Alyssa Panitch, Ph.D.
apanitch@purdue.edu
496-1313

Office Hours: Wednesday, 10:30 – 12:00
Thursday, 1:30-3:00 pm
or by appointment
MJIS 3086

TA: TBD

Office Hours:

Course Description
Fundamental concepts and principles of momentum, heat, and mass transport phenomena in the context of biomedical applications. Integrated biological topics include transport of physiological fluids (e.g. blood), mass transport (e.g. oxygen and nutrients), forced convection (e.g. dialysis) and unsteady-state molecular diffusion (e.g. drug delivery mechanisms).

Course Goals
This course is designed to provide students with a foundation in understanding and solving problems related to biomedical engineering applications of momentum, heat, and mass transport phenomena. At the end of the semester, each student will be able to:

- Understand, model, and solve problems using the principles of Conservation of Momentum, Mass, and energy
- Perform macroscopic and microscopic thermal energy, mass, and momentum, balances

Prerequisites
ME 20000 and (MA 26200 or MA 26600)

Attendance
Students are expected to attend each class period during the semester. If a student knows he or she will be absent during the semester (e.g., attending a conference), he or she needs to communicate with the instructor at least one week before the absence is to occur. Failure to do so will indicate an unexcused absence. Any unexcused absence will result in a grade of zero for any quiz or exam scheduled for that class period. If an emergency exists such that a student is not present for a class period, the instructor will determine if the student will be allowed to make up any homework, quiz, or exam. Students missing a quiz because they arrive late to class will be allowed to make up the quiz only by instructor approval.

Procedures and Policies
- Students are required to read all assigned materials before coming to class.
- Before class begins, please turn off or silence all cell phones, pagers, etc.
- Homework and take-home quizzes are due at the beginning of class. Late homework or take-home quizzes will not be accepted. In the event of an excused absence, please make arrangements to turn in the homework or take-home quiz assignment before class.

Homework
Homework will be assigned frequently throughout the semester. Homework is intended to help each student practice setting up and solving momentum, heat, and mass transfer problems. For each assignment, all homework problems are required to be solved. However, not every problem will be graded. Students will not know beforehand which problems will be graded and which problems will not be graded.

Quizzes
Quizzes will be conducted periodically throughout the semester at the beginning or end of a class period. Some quizzes might be administered online using Blackboard Vista or offered as take-home quizzes. Notes will not be allowed during any quiz.

Exams
Three exams will be administered during the semester (two 2-hour evening midterms and one 2-hour final exam) and will be based on information presented during lectures, homework, materials handed out in class or posted online, and in the textbook.

Course Content
This course will be administered online using Blackboard Vista (http://www.itap.purdue.edu/tlt/blackboard). Students are expected to check the site often for announcements, homework assignments, grades, course content, and other information.

Academic Honesty
Purdue University's policy on academic dishonesty states that "the commitment of the acts of cheating, lying, stealing, and deceit in any of their diverse forms (such as the use of ghost – written papers, the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest" (University Senate Document 72-18, December 15, 1972). Furthermore, plagiarism means "to use and to pass off someone else's ideas, inventions, writings, etc. as one's own" (New Webster's Dictionary and Thesaurus, 1992). In this course, cheating, plagiarism, or any act of dishonesty will not be tolerated. Any student involved in acts of academic dishonesty, including cheating and plagiarism, will fail the course.

Grading
Final grades will be assigned based primarily on absolute performance and secondarily on relative performance. The following grading scale is guaranteed but may be modified based on relative student performance:

A+	97%-100%	C	73%-76%
A	93%-96%	C-	70%-72%
A-	90%-92%	D+	67%-69%
B+	87%-89%	D	63%-66%
B	83%-86%	D-	60%-62%
B-	80%-82%	F	below 60%
C+	77%-79%		

Grades will be based on performance using the following assessments:

Quizzes	5%
Homework	10%
Midterm 1	25%
Midterm 2	25%
Final Exam	35%
Total	100%

Calendar
Evening examinations are scheduled from 8:00-10:00 pm in MJIS 1001 and will be announced at beginning of semester.

Campus Emergency
In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Email and Blackboard will be the primary means of communication of course-related information during such emergencies.

Schedule
Monday, Wednesday, Friday 8:30-9:20 AM

The following is a tentative description of the readings, lecture topics, and exams.

Date	**Required Reading**	**Lecture Topic**
Mon, Aug 23		Syllabus; Introduction to Momentum Transfer (W^3R Ch 1.1-1.4)
Wed, Aug 25	Syllabus, W^3R Ch 1&2	Fluid Statics (W^3R Ch 2)
Fri, Aug 27	W^3R Ch 3	Description of a Fluid in Motion (W^3R Ch 3); Conservation of Mass: Control-Volume Approach (W^3R Ch 4)
Mon, Aug 30	W^3R Ch 4, 5.1-5.2	Conservation of Mass: Control-Volume Approach (W^3R Ch 4); Netwon's 2nd Law of Motion: Control-Volume Approach (W^3R Ch 5.1-5.2)
Wed, Sep 1	W^3R Ch 6	Conservation of Energy: Control-Volume Approach (W^3R Ch 6)
Fri, Sep 3	W^3R Ch 7	Shear Stress in Laminar Flow (W^3R Ch 7)
Mon, Sep 6	None	No Class – Labor Day
Wed, Sep 8	W^3R Ch 8	Shear Stress in Laminar Flow (W^3R Ch 7); Analysis of a Differential Fluid Element in Laminar Flow (W^3R Ch 8)
Fri, Sep 10	W^3R Ch 9	Analysis of a Differential Fluid Element in Laminar Flow (W^3R Ch 8); Differential Equation of Fluid Flow (W^3R Ch 9)
Mon, Sep 13		Differential Equation of Fluid Flow (W^3R Ch 9)
Wed, Sep 15	Matlab help "PDEPE"	Matlab PDEPE; Differential Equation of Fluid Flow (W^3R Ch 9)
Fri, Sep 17		Matlab PDEPE; Differential Equation of Fluid Flow (W^3R Ch 9)
Mon, Sep 20	W^3R Ch 11.1-11.2, 12.1-12.3, 13 (all)	Dimensional Analysis and Similitude (W^3R Ch 11.1-11.2); Viscous Flow (W^3R Ch 12.1-12.3); Flow in Closed Conduits (W^3R Ch 13)
Wed, Sep 22	W^3R Ch 14	Flow in Closed Conduits (W^3R Ch 13); Fluid Machinery (W^3R Ch 14)
Fri, Sep 24	W^3R Ch 15	Fundamentals of Heat Transfer (W^3R Ch 15)
Mon, Sep 27	W^3R Ch 16	Differential Equations of Heat Transfer (W^3R Ch 16)
Wed, Sep 29		**Evening Exam #1** (covering 8/23 to 9/22); no class
Fri, Oct 1	W^3R Ch 17	Steady-State Conduction (W^3R Ch 17)
Mon, Oct 4		Steady-State Conduction (W^3R Ch 17), 2-D with Matlab

Wed, Oct 6	W³R Ch 18	Steady-State Conduction (W³R Ch 17); Unsteady-State Conduction (W³R Ch 18)
Fri, Oct 8		Unsteady-State Conduction (W³R Ch 18)
Mon, Oct 11	None	No Class – Fall Break
Wed, Oct 13		Unsteady-State Conduction (W³R Ch 18), with PDEPE
Fri, Oct 15		Unsteady-State Conduction (W³R Ch 18), with PDEPE
Mon, Oct 18	W³R Ch 19.1-19.3, 20.1, 22 (all)	Convective Heat Transfer (W³R Ch 19.1-19.3); Convective Heat Transfer Correlations (W³R Ch 20.1); Heat Transfer Equipment (W³R Ch 22)
Wed, Oct 20		Heat Transfer Equipment (W³R Ch 22)
Fri, Oct 22	W³R Ch 24	Fundamentals of Mass Transfer (W³R Ch 24)
Mon, Oct 25	W³R Ch 25	Differential Equations of Mass Transfer (W³R Ch 25)
Wed, Oct 27		**Evening Exam #2** (covering 9/24 to 10/20); no class
Fri, Oct 29	W³R Ch 26	Steady-State Molecular Diffusion (W³R Ch 26)
Mon, Nov 1		Steady-State Molecular Diffusion (W³R Ch 26)
Wed, Nov 3	W³R Ch 27	Unsteady-State Molecular Diffusion(W³R Ch 27)
Fri, Nov 5		Unsteady-State Molecular Diffusion (W³R Ch 27)
Mon, Nov 8		Unsteady-State Molecular Diffusion (W³R Ch 27)
Wed, Nov 10	TYK Ch 10	Homogenous and Heterogeneous Chemical Reactions (TYK Ch 10)
Fri, Nov 12		Enzyme Kinetics and Higher Order Reactions
Mon, Nov 15	TYK Ch 11.7	Gene Regulation
Wed, Nov 17	TYK Ch 11 (remainder)	Cell Surface Receptor Biophysics
Fri, Nov 19		Signal Transduction
Mon, Nov 22	W³R Ch 28.1-28.3, 29 (all)	Convective Mass Transfer (W³R Ch 28.1-28.3); Convective Mass Transfer Between Phases (W³R Ch 29)
Wed, Nov 24	None	No Class – Thanksgiving Break
Fri, Nov 26	None	No Class – Thanksgiving Break
Mon, Nov 29	W³R Ch 30.1-30.2, 30.7	Convective Mass Transfer Correlations (W³R Ch 30.1-30.2, 30.7)
Wed, Dec 1	W³R Ch 31	Mass Transfer Equipment (W³R Ch 31)
Fri, Dec 3	W³R Ch 23	Radiation Heat Transfer (W³R Ch 23)
Mon, Dec 6		Radiation Heat Transfer (W³R Ch 23); Radiation as Chemotherapy
Wed, Dec 8	Primary Literature	In-Class Discussion on Primary Literature
Fri, Dec 10	Review all material	In-Class Review

Former BME 30400 Syllabus, Spring 2010

BME 304: BIOHEAT AND MASS TRANSFER

Spring Semester, 2010

Lecture: Monday, Wednesday, and Friday from 8:30 pm to 9:20 am in MJIS 1001

Textbook: *Fundamentals of Heat and Mass Transfer, 6th edition.* F.P. Incropera, D.P. DeWitt, T.L. Bergman, and A.S. Lavine. John Wiley & Sons, 2007.

Instructor: Brandon Seal, Ph.D.
bseal@purdue.edu
494-7330

Office Hours: Wednesday, 10:30 am – 12:00 pm
Thursday, 1:30-3:00 pm
or by appointment
BMED 3084

TA: Rush Bartlett
rush256@gmail.com

Office Hours:
or by appointment

Course Description
Fundamentals of heat and mass transport concepts in the context of biomedical applications. Heat transfer concepts include: steady- and unsteady-state thermal conductivity, convection, radiation, and combined mechanisms of heat transfer. Mass transport concepts include: steady- and unsteady-state molecular mass transfer, diffusion, interphase mass transport, and convective mass transport. Integrated biological topics include fluid and mass transport in the body, pathological conditions (such as fever and arteriosclerosis), forced convection (i.e., dialysis), radiation exposure to cells/tissues, unsteady-state molecular diffusion such as in drug delivery mechanisms.

Course Goal
This course is designed to provide students with a foundation in understanding and solving problems related to biomedical engineering applications of heat and mass transport phenomena. At the end of the semester, each student will be able to:

- Perform microscopic (local) thermal energy, mass, and species mass balances
- Perform macroscopic thermal energy, mass, and species mass balances
- Describe the different mechanisms of heat transfer—conduction, convection, and radiation
- Apply thermal energy balances and Fourier's Law to steady-state and transient conduction
- Apply thermal energy balances and Newton's Law of Cooling to convective heat transfer
- Apply species mass balances and Fick's Law to steady-state and transient diffusion
- Apply species mass balances and relevant rate equations to convective mass transfer
- Describe and design heat and mass transfer processes with applications to biomedical engineering
- Describe analogies between transport of momentum, heat, and mass and applications of practical problems

Prerequisites
ME 309 or equivalent

Attendance
Students are expected to attend each class period during the semester. If a student knows he or she will be absent during the semester (e.g., attending a conference), he or she needs to communicate with the instructor at least one week before the absence is to occur. Failure to do so will indicate an unexcused absence. Any unexcused absence will result in a grade of zero for any quiz or exam scheduled for that class period. If an emergency exists such that a student is not present for a class period, the instructor will determine if the student will be allowed to make up any homework, quiz, or exam. Students missing a quiz because they arrive late to class will be allowed to make up the quiz only by instructor approval.

Procedures and Policies
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- Before class begins, please turn off or silence all cell phones, pagers, etc.
- Homework and take-home quizzes are due at the beginning of class. Late homework or take-home quizzes will not be accepted. In the event of an excused absence, please make arrangements to turn in the homework or take-home quiz assignment before class.

Homework
Homework will be assigned frequently throughout the semester. Homework is intended to help each student practice setting up and solving heat and mass transfer problems. For each assignment, all homework problems are required to be solved. However, not every problem will be graded. Students will not know beforehand which problems will be graded and which problems will not be graded.

Quizzes
Quizzes will be conducted periodically throughout the semester at the beginning or end of a class period. Some quizzes might be administered online using Blackboard Vista or offered as take-home quizzes. Notes will not be allowed during any quiz.

Exams
Three exams will be administered during the semester (two 2-hour evening midterms and one 2-hour final exam) and will be based on information presented during lectures, homework, materials handed out in class or posted online, and in the textbook.

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Grading
Final grades will be assigned based primarily on absolute performance and secondarily on relative performance. The following grading scale is guaranteed but may be modified based on relative student performance:

A+	97%-100%	C	73%-76%
A	93%-96%	C-	70%-72%
A-	90%-92%	D+	67%-69%
B+	87%-89%	D	63%-66%
B	83%-86%	D-	60%-62%
B-	80%-82%	F	below 60%
C+	77%-79%		

Grades will be based on performance using the following assessments:

Quizzes	5%
Homework	15%
Midterm 1	25%
Midterm 2	25%
Final Exam	30%
Total	100%

Calendar
Evening examinations are scheduled from 8:00-10:00 pm in MJIS 1001 on the following dates:

- Wednesday, February 17
- Wednesday, March 31

Class will not be held on the following dates:

- Monday, January 18 (Martin Luther King Jr. Day)
- Monday, March 15 (Spring Break)
- Wednesday, March 17 (Spring Break)
- Friday, March 19 (Spring Break)
- To be determined (canceled for midterm 1)
- To be determined (canceled for midterm 2)

Campus Emergency
In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Email and Blackboard will be the primary means of communication of course-related information during such emergencies.

Final Clause
The instructor reserves the right to change any portion of this syllabus at any time throughout the semester.