PHYSICS 2600 – INTRODUCTION TO MEDICAL PHYSICS
COURSE SYLLABUS

1. **COURSE DESCRIPTION**

Physics 2600 – Introduction to Medical Physics (3 lecture hours, 0.5 course): A practical introduction to key physical principles as applied to medical imaging and radiation therapy. Topics covered will include: imaging metrics, ionizing radiation and radiation safety, radioactivity, radiation therapy, computed tomography, nuclear medicine, ultrasound, and magnetic resonance imaging.

*Pre-requisites:* Physics 1020 or 1024 or 1026 or 1028/1029; (Calculus 1000 or 1100) and (Calculus 1301 or 1501), or Applied Math 1413.

*Anti-requisite:* Medical Biophysics 4475 (Medical Imaging)

*Note:* It is the student's responsibility to ensure that all pre-requisite, co-requisite and anti-requisite conditions are met or that special permission to waive these requirements has been granted by the Faculty. As per the UWO Handbook of Academic and Scholarship Policy, “Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.”

2. **COURSE OBJECTIVES**

- Develop basic understanding of medical physics concepts,
- Develop problem-solving and critical-thinking skills,
- Learn to integrate and apply various physics concepts to real-life medical physics problems,
- Develop scientific communication skills.

3. **LEARNING OBJECTIVES**

By the end of the course, students will be expected to be able to…

- Describe an imaging system and break it down into its components and physical principles, for each of the imaging modalities covered (x-ray, CT, NM, US, MRI);
- Identify the key factors that affect image quality and address these factors for the different imaging modalities;
- Describe and compare the strengths and weaknesses of the different imaging modalities;
- Describe the basic principles and the tradeoffs encountered in radiation therapy;
- Learn to communicate the physical principles behind medical technology, radiation safety, and relevant applications.

4. **COURSE OUTLINE** (Provisional)

1. Medical physics and imaging principles: intensity, resolution, contrast
2. X-ray physics: photon interactions, attenuation
   - X-ray imaging: x-ray production & detection, mammography, computed tomography
3. Nuclear medicine physics: radioactivity, radioisotope production
   - Nuclear medicine imaging: SPECT, PET
4. Radiation exposure physics: radiobiology, dosimetry, kerma
   - Radiation exposure applications: safety, risk, radiation therapy, radiation protection
5. Ultrasound physics: waves, reflection, transmission, attenuation
   - Ultrasound imaging principles: echoes, resolution, speckle, Doppler
6. Nuclear magnetic resonance physics: magnetic moment, magnetization, relaxation
   - Nuclear magnetic resonance spectroscopy (NMRS) and imaging (MRI) principles: chemical shift, magnetic resonance signal induction and relaxation, pulse sequences, spatial encoding.
5. CONTACT DETAILS

Instructor: Dr. Tamie Poepping
Assistant Professor, Department of Physics and Astronomy
Physics and Astronomy Building, Office 133

Office Hours: Thursdays 10:30-11:30, or by appointment (recommended due to renovations)
Website: http://quark.physics.uwo.ca/~poepping
Email: poepping@uwo.ca  Please only email from your UWO email account.

Feedback & Suggestions: If you have a concern related to the course, please come to see me (Prof. Tamie Poepping), the Departmental Chair of Physics & Astronomy (Prof. Shantanu Basu) or the Associate Chair of Undergraduate Studies (Prof. Jeff Hutter). I welcome and encourage your feedback at any time.

6. COURSE DELIVERY & RESOURCES

Lectures: 3 lecture hours per week – Tues 09:30-11:20 and Thurs 09:30-10:20 in PAB137.

Important Dates:
Lectures: Tues Jan 4 – Thurs Apr 7, excl. Reading Week (Feb 21 – 25)
Midterm: Tues Feb 15, 2011, 09:30-11:20 in class
Research Topic due: Fri Mar 4, 2011 by midnight via WebCT
Research Report due: Mon Mar 28, 2011 by noon via WebCT
Tour (voluntary): Robarts Research Institute (Imaging Labs) (tentative)
    Thurs Mar 31, 2011, 09:30-10:20 (class time)
Research Presentations: Tues Mar 29, 2011, 17:30-19:00
    Thurs Mar 31, 2011, 17:30-19:00
    Sat Apr 2, 2011, 14:00-16:00 (if needed)
    (tentative dates & times, locations TBA)
Final: April 2011 (date & time to be determined by UWO Registrar’s Office).

WebCT Owl: Online course Management System (http://webct.uwo.ca). Course material will be posted here along with images and links to useful websites. Syllabus and course material are subject to changes. Check regularly for updates and notices on the WebCT Physics 2600 Home Page by logging in at http://webct.uwo.ca using your UWO username and password.

Please post questions on course content or assignments on the WebCT course forum, rather than emailing me directly, so that everyone can benefit from the response. Please allow 2-3 working days for a response.

Textbook Resources: I recommend selecting one of the following for contextual reading.

  Available online, ~$150.
  On short-loan reserve at UWO Taylor Library (WN110.W848p, 1-DAY loan)

  Available online or used from previous years’ students, ~$150-190.
  On short-loan reserve at UWO Taylor Library (WN110.H495m – two 2002 copies, one 1992 copy; 1-DAY loan).

• The Essential Physics of Medical Imaging, J.T. Bushberg, et al., ISBN 0683301187.
  Available online or used from previous years’ students, ~$150-190.
  On short-loan reserve at UWO Taylor Library (WN200.E78, 2-HOUR loan)
7. COURSE EVALUATION

Assignments – Problem solving 30%  
Research project 15%  
Midterm Examination 25%  
Final Examination 30%  

Assignments are due at the beginning of class on the due date. If you are having difficulty, arrange to see me prior to the assignment due date.  

Examinations will consist of both short-answer concept questions and problem-solving questions. Examinations will be closed book with a formula sheet provided. Calculators may be required. Only non-programmable pocket calculators will be permitted. Personal communication or entertainment devices (e.g. cell phone, MP3 player) are not permitted. Exam times and locations will be confirmed via the course web site when available. Students needing to make travel arrangements are advised to book a travel date after the end of the final exam period. No makeup exams will be given to accommodate travel.

Solutions to the midterm and assignments will be posted to WebCT. Note that solutions include additional and complementary information that may be useful and hence worth looking over even if you got full marks on a question.

Marks will be posted in the grade book on the WebCT site (http://webct.uwo.ca). Any errors, or appeals to your scores, must be reported to your instructor within two weeks of their initial posting.

Research Project:
The two primary purposes for this project are:

1) to allow additional coverage of material of particular interest to you; and
2) to help you develop valuable research and communication skills.

Topic: Following the midterm, you will be asked to form small groups of 2-4 people, depending on class size. Each group will select and research a particular topic relevant to medical physics.

Report: Each group will prepare a four-page report to be submitted via WebCT by the deadline given under Important Dates (prior to the oral presentations). Reports are worth 5% of your final mark and will be evaluated by the instructor.

Presentation: The oral presentations are scheduled near the end of the term (i.e. early April) during a time outside of normal lecture hours. A sign-up area will be made available in early March on WebCT for selecting a suitable timeslot from the available options. The individual presentations will be 10-15 minutes in length, with 5 minutes allowed for questions (i.e. 15-20 min. total length).

Evaluation: There will be individual grades for the presentations. The individual grades (for a total of 10% of your final grade) will be obtained in the following way: 50% by instructor(s), 25% by your other classmates (outside your group), and 25% by you and your group (self-assessment). A detailed description of the evaluation criteria will be posted on WebCT under the research project folder.
8. **ADMINISTRATIVE POLICIES**


1. **Accommodations**: The only acceptable excuses for missing an examination are serious personal illness, immediate-family bereavement, or approved religious conflicts.

Absences & Illness—If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Dean's office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's Office immediately. For further information please see: [http://www.uwo.ca/univsec/handbook/appeals/medical.pdf](http://www.uwo.ca/univsec/handbook/appeals/medical.pdf).

A student requiring academic accommodation due to illness should use the Student Medical Certificate when visiting an off-campus medical facility or request a Record's Release Form (located in the Dean's Office) for visits to Student Health Services. The form can be found here: [https://studentservices.uwo.ca/secure/medical_document.pdf](https://studentservices.uwo.ca/secure/medical_document.pdf)

Religious Holidays—Please see the following link regarding approved religious holidays, [http://www.uwo.ca/equity/docs/mfcalendar.htm](http://www.uwo.ca/equity/docs/mfcalendar.htm)

Accessibility—Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

3. **Make-up Policy for Final Examinations**: In accordance with Senate Policy, a Special Examination will be held within thirty days of the regular final examination for students who are unable to write the regular examination for medical or other documented reasons. Requests for such a Special Examination must be made to the Associate Dean, Faculty of Science. Note that if you fail to write a scheduled Special Examination, permission to write another Special Examination will be granted only with the permission of the Dean in exceptional circumstances and with appropriate supporting documents. In such a case, the date of this Special Examination normally will be the scheduled date for the final exam the next time the course is offered.

4. **Cheating and Plagiarism**: University Policy states that cheating, including plagiarism, is a major scholastic offence. The commission of a scholastic offence is attended by academic penalties that might include expulsion from the program. If you are caught cheating, there will be no second warning.

As per the UWO Handbook of Academic and Scholarship Policy, “Plagiarism: Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing, such as footnotes or citations.” All required papers may be subject to submission for textual similarity review to the commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com ([http://www.turnitin.com](http://www.turnitin.com)).”