To: The Faculty of the College of Engineering

From: The Faculty of the Department of Biomedical Engineering

Subject: New Dual-Level Course

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

BME 553 Biomedical Optics
Sem. 1, Class 3, cr. 3.
Prerequisite: PHYS 241 or equivalent, BIOL 295E or equivalent

Course description: Optical methods applied to address biological and biomedical problems. Course includes two parts: fundamentals of optical microscopy and advanced techniques that are currently used to probe and/or manipulate cell and tissue samples.

Reasons: This course introduces biophotonics, a frontier area of biomedical engineering. A variety of advanced optical methods and their applications to biomedical research are presented. By taking this course, students will learn physical principles and practical methods of optical imaging. Students will also be able to incorporate what they learn in class to their research. This course has been taught twice on an experimental basis with an enrollment of 15 and 16 students.

George Wodicka
Professor and Head

Supporting Documentation:

1. Level: Graduate and Undergraduate

2. Course Instructor: Ji-Xin Cheng

3. Course Outline:

Syllabus

Class 1	Basics of light
Class 2	Light matter interactions
Class 3	Principle of lasers and current laser technology
Class 4	Interactions of cells and tissues with light
Class 5	Principles of optical microscopy
Class 6	Diagnostic detection with optical spectroscopy and imaging
Class 7	Labor Day
Class 8	Confocal microscopy
Class 9	Exam 1
Class 10	Total internal reflection fluorescence microscopy
Class 11	Fluorescence energy transfer and lifetime imaging
Class 12	Literature review
Class 13	Two-photon fluorescence microscopy
Class 14	Nonlinear optics and second harmonic generation imaging
Class 15	Literature review
Class 16	Single molecule fluorescence detection and spectroscopy
Class 17	High-resolution imaging by near field optical microscopy
Class 18	Literature review
Class 19	Exam 2
Class 20	FTIR spectroscopy and imaging
Class 21	Spontaneous Raman microscopy and applications to diagnostic detection
Class 22	Literature review
Class 23	Coherent anti-Stokes Raman scattering microscopy
Class 24	Third harmonic generation microscopy

Class 25	Literature review
Class 26	Light fluctuation correlation spectroscopy
Class 27	Fluorescence recovery after photo bleaching and single particle tracking
Class 27	Literature review
Class 28	Methods for deep tissue imaging
Class 29	Literature review
Class 30	Optical and magnetic tweezers
Class 31	Literature review
Class 32	Light fluctuation correlation spectroscopy
Class 33	Literature review
Class 34	Biomedical imaging with nano materials
Class 35	Teraherz spectroscopy and imaging
Class 36	Optical biosensors
Class 37	Photodynamic therapy
Class 38	Exam 3
Class 39	Course review
Class 40	Student presentation of original proposals (final project)
Class 41	Student presentation of original proposals (final project)
Class 42	Student presentation of original proposals (final project)
Class 43	Student presentation of original proposals (final project)
Class 44	Student presentation of original proposals (final project)
Class 45	Final exam

Note for literature review: For each specific topic, two or three students will present in class a few recently published papers. Each student will submit a short paper that summarizes their comments on the significance, methods and results, strength and weakness of the papers.

Textbook: Introduction to Biophotonics (John Wiley & Sons, Inc. 2003)

Grading:

Three exams	45%
Literature review	15%
Homework	20%
Final project	20%

Documentation of previous teaching
Fall semester of 2003
The total number of registered students is 15, 4 of which are from BME, 8 from Chemistry, 2 from ECE, 1 from ME. The results of the student evaluation are as follows

BME595Z / CHM 599Z	From BME	From Chemistry
Ave. rating for the course	4.6	4.8
Ave. rating for the instructor	4.2	4.8

Fall semester of 2004
The total number of registered students is 16, 6 of which are from BME, 8 from Chemistry, 2 from ME. The results of the student evaluation are as follows

BME595Z / CHM 599Z	From BME	From Chemistry
Ave. rating for the course	3.7	3.8
Ave. rating for the instructor	3.3	3.6