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

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

From:
BME 541 Biomedical Fluid Dynamics Sem. 2. Class 3, cr. 3. (Offered in alternate years.) Prerequisites: Senior or Graduate standing; ME309 or equivalent.

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.

To:
BME 541 Biomedical Fluid Dynamics Sem. 1. Class 3, cr. 3. (Offered in alternate years.) Prerequisites: Senior or Graduate standing; ME309 or equivalent.

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: Biomedical Engineering is beginning to offer undergraduate courses and due to the distribution of the teaching load we request a change of semester for this course offering.

George R. Wodicka
Professor and Head

Biomedical Fluid Dynamics

Instructor: Tom Webster

Offered: fall semester (odd years)

Level: Graduate level

Prerequisites: Senior or Graduate standing; ME 309 or equivalent.

Credits: 3

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 flow	
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		5
	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