

**YEATES SCHOOL OF GRADUATE STUDIES**

***REPORT TO SENATE, MAY 1, 2012***

1. Option in Medical Physics – ***PhD and MSc in Physics*** (for approval)

**Motion:**

“That Senate approve the *Option in Medical Physics* in the *PhD and MSc Physics* program, as approved by YSGS Council at its April 12, 2012 meeting.”

Submitted by:

A handwritten signature in blue ink, appearing to read 'J Mactavish', with a large, sweeping flourish underneath.

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Jennifer Mactavish, Dean  
Chair, Yeates School of Graduate Studies Council

## Proposal:

**Master of Science and Doctor of Philosophy in the field  
of Biomedical Physics**

# Option in Medical Physics

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Version: April 17, 2012

## Executive Summary

Ryerson University is one of the 18 Universities in the province of Ontario (Canada) which are governed by the [1992 University Foundations Act](#). Ryerson offers more than 100 undergraduate and graduate programs and it is home to 28,000 students, including 2,300 master's and PhD students and nearly 2,700 faculty and staff. Located in downtown Toronto, Ryerson University also has Canada's largest continuing education program, with approximately 70,000 enrollments each year.

Biomedical Physics is a branch of applied physics that aims to understand and make use of the complex interactions between the physical and biological systems. Research done in Biomedical Physics shares common themes with three other areas of study: *Biophysics*, which is known as "the branch of knowledge that applies the principles of physics and chemistry and the methods of mathematical analysis and computer modeling to understand how the mechanisms of biological systems work" (source: *Biophysical Society* ([www.biophysics.org](http://www.biophysics.org))); *Medical Physics*, described as "an applied branch of physics concerned with the application of the concepts and methods of physics to the diagnosis and treatment of human disease" (source: *American Association of Physicists in Medicine* ([www.aapm.org](http://www.aapm.org))); and *Health Physics* as "the science and practice of radiation safety: understanding, evaluating and controlling the potential risks of radiation exposure on humans and their environment" (source: *Health Physics Society* ([www.hps.org](http://www.hps.org))).

The Department of Physics at Ryerson University offers an undergraduate B.Sc. degree in Medical Physics, and a M.Sc. and Ph.D. degree in Physics in the field of Biomedical Physics. The existing Master's degree program, in place since 2006, leads to a M.Sc. in Biomedical Physics. This program consists of full-time study including coursework and the preparation of a research thesis, typically completed in two calendar years. A total of 46 students graduated from the M.Sc. program until today. They have either continued in academia (Ph.D. positions at the University of Toronto, McMaster University, McGill University and the University of Western Ontario amongst other institutions), industry or hospitals. Information about their careers can be found either at the alumni section of the Department of Physics website (<http://www.physics.ryerson.ca/people/alumni>), or the Ryerson Physics Alumni [Linkedin](#) group (<http://goo.gl/w00Dy>).

Our Ph.D. program in Physics (in the field of Biomedical Physics) started in 2011. We currently have 26 graduate students enrolled in our programs; 5 in the PhD program and 21 in the MSc program. Detailed information about program admissions and requirements can be found at: [http://ryerson.ca/graduate/programs/biomedical\\_physics](http://ryerson.ca/graduate/programs/biomedical_physics).

There are 10 core graduate faculty members in the department (15 full time faculty members in total), 15 adjunct faculty members (primarily from the surrounding hospitals in the GTA) and 7 staff members. The Department of Physics is located on the second and third floor of the south east corner of Kerr Hall, part of the main quad building at the center of Ryerson University. All faculty members have appropriately furnished individual private offices and each office is equipped with a research-quality computer, connected to the University network. All graduate students have a personal office desk in the graduate student areas and also have a personal computer. Workshop space and research facilities, both for research and teaching requirements are also available to the faculty. All students enrolled in our programs at Ryerson University have access to an excellent array of computer hardware and software resources as well as Ryerson library with holdings appropriate to the size and nature of the graduate programs and the research activities of faculty members and students. These resources are either centralized and administered by University centers or are locally owned and administered by the Department of Physics.

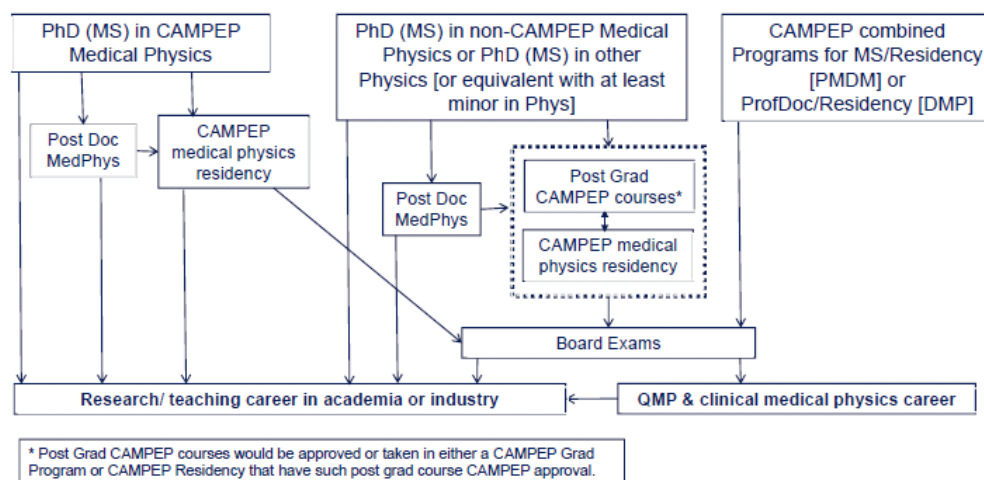
## **Background**

Medical Physics is a branch of physics which involves application of physics concepts to the diagnosis and treatment of disease. Medical physicists who practice in a clinical environment are traditionally employed in one of the four subfields: therapeutic physics; diagnostic physics; medical nuclear physics and medical health physics.

The pathway to becoming a certified clinical medical physicist (figure 1) typically follows three steps: 1) completion of a graduate degree (typically a PhD in Canada) in medical physics or another physics discipline; 2) 2 years of on the job clinical training or completion of a medical physics residency program at a Hospital; and 3) completion of board certification exams. The role of the graduate program is to provide didactic education as well as research training and some basic clinical exposure. The role of the residency program, on the other hand, is to complete the clinical training necessary for the practice of clinical medical physics. It is important to make the distinction between the graduate program, which is offered by a university, and the clinical medical physics residency, which is typically offered by a teaching hospital (usually a cancer center).

Certification permits recognition of individuals having attained a certain standard of knowledge and skill necessary for clinical practice of medical physics. The certification process is regulated by the Canadian College of Physicists in Medicine (CCPM; [www.ccpm.ca](http://www.ccpm.ca)) in Canada and the American Board of Radiology (ABR; [www.theabr.org](http://www.theabr.org)) in the United States of America (USA) and is increasingly become a requirement for employment as a clinical medical physicist. Medical physicists in Canada and the US join their national organizations, the [Canadian Organization of Medical Physics \(COMP\)](http://www.comp.ca) and the [American Association of Physicists in Medicine \(AAPM\)](http://www.aapm.org), which are part of the international organization, [International Organization of Medical Physics \(IOMP\)](http://www.iomp.org).

### **Graduate Training and Career Pathways in Medical Physics**



**Figure 1: Education and training pathways to a career in medical physics [source: AAPM].**

Starting in 2012, the ABR will require applicants for the board certification exam in Medical Physics to either have graduated from an accredited graduate medical physics program or, if their graduate degree is from a non-accredited program, to have additionally completed an accredited residency program. In 2014, application to Part 2 of the board exams will be further restricted by making completion of an accredited

residency program **mandatory**. The CCPM will implement the same requirement effective January 2016. Thus, by 2016, all applicants to the CCPM membership certification exams in Medical Physics will have to pass through an accredited medical physics residency program.

Graduate medical physics programs in USA and Canada may apply for accreditation from the Commission on Accreditation of Medical Physics Education Programs (CAMPEP) ([www.campep.org](http://www.campep.org)). While graduation from an accredited graduate medical physics program is not a requirement for acceptance into an accredited residency program, it is an asset for a candidate applying to a residency program. Since the announcement of ABR and CCPM 2014 and 2016 initiatives, the demand for accredited residency positions has significantly increased. Moreover, personal communications with program directors for residency programs indicates that a strong preference will be given to applicants from an accredited graduate medical physics program. Furthermore, residents who have not completed the required CAMPEP courses will have to complete them during their residency as an additional coursework.

### **Rationale and Opportunity for Ryerson University**

There is currently no CAMPEP accredited medical physics graduate programs in the Greater Toronto Area (GTA) or Hamilton, an area which encompasses six of the largest cancer centers in Canada employing many clinical medical physicists. However, an accredited medical physics residency is offered by the Department of Radiation Oncology of the University of Toronto based out of the Princess Margaret Hospital (PMH) and the Odette Cancer Center at the Sunnybrook Hospital (considered a very strong program internationally). Given its mandate for career-focused University education and the Department of Physics focus in Biomedical Physics, Ryerson University is *uniquely positioned* to fill the demand for a Toronto-based CAMPEP accredited medical physics graduate program. Graduates from this program would be able to complete an accredited residency program at the major Toronto cancer centers: the Princess Margaret Hospital (PMH), Sunnybrook hospital or other Hospitals, and seek employment at one of the many cancer centers in North America.

In Canada the accreditation is obtained through passing a rigorous evaluation of the program curricula and is required for medical physicists obtaining residency or career positions in starting 2016. CAMPEP standards pay special attention to the overall quality of the program (i.e., number and competence of the teaching staff; teaching loads, breadth and depth of instructional offerings; adequacy of facilities and supporting personnel; aptitude of its students; and performance of its graduates).

**Therefore we are proposing addition of an Option in Medical Physics in the Master of Science and Doctor of Philosophy in Physics in the field of Biomedical Physics** currently offered by the Yeates Graduate School at Ryerson. The accreditation of Master of Science and Doctor of Philosophy in the field of Biomedical Physics, Option in Medical Physics, is one of the strategic objectives of the Department of Physics. Furthermore, our efforts have the full support of the Dean of Engineering, Architecture and Science, Dr. M Lachemi (Appendix A). In fact, it was ranked as the highest priority for the faculty.

### **Objectives of the Option in Medical Physics**

The objectives of the Option in Medical Physics are to prepare its graduate students

- (1) for further education, teaching, and research in the area of medical physics,
- (2) to assume appropriate responsibilities in the clinical practice of medical physics
- (3) to enter a medical physics residency program in at least one subspecialty (radiation oncology, diagnostic radiology, or nuclear medicine).

## Curriculum of the Master of Science and Doctor of Philosophy in the field of Biomedical Physics, Option in Medical Physics

The required courses are consistent with the topics required by CAMPEP (specified in Report #197 of the committee of Education and Training of Medical Physicists of the American Association of Physicists in Medicine, [http://www.aapm.org/pubs/reports/RPT\\_197.pdf](http://www.aapm.org/pubs/reports/RPT_197.pdf)). The Master of Science in the field of Biomedical Physics, Option in Medical Physics comprises of 9 required courses, out of which two are Master Seminar courses, and 1 elective course as indicated in Table 1.

Table 1: Degree requirements of Master of Science in the field of Biomedical Physics, Option in Medical Physics

| Master of Science in the field of Biomedical Physics  | Required/<br>Elective | Credits   | Faculty member(s)<br>Responsible for teaching |
|---|-----------------------|-----------|---|
| BP8102: Medical Diagnostic Techniques                 | R                     | 1         | Xu, Toronov or Douplik                        |
| BP8103: Fundamentals of Radiation Physics             | R                     | 1         | Heath or Pejović-Milić                        |
| BP8201: Master's Seminar I                            | R                     | Pass/Fail | Program Director                              |
| BP8202: Master's Seminar II                           | R                     | Pass/Fail | Program Director                              |
| One course from elective list                         | E                     | 1         |   |
|   |                       |           |   |
|   |                       |           |   |
| <b>Option in Medical Physics</b>                      |                       |           |   |
| BP8104: Radiation Therapy                             | R                     | 1         | Heath or adjunct medical physicist            |
| BP8113: Advanced Imaging                              | R                     | 1         | Xu, Toronov or Douplik                        |
| BP8107: Radiation Protection and Dosimetry            | R                     | 1         | Pejović-Milić or Heath                        |
| BP8112: Radiobiology                                  | R                     | 1         | Adjunct medical physicist                     |
| BP8nnn: Anatomy and Physiology for Medical Physicists | R                     | 1         |   |

| Elective List  | Credits | Faculty member(s)<br>Responsible for teaching |
|--|---------|---|
| BP8101: Stats for the Health Sciences  | 1       | Escobar                                       |
| BP8105: Comp Methods in Biomed Phys  | 1       | Kumaradas or Beauchemin                       |
| BP8108: Special Topics I   | 1       | Guest or visiting professor                   |
| BP8109: Special Topics II  | 1       | Guest or visiting professor                   |
| BP8106: Optical, Acoustic and Thermal Physics  | 1       | Kolios, Tavakkoli, Karshafian or Douplik      |
| BP8110: Biomedical Ultrasound  | 1       | Tavakkoli, Kolios or Karshafian               |
| Note: with permission from Supervisor and Program Director, Master's and PhD students may use one graduate course from a relevant program at Ryerson or local Universities in place of one elective. |         |   |

The Doctor of Philosophy in the field of Biomedical Physics, Option in Medical Physics comprises of 11 required courses, out of which four are Doctoral Seminar courses, and 2 elective courses, as indicated in Table 2.

Table 2: Degree requirements of Doctor of Philosophy in the field of Biomedical Physics, Option in Medical Physics

| Doctor of Philosophy in the field of Biomedical Physics | Required/<br>Elective | Credits   | Faculty member(s)<br>Responsible for teaching |
|---|-----------------------|-----------|---|
| BP9201: Doctoral Seminar I                              | R                     | Pass/Fail | Program Director                              |
| BP9202: Doctoral Seminar II                             | R                     | Pass/Fail | Program Director                              |
| BP9203: Doctoral Seminar III                            | R                     | Pass/Fail | Program Director                              |

|   |          |           |                                      |
|---|----------|-----------|--------------------------------------|
| BP9204: Doctoral Seminar IV                           | <b>R</b> | Pass/Fail | Program Director                     |
| BP9101: Science Communication                         | <b>R</b> | 1         | Karshafian, Kolios or Pejović-Milić  |
| One course from elective list                         | <b>E</b> | 1         |                                      |
| One course from elective list                         | <b>E</b> | 1         |                                      |
|   |          |           |                                      |
|   |          |           |                                      |
| <b>Option in Medical Physics</b>                      |          |           |                                      |
| BP8102: Medical Diagnostic Techniques                 | <b>R</b> | 1         | Xu, Toronov or Douplik               |
| BP8103: Fundamentals of Radiation Physics             | <b>R</b> | 1         | Heath or Pejović-Milić               |
| BP8104: Radiation Therapy                             | <b>R</b> | 1         | Heath or adjunct medical physicist   |
| BP8107: Radiation Protection and Dosimetry            | <b>R</b> | 1         | Pejović-Milić or Heath               |
| BP8112: Radiobiology                                  | <b>R</b> | 1         | Adjunct medical physicist or Douplik |
| BP8nnn: Anatomy and Physiology for Medical Physicists | <b>R</b> | 1         | Faculty member, Chemistry & Biology  |

| <b>Elective List</b>  | <b>Credits</b> | <b>Faculty member(s)<br/>Responsible for teaching</b> |
|---|----------------|---|
| BP8101: Stats for the Health Sciences   | 1              | Escobar   |
| BP8105: Comp Methods in Biomed Phys   | 1              | Kumaradas or Beauchemin                               |
| BP8108: Special Topics I  | 1              | Guest or visiting professor                           |
| BP8109: Special Topics II   | 1              | Guest or visiting professor                           |
| BP8106: Optical, Acoustic and Thermal Physics   | 1              | Kolios, Tavakkoli, Karshafian or Douplik              |
| BP8110: Biomedical Ultrasound   | 1              | Tavakkoli, Kolios or Karshafian                       |
| <p>Note: with permission from Supervisor and Program Director, Master's and PhD students may use one graduate course from a relevant program at Ryerson or local Universities in place of one elective.</p> |                |   |

All required and elective courses are already offered to students enrolled in graduate programs in Biomedical Physics at the Ryerson Yeates School of Graduate studies. Only one new graduate course is required, BP8nnn: Anatomy and Physiology for Medical Physicists, and it will be developed and offered by the Department of Chemistry and Biology at Ryerson University.

**Sequence of course offerings of the Master of Science and Doctor of Philosophy in the field of Biomedical Physics with Option in Medical Physics**

Presently in the graduate programs offered by the Department of Physics most courses are offered bi-yearly, thus allowing students access to all courses during their tenure in the graduate programs. The following tables illustrate the proposed sequence of required and elective courses delivery for graduate students enrolled in the Option in Medical Physics entering in even and odd years (Tables 3 to 6).

Table 3: Sample course schedule for Master’s student entering in Fall 2013

| Fall 2013                              | Winter 2014                                | Fall 2014                   | Winter 2015               |
|--|--|-----------------------------|---------------------------|
| BP8201: Master’s Seminar I             |  | BP8202: Master’s Seminar II |                           |
| BP8102: Medical Diagnostic Techniques  | BP8nnn: Anatomy and Physiology             | BP8112: Radiobiology        | BP8104: Radiation Therapy |
| BP8103: Fndamntls of Radiation Physics | BP8107: Radiation Protection and Dosimetry |                             | BP8113: Advanced Imaging  |
|  | (Elective)                                 |                             | (Elective)                |

Table 4: Sample course schedule for PhD student entering in Fall 2013

| Fall 2013                              | Winter 2014                                | Fall 2014                     | Winter 2015               |
|--|--|-------------------------------|---------------------------|
| BP9201: Doctoral Seminar I             |  | BP9202: Doctoral Seminar II   |                           |
| BP8102: Medical Diagnostic Techniques  | BP8nnn: Anatomy and Physiology             | BP8112: Radiobiology          | BP8104: Radiation Therapy |
| BP8103: Fndamntls of Radiation Physics | BP8107: Radiation Protection and Dosimetry | BP9101: Science Communication | BP8113: Advanced Imaging  |
|  | (Elective 1 or 2)                          |                               | (Elective 1 or 2)         |

| Fall 2015                    | Winter 2016       | Fall 2016                 | Winter 2017 |
|------------------------------|-------------------|---------------------------|-------------|
| BP9203: Doctoral Seminar III |                   | BP9204: Doctor Seminar IV |             |
|                              | (Elective 1 or 2) |                           |             |

Table 5: Sample course schedule for Master’s student entering in Fall 2014

| Fall 2014                              | Winter 2015               | Fall 2015                   | Winter 2016                                |
|--|---------------------------|-----------------------------|--|
| BP8201: Master’s Seminar I             |                           | BP8202: Master’s Seminar II |  |
| BP8102: Medical Diagnostic Techniques  | BP8104: Radiation Therapy | BP8112: Radiobiology        | BP8nnn: Anatomy and Physiology             |
| BP8103: Fndamntls of Radiation Physics | BP8113: Advanced Imaging  |                             | BP8107: Radiation Protection and Dosimetry |
|  | (Elective)                |                             | (Elective)                                 |

Table 6: Sample course schedule for PhD student entering in Fall 2014

| Fall 2014                              | Winter 2015               | Fall 2015                   | Winter 2016                                |
|--|---------------------------|-----------------------------|--|
| BP9201: Doctoral Seminar I             |                           | BP9202: Doctoral Seminar II |  |
| BP8102: Medical Diagnostic Techniques  | BP8104: Radiation Therapy | BP8112: Radiobiology        | BP8nnn: Anatomy and Physiology             |
| BP8103: Fndamntls of Radiation Physics | BP8113: Advanced Imaging  |                             | BP8107: Radiation Protection and Dosimetry |
|  | (Elective 1 or 2)         |                             | (Elective 1 or 2)                          |

| Fall 2016                     | Winter 2017       | Fall 2017                   | Winter 2018 |
|-------------------------------|-------------------|-----------------------------|-------------|
| BP9203: Doctoral Seminar III  |                   | BP9204: Doctoral Seminar IV |             |
| BP9101: Science Communication | (Elective 1 or 2) |                             |             |



## **Calendar course descriptions**

### **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: PCS 405. 1 Credit

### **BP8103: Fundamentals 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, interactions 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. Prerequisite: BP8103. 1 Credit

### **BP8105: Computational Methods in Biomedical Physics**

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. 1 Credit

### **BP8106: Optical, Acoustic and Thermal Physics**

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: Radiation Protection and Dosimetry**

The course will focus on health physics, radiation safety and radiation protection (shielding). Students will learn the essentials of determining radiation doses from internal and external ionizing radiation sources. A survey of sources, applications, risks and control of environmental radiation will be presented. The final part of the course will review microdosimetry. 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

**BP8108: 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

**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. Anti-requisite: PCS354. 1 Credit

**BP8113: Advanced Imaging**

This advanced level course will include mathematical methods in imaging science (linear systems and image processing), image reconstruction techniques for CT, cone-beam CT, PET and MRI, and MRI imaging. Image registration, Rose Model, ROC curves, signal-to-noise ratio and DQE will also be discussed. Pre-requisite BP8102 or equivalent. 1 Credit

**BP8nnn: Anatomy and Physiology for Medical Physicists**

An overview of the structure of the main regions of the human body including the thorax, abdomen, bones, brain and central nervous system. Function of respiratory, circulatory, nervous, digestive, urinary and reproductive systems. Anatomical nomenclature and the radiographic appearance of different body regions will be discussed. 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 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

**BP9101: Science Communication**

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 as well as an awareness of ethical issues in research and professional environments. 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 presentation for a range of audiences (scientist, media, lay audience, 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

### **Entrance requirements for the Option in Medical Physics**

Only graduate students enrolled in the Master of Science and Doctor of Philosophy in the field of Biomedical Physics will be considered for enrolment in the Option in Medical Physics. To be consistent with CAMPEP requirements, students entering the Option in Medical Physics must also have a physics or engineering-related background and must have completed a minimum of 3 upper-level physics courses at the undergraduate level. The program director and the admissions committee will assess the background of the applicants at the time of application/transfer to the Option in Medical Physics.

In addition, students wishing to enroll in the Medical Physics Option from the Biomedical Physics graduate programs must do so by the end of their first semester; January starting date is permitted only for PhD students due to the course scheduling.

### **Demand and Availability of Option in Medical Physics**

It is anticipated that the interest in the Option in Medical Physics will be strong due to new requirement imposed by the ABR and CCPM professional societies, as well as the lack of an accredited graduate program in the GTA and Hamilton. Graduate students are required to consult with the Department of Physics Graduate Program Director and their thesis supervisor before commencing courses in the Option in Medical Physics.

All polices and supplemental policies of the existing Master of Science and Doctor of Philosophy in the field of Biomedical Physics will stay in effect for the students selecting the Option in Medical Physics. The Option in Medical Physics is not offered part-time.

### **Implementation of Option in Medical Physics**

The Option in Medical Physics is targeted to begin in Fall 2013 and once the CAMPEP accreditation of the Master of Science and Doctor of Philosophy in the field of Biomedical Physics, Option in Medical Physics is completed. It is important to note that students enrolled in the Master of Science and Doctor of Philosophy in the field of Biomedical Physics will not be graduating from an accredited graduate program, since they will not obtain required knowledge in Medical Physics as specified in Report #197 of the committee of Education and Training of Medical Physicists of the American Association of Physicists in Medicine. Only students enrolled in the Option in Medical Physics will be considered to be graduating from an accredited graduate program.

Implementation of this Option would not require new faculty positions contingent upon the faculty hire, with expertise in Medical Imaging, approved by the Board of Governors in 2010 for the launching of the PhD program in Physics. Resources on space, library, and computers are adequate if these requirements outlined and approved in the PhD brief are followed through. Changes in the current graduate student funding formula are not also foreseen. Furthermore, changes in the enrolment targets (10 Master and 5 Doctoral students) are not anticipated at this time. If interest in the Master of Science and Doctor of Philosophy in the field of Biomedical Physics, Option in Medical Physics dramatically increases, the programs will work with the Yeates School of Graduate Studies at Ryerson University to adjust the enrolment targets to accommodate higher demand.



OFFICE OF THE DEAN  
FACULTY OF ENGINEERING, ARCHITECTURE AND SCIENCE

March 1, 2012

Dr. Chris Evans  
Vice Provost, Academic  
Chair, Academic Standards Council

**Re: Proposed Option in Medical Physics for the Master of Science and Doctor of  
Philosophy in the field of Biomedical Physics**

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Dear Chris,

I am writing to express my support for the development of an option in medical physics for the Master of Science and Doctor of Philosophy degrees in the field of biomedical physics. Having reviewed the proposal, I feel that the document makes a strong case for both the societal need and viability of the option.

The Faculty of Engineering, Architecture and Science recognizes the importance of the dynamic field of medical physics in today's world. Medical physicists help to ensure that medical conditions are properly diagnosed and treated. The proposed option would truly complement our current biomedical physics graduate programs, and is likely to be quite popular amongst our students. Furthermore, I am confident that the impressive level of scholarship of the core faculty in the Department of Physics is more than sufficient to offer the proposed option.

Based on the above, I strongly support the development and implementation of the proposed option in medical physics for the Master of Science and Doctor of Philosophy degrees in the field of biomedical physics.

Sincerely,

A handwritten signature in blue ink, appearing to read "M. Lachemi".

Dr. Mohamed Lachemi, P.Eng., FCAE, FCSCE  
Dean  
Faculty of Engineering, Architecture and Science