CBEMS 126 BIOMEDICAL PHOTONICS

Catalog Data:	**CBEMS 126 Biomedical Photonics (Credit Units: 3).** Biophysical principles governing the interaction of laser radiation with biological materials, cells, and tissues. Utilization of these principles in several biomedical therapeutic and diagnostic applications is also covered and discussed in detail. Prerequisite: CBEMS120A, CBEMS120B; or consent of instructor. Concurrent with CBEMS226. (Design Units: 0).
Textbook:	None
References:	A.J. Welch and M.J.C. van Gemert, editors, *Optical-Thermal Response of Laser-Irradiated Tissue,* Plenum, 1995.
Coordinator:	Vasan Venugopalan
Course Objectives:	To introduce students to the physics of the interaction of laser radiation with biological systems and to demonstrate show how these interactions are exploited in the development of techniques for the non-invasive manipulation and measurement of biological systems as well as for medical therapeutics and diagnostics.
Course Outcomes:	Students are able to: Understand the electronic and vibrational molecular transitions of bio-molecules that govern optical absorption properties of biological tissues. Understand the material properties that govern the optical cattering within biological tissues. Understand the principles that govern radiative transport in absorbing and scattering tissues. Understand the principles governing laser-induced thermal processes in tissue. Determine the magnitude of thermo-elastic stresses generated by pulsed laser irradiation. Determine if thermal or mechanical confinement is established in a pulsed laser application. Understand the layout of a Jablonski diagram and the radiative and non-radiative processes that it depticts. Have been exposed to the processes that govern residual thermal injury and material removal in laser ablation processes. Have been exposed to the governing principles of optical coherence and multi-photon microscopy techniques. Familiar with the capabilities of highly focused laser beams for cellular microsurgery and micromanipulation.
Prerequisite by Topics:	Fluid Mechanis, Heat and Mass Transfer
Lecture Topics:	Introduction/Overview (1 class) Optical Properties of Biological Tissues (1 class) Radiative Transport within the Turbid Media (3 classes)
Lecture Topics:	Photothermal Phenomena (1.5 classes)

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Photomechanical Phenomena (0.5 classes)
Photochemical Phenomena (1 class)
Non-Linear/Coupled Effects (1 class)
Photon Migration Techniques (2 classes)
Optical Coherence Tomography (1 class)
Two-photon and Confocal Microscopy (1 class)
Laser Ablation and Coagulation of Tissue (1 class)
Photomechanical Disruption (1 class)
Photodynamic Therapy (1 class)
Student Paper Presentations (2 classes)

Class Schedule: Each class meets 4 hours per week for 10 weeks.

Computer Usage: None

Laboratory Projects: None

Professional Component: This course is designed to contribute to the students' knowledge of engineering topics that are related to use of biomedical optics and photonic systems for biomedical diagnostic systems. Basic concepts covered in theis course have application domains ranging from single molecule detection, optical sensors, bioMEMS, biomedical microscopy, coherent optical imaging and diffuse optical/functional imaging. .

Relationship to Program Outcomes:

This course relates to Program Outcomes 4, 10, and 11 as stated at: http://www.eng.uci.edu/dept/objective_chemical

Design Content Description:

Approach: N/A
Lectures: N/A
Laboratory Portion: N/A

Grading Criteria

Term project	35%
Midterm exam	35%
Homework & class participation	30%

Estimated ABET Category Content:

Mathematics and Basic Science: 0 credit units or 0%
Engineering Science: 3 credit units or 100%
Engineering Design: 0 credit unit or 0%

Prepared by: Vasan Venugopalan **Date: June 2005**
Last Modified: Fall 2001