PHYSICS

CURRICULUM

Master of Science in the field of Biomedical Physics

DEGREE REQUIREMENTS		**Credits**
Master's Thesis		(Milestone)
BP8102	Medical Diagnostic Techniques	1
BP8103	Fndamntls of Radiation Physics	1
BP8111	Science Communication !	1
BP8201	Master's Seminar I	Pass/Fail
BP8202	Master's Seminar II	Pass/Fail
Two credits from elective list		2

Doctor of Philosophy in the field of Biomedical Physics

First Offered Fall 2011

DEGREE REQUIREMENTS		
Doctoral Candidacy Examination		(Milestone)
Doctoral Dissertation		(Milestone)
BP9101	Science Communication II	1
BP9201	Doctoral Seminar I	Pass/Fail
BP9202	Doctoral Seminar II	Pass/Fail
BP9203	Doctoral Seminar III	Pass/Fail
BP9204	Doctoral Seminar IV	Pass/Fail
Two credits from elective list		2
Up to two additional credits, if necessary		Up to 2

Elective List		**Credits**
BP8101	Stats for the Health Sciences	1
BP8104	Radiation Therapy	1
BP8105	Comp Methods in Biomed Phys	1
BP8106	Optcl, Acstc and Thrmal Phys	1
BP8107	Rad Protection and Dosimetry	1
BP8108	Special Topics I	1
BP8109	Special Topics II	1
BP8110	Biomedical Ultrasound	1
BP8112	Radiobiology	1
BP8113	Advanced Imaging	1

Note: with permission from Supervisor and Program Director, Master's and PhD students may use one graduate course from a relevant program in place of one elective.

COURSE LISTING

Doctoral Candidacy Examination
The aim of the candidacy exam is to assess the originality and appropriateness of the proposed research, its relevance to the program, and the students' ability to complete the research and the program. The exam consists of a written and oral component. This is a "Milestone." Pass/Fail

Doctoral Dissertation

Students are required to conduct advanced research in the area of Biomedical Physics. A specific research topic must be chosen in consultation with the student's supervisor(s) and with advice from the supervisory committee. The student will conduct the research under the direction of the supervisor(s) with guidance from the supervisory committee. In order to complete the course the student must, upon approval from the supervisory committee, submit a written dissertation to an examination committee, and make an oral presentation and defense of the dissertation to this committee. Through the dissertation, the student must demonstrate an original contribution of new knowledge to the field of research, competence in research and a deep understanding of knowledge in the area of research. This is a "Milestone." Pass/Fail

Master's Thesis
This a laboratory-based research project. Students are required to conduct research, submit their completed research in a thesis format to an examination committee, and make an oral presentation and defence of the research thesis and results to this committee. Through the thesis, students are expected to demonstrate competence in oral and written communicaton, experimental design and scientific thought processes, as well as a sound understanding of the specialty area associated with the research. This is a "Milestone." Pass/Fail

BP8101 Stats for the Health Sciences
This course is designed as a first course in biostatistics with emphasis on relevance in biomedical physics applications. Topics include nonparametric statistics, linear regression, errors and structural analysis of linear relationships between variables, nonlinear estimation, survival analysis and multivariate analysis of data. A statistics computer package will be used. 1 Credit

BP8102 Medical Diagnostic Techniques
This course will cover a wide variety of contemporary topics in medical imaging including x-ray imaging (production, planar x-ray, fluoroscopy, dual x-ray absorptiometry), computed tomography (CT), functional CT, magnetic resonance imaging (temperature mapping, functional MRI), ultrasound, Doppler techniques, positron emission tomography, bone densitometry, trace element detection and nuclear medicine. Antirequisite: PCS405 1 Credit

BP8103 Fndmntls of Radiation Physics
This course is designed for students with an undergraduate background in radiation physics. Topics include the Bohr atomic model, Rutherford scattering, emission of photons, x-ray spectra, Bremsstrahlung and characteristic radiation, homogeneous and heterogeneous photon beams, thin and thick x-ray targets, absorption and scatter of photon beams, beam attenuation, Thomson scattering, Photoelectric effect, Rayleigh scattering, Compton effect, pair production, interaction of neutrons with matter, radiation quantities and units, radiation decay, exposure, kerma, dose, and dose equivalent. 1 Credit

BP8104 Radiation Therapy
This course is an introduction to radiation therapy physics, including topics such as radiation teletherapy units; interaction of radiation with tissue; dosimetry of a single beam of x-ray; beam calibration and patient dose calculation; combination of beams and treatment planning, brachytherapy; radiation detection. Antirequisite: PCS407. Prerequisite: BP8103. 1 Credit

BP8105 Comp Modeling in Biomed Phys
The course will focus on the use of computational modeling techniques for hypothesis driven investigation of problems in biomedical physics. The student will apply and integrate fundamental knowledge of mathematics, physics and life sciences to design and implement appropriate models and to analyse and interpret simulation results. Emphasis will be placed on simulation methods such as Monte Carlo methods, and finite element and finite difference techniques. Corequisite:BP8106. 1 Credit

BP8106 Optcl, Acstc and Thrml Phys
The course will begin with basic optical, acoustic and thermal propagation in biomaterials. This will be followed by the presentation of the principles of photodynamic therapy, optical sensing, ultrasound biomicroscopy, optoacoustics imaging, thermal therapy and thermography. 1 Credit

BP8107 Rad Protection and Dosimetry
The first half of the course reviews microdosimetry; the second half focuses on biological effects of radiation and radiation safety, basic radiation physics, radioactive decay, radiation producing devices, characteristics of the different types of radiation and their interactions with materials. Students will learn essentials of determining absorbed doses from ionizing radiation sources used in clinical situations and for health physics purposes. A survey of sources, applications, risks, and control of environmental radiation will be presented. 1 Credit

BP8108 Special Topics I
This course examines selected topics in areas related to the program that are not covered by existing courses. The topic(s) will vary depending on the needs and interests of the students and the instructor. The course description will be announced prior to scheduling the course. 1 Credit

BP8109 Special Topics II
This course examines selected topics in areas related to the program that are not covered by existing courses. The topic(s) will vary depending on the needs and interests of the students and the instructor. The course description will be announced prior to scheduling the course. 1 Credit

BP8110 Biomedical Ultrasound

This course covers the essential elements in the physics of ultrasound and its current applications in medicine and biology. Topics include: physics of ultrasound, linear and non-linear ultrasound field calculations, scattering of ultrasound, ultrasound transducers, ultrasound imaging systems, Doppler ultrasound, and therapeutic ultrasound. 1 Credit

BP8111 Science Communication I
The course is designed for students who are interested in pursuing an academic career as well as those intending to work outside the academic environment after graduating. Specific course goals are to provide graduate students with insight into, and practice in effective means of science communication. This will be done through various activities that include writing scholarship applications and CVs, and presenting their research activities to a diverse audience (their peers, scientists, engineers, politicians, lay public) through oral, poster and written communications. The course is suitable for students in other scientific or engineering disciplines. 1Credit

BP8112 Radiobiology
Fundamentals of physics and chemistry of radiation interactions, free radicals, oxidation and reduction. Subcellular and cellular effects: killing, repair, sensitization and protection. Measurement methods. Survival curves and their significance. Modification of the radiation response. Tissue effects, genetic and carcinogenic effects, mutations, hazards. Effects of heat on tissue. Thermal dosimetry. Biology of Thermal Potentiation of Radiotherapy. High temperature thermal therapy. Antirequisite: PCS354. 1 Credit

BP8113 Advanced Imaging
Various emerging medical imaging modalities will be discussed with the emphasis on quantitative and functional medical imaging. The imaging modalities covered in the course include functional magnetic resonance imaging, optical imaging techniques such as optical coherence tomography and diffusive optical imaging, functional and molecular imaging with ultrasound, and imaging modalities on the electrical properties of biological tissues. Prerequisite: BP8102 or equivalent. 1 Credit

BP8201 Master's Seminar I
This course consists of weekly seminars with emphasis on current research in the specialization fields and emerging areas of medical physics. This is a two term course (Fall and Winter) in the first year of the program, and is generally one hour per week. Presentations will be given by graduate students, faculty members, visiting scholars and guest speakers. Pass/Fail.

BP8202 Master's Seminar II
This course consists of weekly seminars with emphasis on current research in the specialization fields and emerging areas of medical physics. This is a two term course (Fall and Winter) in the second year of the program, and is generally one hour per week. Presentations will be given by graduate students, faculty members, visiting scholars and guest speakers. Pass/Fail.

BP9101 Science Communication II
The course is designed for students who are interested in pursuing an academic career as well as those intending to work outside the academic environment after graduating. Specific course goals are to provide graduate students with insight into, and practice in effective means of science communication. This will be done through various activities that include writing and reviewing research grant proposals, teaching physics mini-lessons, literature and presentation critiques, manuscript and thesis/dissertation preparation, and oral presentations for a range of audiences (scientists, media, general population, school children) and subjects (including research-related and more general topics). The course is suitable for students in other scientific or engineering disciplines. 1 Credit

BP9201 Doctoral Seminar I
This course consists of weekly seminars with emphasis on current research in the specialization fields and emerging areas of medical physics. This is a two term course (Fall and Winter) in the first year of the Doctoral program, and is generally one hour per week. Presentations will be given by graduate students, faculty members, visiting scholars and guest speakers. Pass/Fail.

BP9202 Doctoral Seminar II
This course consists of weekly seminars with emphasis on current research in the specialization fields and emerging areas of medical physics. This is a two term course (Fall and Winter) in the second year of the Doctoral program, and is generally one hour per week. Presentations will be given by graduate students, faculty members, visiting scholars and guest speakers. Pass/Fail.

BP9203 Doctoral Seminar III
This course consists of weekly seminars with emphasis on current research in the specialization fields and emerging areas of medical physics. This is a two term course (Fall and Winter) in the third year of the Doctoral program, and is generally one hour per week. Presentations will be given by graduate students, faculty members, visiting scholars and guest speakers. Pass/Fail.

BP9204 Doctoral Seminar IV
This course consists of weekly seminars with emphasis on current research in the specialization fields and emerging areas of medical physics. This is a two term course (Fall and Winter) in the fourth year of the Doctoral program, and is generally one hour per week. Presentations will be given by graduate students, faculty members, visiting scholars and guest speakers. Pass/Fail.