Office of the Registrar
FORM 40 REV. 11/09

UD 8/10/11

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

Print Form

EFD 77-10

DEPARTMENT Biomedical Engineering

EFFECTIVE SESSION ~~Spring 2011~~ 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
- [ ] 5. Change in course title
- [x] 6. Change in course credit/type
- [ ] 7. Change in course attributes (department head signature only)
- [x] 8. Change in instructional hours
- [x] 9. Change in course description
- [x] 10. Change in course requisites
- [ ] 11. Change in semesters offered (department head signature only)
- [ ] 12. Transfer from one department to another

	PROPOSED:	EXISTING:
Subject Abbreviation		BME
Course Number		30600

Long Title Biotransport Laboratory

Short Title Biotransport Laboratory

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

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

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

CREDIT TYPE
1. Fixed Credit: Cr. Hrs. 2
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 [ ]

Schedule Type	Minutes Per Mtg	Meetings Per Week	Weeks Offered	% of Credit Allocated
Lecture	50	1	16	50
Recitation				
Presentation				
Laboratory	150	1	16	50
Lab Prep				
Studio				
Distance				
Clinic				
Experiential				
Research				
Ind. Study				
Pract/Observ				

Cross-Listed Courses

2011 AUG -9 AM 9:43
OFFICE OF THE REGISTRAR RECEIVED

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):
Major Restriction: BME Only. Prerequisite: BME 30400. Description: Practical experience with transport principles related to physiological systems is presented through inquiry-based modules. Modules contain elements of computer simulation, experimental design, implementation, and data analysis and address biomedical applications.

*COURSE LEARNING OUTCOMES:
1. Use theoretical equations from fluid, heat, and mass transport to describe, model, analyze, and explain biomedical data.
2. Design experiments to investigate biomedical transport phenomena, collect relevant data, and compile a comprehensive report that clearly demonstrates the findings and implications of the data.
3. Work in a team to simulate and experimentally model biomedical transport, and use peer- and self-reviews to describe how each team member contributed to group efforts

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
George R. Wodicka	4/28/11	[signature]	7/25/11
West Lafayette Department Head	Date	West Lafayette College/School Dean	Date

[signature] 8/10/11
West Lafayette Registrar Date

OFFICE OF THE REGISTRAR

Engineering Faculty Document No. 77-10
February 3, 2011

TO: The Faculty of the College of Engineering

FROM: The Faculty of the School of Biomedical Engineering

RE: Changes in Undergraduate-Level Course, BME 30600 Biotransport Laboratory, requisites, course description, and course credit

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 30600 Biotransport Laboratory**
Semester offered: Spring, Lab 3, Cr. 1
Prerequisite: ME 30900 or equivalent
Co-requisite: BME 30400

Description: Practical experience with fluid, mass, and heat transport principles and dimensional analysis relevant to biomedical applications. Experiments include simulations of normal and pathological conditions of blood flow with vessel constructs, mass transfer in unique boundary layers and molecular diffusion in cell and tissues, heat generation and transfer in biomaterials emphasizing tissue-tissue and tissue-cell interfaces.

To: **BME 30600 Biotransport Laboratory**
Term offered: Spring, Lecture 1, Lab 3, Cr. 2
Prerequisite: BME 30400
Restriction: Must be enrolled in the School of Biomedical Engineering (BME)

Description: Practical experience with transport principles related to physiological systems is presented through inquiry-based modules. Modules contain elements of computer simulation, experimental design, implementation, and data analysis and address biomedical applications.

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 will be removed as a prerequisite course because it no longer will be required in the BME curriculum (see EFD 28-11). BME 30400 was changed from a co-requisite to a prerequisite because it is now offered in the Fall semester and introduces students to theory necessary to accomplish BME 30600. The course credit hours were changed to reflect the addition of a 50 minute lecture. This provides a bridge between BME 30400 which is largely based on textbook/analytically tractable problems to more realistic and complex transport problems that are characteristic of those encountered by biomedical engineering. The course format was changed to help students master literature search/review skills, develop experiment design skills and recognize the value and use of simulation and prototyping tools for exploring biological systems of interest. Because this laboratory format will increase students' skills in the aforementioned areas, this laboratory experience is expected to provide a smoother transition between junior level laboratories and senior design.

George R. Wodicka

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

Proposed BME 30600 Syllabus

BME 30600: Biotransport Laboratory

Spring 2011

Instructor of Record:	Dr. Alyssa Panitch	Office: MJIS 3086
	Email: apanitch@purdue.edu	
	Dr. Ann Rundell	Office: MJIS 3029
	Email: rundell@purdue.edu	
Lab Coordinator:	Dr. Marcia Pool	Office: MJIS 1055
	Email: mpool@purdue.edu	
Course TAs:	Trisha Eustaquio	
	Email: teustaqu@purdue.edu	Office Hours:
	Scott Jewett	
	Email: sajewett@purdue.edu	Office Hours:
	Rajtarun Madangopal	
	Email: rmadango@purdue.edu	Office Hours:
Other support:	Dr. Kate Stuart	
	Email: kstuart@purdue.edu	
Class Location:	MJIS 1061	
Lecture:	Monday 8:30 – 9:20 am in MJIS 1001	

Lab: Tuesday 3:00 – 5:50 pm OR Thursday 8:30 – 11:20 am OR Thursday 3:00 – 5:50 pm

Pre-requisites: BME 304

Course Description: Practical experience with transport principles related to physiological systems is presented through inquiry-based modules. Modules contain elements of computer simulation, experimental design, implementation, and data analysis and address biomedical applications.

Course Outcomes:

Upon completion of the course each student will have the ability to:

1. Use theoretical equations from fluid, heat, and mass transport to describe, model, analyze, and explain biomedical data.
2. Design experiments to investigate biomedical transport phenomena, collect relevant data, and compile a comprehensive report that clearly demonstrates the findings and implications of the data.
3. Work in a team to simulate and experimentally model biomedical transport, and use peer- and self-reviews to describe how each team member contributed to group efforts.

Required Supplies:

- R. Fournier. *Basic Transport Phenomena in Biomedical Engineering*, 2nd ed. New York, New York: Taylor and Francis Group, LLC. , 2007. (ISBN: 1591690269)

- Laboratory Notebook with duplicate pages

  Roaring Springs, Edison Lab Notebook # 7097277644

  National Brand, Laboratory Research Notebook # 7333343649

  Safety Goggles

Laboratory Attire: Safety regulations require that you wear long pants (or equivalent) and closed-toe shoes while working in the laboratory. You will not be allowed to work in the lab if you are improperly dressed.

Academic Conduct: You are expected to behave in a professional and ethical manner in all aspects of this course. Plagiarism or cheating will result in a zero for that particular assignment. Instances of unethical behavior will be reported to the Dean of Students Office and will result in a grade reduction of at least one letter grade. If an individual behaves unprofessionally or unethically during the semester, the instructor reserves the right to fail the student. For more information, see Purdue University Student Conduct Code at: http://www.purdue.edu/usp/acad_policies/student_code.shtml .

All assignments must be submitted to **Blackboard Vista** (http://blackboard.purdue.edu) before the beginning of the lab period in which the assignment is due. All hard copies of assignments must be submitted in the first 15 minutes of the laboratory period.

Class Attendance: 100% attendance is required to pass the course. If a student misses a class due to extenuating circumstances (e.g., death in family), he/she must contact the lab instructor immediately. In some instances, written documentation will be required. Make-up work will be considered and assigned on a case-by-case basis. **To receive credit for the lab, a student must be in the lab on time, no more than 15 minutes late. A student who is more than 15 minutes late and who does not have an excused reason may receive a zero on the lab.**

Office Hours: Lab office hours will be held in MJIS 1061. In addition to using office hours to obtain further understanding of laboratory concepts, office hours may also be used to complete laboratory procedures not finished in lab. Office hours will be held on **Monday (5 – 7 pm)** and **Wednesday (5 – 7 pm)** evenings.

Campus Emergency Response Procedures:
http://www.purdue.edu/fire/safety_handbook.pdf

- **Fire Alarm** – Evacuate MJIS 1061 through the south door (nearest the elevator); then, leave the building through the doors which exit to the east side of the building (back of the building near the "Building and Grounds" area). Only gather personal items if it does not jeopardize your safety. Assist those who need help. Proceed to the front lawn Lilly Hall of Life Sciences (corner of State St. and S. Russell Dr.) **Report to a course instructor your name before leaving the emergency assembly area.**

- **All hazards warning** (Tornado, hazardous release, civil unrest, etc.) – When you hear the all hazards alarm immediately seek shelter (**Shelter-In-Place**) in a safe location. For a tornado, proceed to the basement of MJIS, using either the stairwell on the northwest side (by the police station) or the southeast side (across from MJIS 1087).

Campus Emergency Policy: 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. If an emergency should occur, check Blackboard and your Purdue email accounts to learn about modifications to the course.

Online Course Evaluations: You must complete all online course evaluations for this class AND submit to the lab coordinator evidence of survey completion before finals week. If no evidence of survey completion is submitted you will lose 5% off your final class grade.

Laboratory Notebook: Each student must maintain a laboratory notebook. A lab notebook is used to document work in a research setting; it details what was done, when it was done, and who did it. Whether your career takes you into an industrial or academic research setting, you will be expected to maintain a proper lab notebook. In these settings, notebooks become important legal documents which can be used to submit a patent claim and credit an original discovery. Notebooks should be completed in a legible manner and contain the following components, at a minimum:

- Experiment title
- Lab partner(s) names and date
- Experiment purpose or problem statement
- Steps taken to achieve your goal; this is not a repeat of items in the lab manual but a description (in your own words) of how you performed the experiment
    - Including schematics to represent what you have done
    - Including deviations from the procedure documented in the lab manual
    - Including calculations necessary to complete the procedure
    - Including parameters of experimental set ups
    - Etc.
- Observations/Results obtained as you perform the experiment
    - Record these immediately – you will easily forget important items
    - Including general observations – for instance, the solution turned pink when we added chemical X
    - Including any difficulties you may have encountered and how these may affect your data
- Conclusions
    - Comment on potential sources of error in your experiment
    - Any statements you can make based on raw data collected in class

Please revisit your BME 205, 206, and 305 manuals for further explanation and examples of what should be included in your lab notebook.

Expectations for each module:

Week one

- Problem statement (given)
- Screen literature base
- Testing system design
- Experiment design (factors, replicates, etc.)

Week two

- Construct and use mathematical model to set experimental conditions and parameters
- Conduct any necessary preliminary experiments to obtain key estimates of model parameters

Week Three

- Conduct the primary experiment
- Analyze data
- Interpret results within context of mathematical model and your problem statement

Week Four

- Construct and use mathematical model to extend findings to predict behaviors that are too complex to evaluate experimentally
- Complete lab report

Formal Lab Reports and Post Lab Analysis: At the conclusion of each module, your group will write a formal lab report. This will include an abstract, introduction, materials & methods, results, discussion/analysis, and conclusion sections. The ability to integrate ideas will demonstrate that you have fully achieved the objectives of the lab exercises; this is an important part of your lab report. It is up to your team to integrate the concepts from the labs within each module; the background and conclusions sections may be excellent choices to tie the experiments and results together.

Self and Peer Reviews: At the close of each module, your team will complete self and peer evaluations; that is, each person will assess his/her own performance on the team as well as the performance of each team member. Evaluations will be submitted online. At the end of the module, a link to the survey will be sent to you.

Evaluation results will be factored in as part of your overall course grade; negative evaluations can adversely affect your grade.

Grading Scale: The following grading scale is a guaranteed minimum; however, based upon student performance, final grades may be curved by the instructor.

90-100	A
80-89	B
70-79	C
60-69	D
<59	F

*Note: Negative peer evaluations can adversely affect your final grade.

Re-grade Policy: Students have the right to contest any grade throughout the semester. Once an assignment has been graded and returned, students have 1 week to protest a grade; after this time grade disputes will not be accepted. In the event that a student feels an assignment has been inappropriately graded, the student must submit a one page, typed document indicating the source of the problem and an explanation for the re-grade submission. The original assignment must be returned with the protest explanation. Papers submitted for a re-grade will be completely reevaluated (i.e., the entire paper will be re-graded, not only the portion under protest), which means that students risk losing additional points for mistakes missed during the first grading process. Please note that all re-grade requests will be evaluated at the end of the term and will only be considered for those students with a borderline grade (i.e., between an A and B).

Course Schedule:

Week	Week of (in 2011)	Lecture*	Lab	Recommended Reading	Assignment Due
		Module 1: Intro to modeling and statistics; Effect of molecular size on diffusion			
1	1/10	Support Lecture	Experimental design; modeling; experiment and data collection	Ch. 5 (Fournier) 5.10 (Krogh)	
2	1/17	MLK (no class)			Approval of experimental design
3	1/24	Support Lecture			
4	1/31	Support Lecture			
		Module 2: Effect of molecular size and tissue density on diffusion			
5	2/7	Support Lecture	Experimental design; modeling; experiment and data collection	Ch. 5 (Fournier) 5.4, 5.5, 5.6	M1 lab report; notebook
6	2/14	Support Lecture			Approval of experimental design
7	2/21	Support Lecture			
		Module 3: Exploration of hypothermia and heat transfer			
8	2/28	Support Lecture	Experimental design; modeling	To be distributed on Blackboard	M2 lab report; notebook
9	3/7	Support Lecture			Approval of experimental design
10	3/14	Spring Break (no class, no lab)			
11	3/21	Support Lecture	Modeling and experiment and data collection		
12	3/28	Support Lecture			
		Module 4: Distribution of oral medications			
13	4/4	Support Lecture	Experimental design; modeling; experiment and data collection	Ch. 7 (Fournier) 9.11, 10.6.5	M3 lab report; notebook
14	4/11	Support Lecture			Approval of experimental design
15	4/18	Support Lecture			
16	4/25	Support Lecture			
17	5/2	Final exam week			M4 lab report; notebook

*Lecture order is subject to change, as needed.

Current BME 30600 Syllabus, Spring 2010

BME 306: Biotransport Laboratory

Spring 2010

Instructor of Record:	Dr. Brandon Seal	Office: BMED 3084
	Email: bseal@purdue.edu	
Lab Coordinator:	Dr. Marcia Pool	Office: BMED 1055
	Email: mpool@purdue.edu	
Course TAs:	Trisha Eustaquio	
	Email: teustaqu@purdue.edu	Office Hours:
	Scott Jewett	
	Email: sajewett@purdue.edu	Office Hours:
	Rajtarun Madangopal	
	Email: rmadango@purdue.edu	Office Hours:
Class Location/	BMED 1061	
Hours:	Tuesday 3:00-5:50 pm OR	Thursday 8:30-11:20 am
	OR Thursday 3:00-5:50 pm	
Pre-requisites:	ME 309: Fluid Mechanics	
Co-requisites:	BME 304: Bioheat and Mass Transfer	

Course Description: In this course we will explore the biological ramifications of the laws of transport but also learn how to exploit these phenomena to design biomedical devices and systems. This course consists of four modules, each module containing three related laboratory exercises. In completing each module, students will learn to function efficiently as a team, complete a formal lab report including a small design exercise, and deepen their understanding of the importance of transport phenomenon in both natural and designed biological systems.

Course Outcomes:

Upon completion of the course each student will have the ability to:

1. Use theoretical equations from fluid, heat, and mass transport topics to describe, model, analyze, and explain data collected from a biological system.
2. Design experiments in transport phenomena, collect relevant data, and create a comprehensive report that clearly demonstrates their findings and the implications of their data.
3. Propose and evaluate engineering design solutions to biologically or medically relevant problems using transport phenomena theory.
4. Work in a team to solve problems, and use peer and self reviews to describe how each team member contributed to group efforts.

Lab Manual: Biomedical Concepts in Transport Phenomenon

(Available for purchase at CopyMat)

Required Supplies: Laboratory Notebook with duplicate pages

Roaring Springs, Edison Lab Notebook # 7097277644

National Brand, Laboratory Research Notebook # 7333343649

Safety Goggles

Laboratory Attire: Safety regulations require that you wear long pants (or equivalent) and closed-toe shoes while working in the laboratory. You will not be allowed to work in the lab if you are improperly dressed.

Academic Conduct: You are expected to behave in a professional and ethical manner in all aspects of this course. Plagiarism or cheating will result in a zero for that particular assignment. Instances of unethical behavior will be reported to the Dean of Students Office and will result in a grade reduction of at least one letter grade. If an individual behaves unprofessionally or unethically during the semester, the instructor reserves the right to fail the student. For more information, see Purdue University Student Conduct Code at:

http://www.purdue.edu/odos/administration/codeconduct.htm.

To encourage an environment free of plagiarism, all laboratory reports must be submitted through turnitin.com via Blackboard Vista. Turnitin.com has a vast database which is used to compare your work to all materials that have been published electronically and in paper form. For more details on this software, please visit https://turnitin.com.

All assignments must be submitted to **Blackboard Vista** (http://blackboard.purdue.edu) before **12:00 pm** on the date the assignment is due in class.

Class Attendance: 100% attendance is required to pass the course. If class is missed due to extenuating circumstances (e.g., death in family) the lab instructor should be contacted immediately. In some instances, written documentation will be required. Make-up work will be considered and assigned on a case-by-case basis.

Office Hours: Lab office hours will be held in MJIS 1061. In addition to using office hours to obtain further understanding of laboratory concepts they may also be used to complete laboratory procedures not finished in lab as well as practice for the mid-term lab practical and design project. Office hours will be held on Monday, Tuesday, and Wednesday evenings from 6:00-8:00 p.m. TAs reserve the right to end office hours after the first hour if no one shows up. Should you know in advance you cannot make office hours until the second hour you should contact the specified TA working those office hours. Additionally, should you be unable to attend the assigned office hours please consult with a TA to set up alternative arrangements.

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- **All hazards warning** (Tornado, hazardous release, civil unrest, etc.) – When you hear the all hazards alarm immediately seek shelter (**Shelter-In-Place**) in a safe location. For a tornado, proceed to the basement of MJIS, using either the stairwell on the northwest side (by the police station) or the southeast side (across from MJIS 1087).

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Online Course Evaluations: You must complete all online course evaluations for this class AND submit to the lab coordinator evidence of survey completion before finals week. If no evidence of survey completion is submitted you will lose 5% off your final class grade.

Course Schedule

WEEK OF	WEEK	LAB ACTIVITY	Assignment Due
1/11	1	Review of Safety Procedures Introduction to Team Building	Myers-Briggs assessment, Safety Quiz
MODULE 1: EFFECT OF SHEAR ON CELLS: INVESTIGATING FLOW AND OBSERVING MORPHOLOGICAL CHANGES			
1/18	2	Lab 1: Introduction to ANSYS; Computational Modeling of Fluid Flow	Pre-lab Lab 1
1/25	3	Lab2: Particle Image Velocimetry	Pre-lab Lab 2
2/1	4	Lab 3: Cellular Responses to Shear Stress	Pre-lab Lab 3
MODULE 2: FLUID FLOW IN THE CARDIOVASCULAR SYSTEM: MODELING NORMAL AND PATHOLOGICAL FLOW			
2/8	5	Lab 4: Introduction to LabVIEW; Design and Construction	Pre-lab Lab 4, Module 1 Lab Report
2/15	6	Lab 5: Modeling Pathology	Pre-lab Lab 5
2/22	7	Lab 6: Modeling Roughness	Pre-lab Lab 6
3/1	8	LabVIEW design for Heat Transfer Module; Wheatstone bridge	Module 2 Lab Report
MODULE 3: HEAT TRANSFER IN BIOLOGICAL SYSTEMS: MONITORING, CONTROLLING, AND MODELING			
3/8	9	Lab 7: Experimental Design: Applied Heat Transfer Principles	Pre-lab Lab 7
3/22	10	Lab 8: Computational Modeling of Heat Transfer	Pre-lab Lab 8
3/29	11	Lab 9: Use of Heat Sinks and Cooling Fluids	Pre-lab Lab 9
MODULE 4: MASS TRANSFER IN BIOLOGICAL SYSTEMS: DIFFUSION AND KINETICS IN THE MOVEMENT OF PROTEINS			
4/5	12	Lab 10: Diffusion in Dialysis	Pre-lab Lab 10, Module 3 Lab Report
4/12	13	Lab 11: Release of Protein from Degradable Biomaterial	Pre-lab Lab 11
4/19	14	Lab 12: Cross-link to Control Polymer Degradation	Pre-lab Lab 12
4/26	15		Module 4 Lab Report
5/3	16	FINALS WEEK	

Grading Scheme:

Assignment	**Points Per Assignment**	**Total Points**	**% of Total Grade**
Pre-Labs*	30	360	15%
Laboratory Notebooks	30	360	15%
Lab Reports:	240	960	40%
Abstract	*10*		
Introduction	*25*		
Materials and Methods	*20*		
Results	*75*		
Discussion/Analysis	*80*		
Conclusions	*30*		
Conceptual Design Projects	150	600	25%
Peer/Self Evaluations	20	80	5%
Total Possible Points		**2360**	**100%**

* A 20% penalty will be incurred on all course assignments for each day that an assignment is late. Pre labs will **not** be accepted late.

**A total of 40 points over the semester will be allocated to the individual papers turned in as a team leader or operations officer.

Grading Scale: The following grading scale is a guaranteed minimum; however, based upon student performance, final grades may be curved by the instructor.

90-100%	(2400-2160)	A
80-89	(2159-1920)	B
70-79	(1919-1680)	C
60-69	(1679-1440)	D
<60	(1439 or below)	F

*Note: Negative peer evaluations can adversely affect your final grade.

Re-grade Policy: Students have the right to contest any grade throughout the semester. Once an assignment has been graded and returned, students have 1 week to protest a grade; after this time grade disputes will not be accepted. In the event that a student feels an assignment has been inappropriately graded, the student must submit a one page, typed document indicating the source of the problem and an explanation for the re-grade submission. The original assignment must be returned with the protest explanation. Papers submitted for a re-grade will be completely reevaluated (i.e., the entire paper will be re-graded, not only the portion under protest), which means that students risk losing additional points for mistakes missed during the first grading process. Please note that all re-grade requests will be evaluated at the end of the term and will only be considered for those students with a borderline grade (i.e., between an A and B).