CALIFORNIA STATE UNIVERSITY CHANNEL ISLANDS

NEW COURSE PROPOSAL

PROGRAM AREAS _____BIOLOGICAL AND PHYSICAL SCIENCES, MATH AND COMPUTER SCIENCE

1. **Catalog Description of the Course.** *[Include the course prefix, number, full title, and units. Provide a course narrative including prerequisites and corequisites. If any of the following apply, include in the description: Repeatability (May be repeated to a maximum of ___ units); time distribution (Lecture ___ hours, laboratory ___ hours); non-traditional grading system (Graded CR/NC, ABC/NC). Follow accepted catalog format.]*

PHYS 434. INTRODUCTION TO BIOMEDICAL IMAGING (3)
Two hours of lecture and two hours of lab activity per week, including two field trips per course.
Prerequisite: BIOL 210 or PHYS 200.
The course will present an overview of biomedical images and imaging systems. The fundamental concepts used in several imaging modalities (such as projection radiography, mammography, DEXA, computed tomography, ultrasonography and magnetic resonance imaging) will be examined: the emphasis will be on an intuitive and descriptive presentation of the main components of these systems. Image formation and reconstruction will be addressed. The resulting clinical images will be correlated with the underlying structure and function of the organs, and the diagnostic utility and limitations of the images will be considered.
Same as BIOL 434, HLTH 434.
GenEd: B2, E and Interdisciplinary

BIOL 434. INTRODUCTION TO BIOMEDICAL IMAGING (3)
Two hours of lecture and two hours of lab activity per week, including two field trips per course.
Prerequisite: BIOL 210 or PHYS 200.
The course will present an overview of biomedical images and imaging systems. The fundamental concepts used in several imaging modalities (such as projection radiography, mammography, DEXA, computed tomography, ultrasonography and magnetic resonance imaging) will be examined: the emphasis will be on an intuitive and descriptive presentation of the main components of these systems. Image formation and reconstruction will be addressed. The resulting clinical images will be correlated with the underlying structure and function of the organs, and the diagnostic utility and limitations of the images will be considered.
Same as PHYS 434, HLTH 434
GenEd: B2, E and Interdisciplinary

HLTH 434. INTRODUCTION TO BIOMEDICAL IMAGING (3)
Two hours of lecture and two hours of lab activity per week, including two field trips per course.
Prerequisite: BIOL 210 or PHYS 200.
The course will present an overview of biomedical images and imaging systems. The fundamental concepts used in several imaging modalities (such as projection radiography, mammography, DEXA, computed tomography, ultrasonography and magnetic resonance imaging) will be examined: the emphasis will be on an intuitive and descriptive presentation of the main components of these systems. Image formation and reconstruction will be addressed. The resulting clinical images will be correlated with the underlying structure and function of the organs, and the diagnostic utility and limitations of the images will be considered.
Same as PHYS 434, BIOL 434
GenEd: B2, E and Interdisciplinary

2. **Mode of Instruction.**

	Units	**Hours per Unit**	**Benchmark Enrollment**
Lecture	___2_____	___1_____	__20_____
Seminar	_____	_____	_____
Laboratory	_____	_____	_____
Activity	___1_____	___2_____	__20_____

3. Justification and Learning Objectives for the Course. (Indicate whether required or elective, and whether it meets University Writing, and/or Language requirements) *[Use as much space as necessary]*

The course is an integrative, interdisciplinary course with significant content, ideas and ways of thinking from several disciplines: physics (principles and instrumentation), biology (anatomy and physiology), the health sciences (radiology and diagnosis) and computer science (algorithms). It will present an overview of imaging systems and a critique of the systems and images produced. The course would be available for selection within the Science emphasis in the Teaching and Learning option of the Liberal Studies program, and would be an elective in the Biology, Math and Computer Science majors. It would be particularly suitable for pre-med students.

Through this course, students will be able to

- explain the principles and basic concepts of five clinical imaging modalities
- analyse the images in terms of the structure and function of the organs imaged
- compare the diagnostic utility of images from different modalities
- use image processing software to enhance clinical images
- appreciate the interdisciplinary nature of medical imaging
- critically evaluate scientific and medical literature
- analyse complex issues in diagnostic imaging
- organize and express ideas clearly and convincingly in oral and written forms.

This course is not designed to satisfy the University Writing or Language requirements.

4. Is this a General Education Course **YES** **NO**
If Yes, indicate GE category:

A (English Language, Communication, Critical Thinking)	
B (Mathematics & Sciences)	**X**
C (Fine Arts, Literature, Languages & Cultures)	
D (Social Perspectives)	
E (Human Psychological and Physiological Perspectives)	**X**

5. Course Content in Outline Form. *[Be as brief as possible, but use as much space as necessary]*

Introduction to imaging modalities. Principles and instrumentation used in certain imaging modalities (FIVE to be chosen from: projection radiography, mammography, DEXA for bone density measurement, ultrasonography, digital subtraction angiography, computed tomography, magnetic resonance imaging, nuclear medicine techniques (SPECT and PET)): image formation and reconstruction techniques.
Typical images and their correlation with structure and function of organs within the body, and to disease conditions.
Image critique and enhancement.
Diagnostic utility and limitations. Risk vs. benefit.

There will be 2 projects, in which small teams will (i) investigate the limitations of a particular imaging modality and (ii) either explore the risk vs. benefit of a particular methodology or examine the diagnostic usefulness of applying enhancement techniques to particular images. Reports on the projects will be typed and include figures, graphs, images and references. The second report will be presented orally using PowerPoint.

Field trips (2) to Radiology Departments will demonstrate the use of the various modalities and the relationships within the medical teams that acquire and diagnose the images, and foster a continuing interest in health-care issues.

6. References. *[Provide 3 - 5 references on which this course is based and/or support it.]*

The course presents an overview of biomedical imaging, but minimizes the mathematical treatment used in similar courses within Biomedical Engineering programs (e.g. Case Western Reserve, Southern California, Purdue, Illinois at Urbana-Champaign). It emphasizes the usefulness of the images in determining structure and function, and is similar to material presented to radiographers (e.g. Atlantic State) and those in the biomedical sciences (e.g. Toledo University).

The content of and emphasis within the course has benefited from continuing discussions with Prof. Gary Sayed, Chair of Diagnostic Imaging at Thomas Jefferson University and Dr. Jesse Lee, a local oncologist.

Textbook: Introduction to Biomedical Imaging, A.Webb (John Wiley).

7. List Faculty Qualified to Teach This Course.

Dr. Geoff Dougherty

8. Frequency.

a. Projected semesters to be offered: Fall _____ Spring _X____ Summer _____

9. New Resources Required.

a. Computer (data processing), audio visual, broadcasting needs, other equipment

Use of PC Lab #118 for teaching and activities (4 h per week)
Double-width viewing boxes for viewing radiographs (2)
Dell PC (similar to Office) dedicated to transfer and storage of radiologic images and their analysis

b. Library needs

Books:

"Introduction to Biomedical Imaging", A. Webb (John Wiley, Jan 2003)
"Human Anatomy and Physiology", E.N. Marieb (Benjamin/Cummings, 2000)
"Medical Imaging Physics", W.R. Hendee and E.R. Ritenour (Wiley and Sons, 2002)
"Magnetic Resonance Imaging: Physical and Biological Principles", S. Bushong (Mosby, 1996)
"Principles of Radiologic Imaging", R.R. Carlton and A.M. Adler (Delmar, 2001)
"Principles of Medical Imaging", K.K. Shung et al (Academic Press, 1992)
"Foundations of Medical Imaging", Z.H. Cho et al (Wiley, 1993)
"Digital Image Processing", R.C. Gonzalez and R.E. Woods (Addison-Wesley, 2002)
"Digital Image Processing", B.Jahne (Springer-Verlag,1997)

Journals:
Medical Physics (Journal of AAPM)
Medical Engineering and Physics
Journal of Clinical Imaging

c. Facility/space needs

Transport for two field trips to Radiology Departments.
Storage space for films (within office space already being acquired for Physics)

10. Consultation.

Attach consultation sheet from all program areas, Library, and others (if necessary)

11. If this new course will alter any degree, credential, certificate, or minor in your program, attach a program modification.

__Proposer of Course: Geoff Dougherty Date: 10/16/02