TO: The Engineering Faculty
FROM: Department of Biomedical Engineering
RE: Permanent Dual Level Course Number

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

BME 541 Biomedical Fluid Dynamics

A. Course Description

Sem. 2. Class 3, cr. 3. (Offered in alternate years.)

Prerequisites:
Senior or Graduate standing; must have taken at least one undergraduate course in fluid dynamics.

Course description:
Course discusses advanced principles of convective diffusion of fluids pertaining to the body, particularly vascular circulation. Topics include: blood flow in arteries, convective and diffusion boundary layers in internal flows with reactive and/or permeable walls, Brownian motion, blood rheology, transport in blood, mass transport to the arterial wall, and fluid dynamics of vasculature in physiological and pathological conditions.

Reason:
The second time this course was taught was in the Fall of 2002. No courses currently exist at Purdue that specifically addresses Biomedical Fluid Dynamics.

George R. Wodicka
Professor and Head

1. COURSE TITLE: Biomedical Fluid Dynamics

2. COURSE DESCRIPTION:
Offered: fall semester (odd years)

Level: Graduate level
Prerequisites: Graduate standing or permission of the instructor required
Credits: 3

Course discusses advanced principles of convective diffusion of fluids pertaining to the body, particularly vascular circulation. Topics include: blood flow in arteries, convective and diffusion boundary layers in internal flows with reactive and/or permeable walls, Brownian motion, blood rheology, transport in blood, mass transport to the arterial wall, and fluid dynamics of vasculature in physiological and pathological conditions.

3. SYLLABUS:

Topics	No. of Lectures
Introduction to course	1
Biology of the circulatory system	4
Physical properties of the circulatory system	3
Blood flow in arteries	4
Blood rheology, constitutive equation of blood	
Blood flow in veins	3
Elastic instability, steady flow in collapsible tubes	
Blood flow in microcirculation	3
Pressure distribution in microvessels,	
mechanics of flow at low Reynolds numbers	
Mid-term Exam	1
Mechanics of blood cells	4
Erythrocytes, leukocytes, deformability of red blood cells	
Interaction of red cells with vascular walls	4
The Fahraeus – Linqvist effect	
Blood flow in lung	4
Pressure-flow relationship of pulmonary alveolar blood flow	
Examples of vascular research (group discussions)	3
Mass transport to the arterial wall	
Interactions between particles and conduit wall	
Debate	1
Flow signal transduction and vascular cell communication in arteries	
Blood flow in skeletal muscle	4
Resistance to flow in capillaries	
Student Presentations	4
Final Exam	1
Total	44

4. SUGGESTED REFERENCES AND/OR TEXTBOOKS:

1. Batchelor GK: An Introduction to Fluid Dynamics. Cambridge Univ. Press, Cambridge, 1967.
2. Happel J and Brenner H: Low Reynolds Number Hydrodynamics. Martinus Nijhoff Publishers, Boston, 1973.
3. Fung YC: Biomechanics: Circulation. Springer-Verlag, New York, 1984.
4. Fung YC: Biomechanics: Motion, Flow, Stress, and Growth. Springer-Verlag, New York, 1984.
5. Fung YC: Biomechanics: Mechanical Properties of Living Tissues. Springer-Verlag, New York, 1993.
6. Guyton AC and Hall JE: Textbook of Medical Physiology. W.B. Saunders Company, Philadelphia, 1996.

5. PREVIOUS EVALUATIONS

	Fall 2000	Fall 2002
Total Number of Students Enrolled	4	18
Total BME Students Enrolled	2	12
Course Evaluation	4.5/5.0	4.1/5.0