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 1028A/B or 1301A/B or 1401A/B or 1501A/B) and (Physics 1029A/B or 1302A/B or 1402A/B or 1502A/B), or the former Physics 1020 or 1024 or 1026; Calculus 1000A/B or 1100A/B or 1500A/B or 1501A/B, or Calculus 1301A/B or 1501A/B, or Applied Mathematics 1413.

Anti-requisite: Medical Biophysics 4475 (Medical Imaging)

Notes: 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 Academic Policies, “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 PAB236
Office Hours: Thursdays 10:30-11:30 or by appointment
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. Martin Zinke-Allemang). 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 PAB117.

Important Dates:
- Lectures: Tues Jan 7 – Tues Apr 8, excl. Reading Week (Feb 17 – 21), 2014
- Midterm: Tues Feb 11, 2014, 09:30-11:20 in class
- Research Topic due: Mon Mar 3, 2014 by midnight via OWL
- Research Report due: Mon Mar 31, 2014 by noon via OWL
- Tour (voluntary): Robarts Research Institute (Imaging Labs) Thurs Mar 27, 09:30-10:20 (class time) (tentative)
- Research Presentations: Tues Apr 1, 2014, 17:30-19:00, PAB100
  Thurs Apr 3, 2014, 17:30-19:00, PAB100
  Sat Apr 5, 2014, 14:00-16:00 (if needed, depending on enrolment)
- Final: April 2014 (date & time to be determined by UWO Registrar’s Office).

Online Western Learning (OWL): Course material will be posted to the online course management system (http://owl.uwo.ca), along with images and links to useful websites. Syllabus and course material are subject to changes. Check regularly for updates and notices on the OWL Physics 2600 Home Page by logging in at http://owl.uwo.ca using your UWO username and password. Please post questions on course content or assignments on the OWL course forum, rather than emailing me directly, so that everyone can benefit from (and contribute to) the responses. Please allow 2-3 working days for a response.

Textbook Resources: I recommend selecting one of the following for contextual reading.
  Available as an e-book from Western Libraries (see sidebar link on OWL site).
  Also available for purchase 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).
  Available online or used from previous years’ students, ~$150-190.
  On short-loan reserve at UWO Taylor Library (WN200.E78, 2-HOUR loan)
  Available for purchase online, ~$150.
  On short-loan reserve at UWO Taylor Library (WN110.W848p, 1-DAY loan).
7. COURSE EVALUATION

Assignments – Problem solving 30% (6-8 distributed throughout term; see schedule on OWL)
Research project 15% (Presentation 10%, report 5%; see further details below)
Midterm Examination 25% (See Important Dates above)
Final Examination 30% (See Important Dates above)

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. You are allowed one late assignment without penalty (max 3 days late); any further late assignments will not be accepted.

Examinations will consist of both short-answer concept questions and problem-solving questions. Examinations will be closed book with a formula sheet provided in advance. 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 OWL. 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 OWL site (http://owl.uwo.ca). Any errors, or appeals to your scores, must be reported to your instructor within two weeks of their initial posting. Please note: a) your final exam mark will only be posted to OWL after the end of the exam period, b) your final course mark must come officially from the Registrar’s Office and will not be posted on OWL, and c) final course marks may need to be adjusted in order to conform to department policy.

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 2-3 people, depending on class size. Each group will select and research a particular topic relevant to medical physics. Sign-up your group and topic using the online Physics 2600 forum (see sidebar menu in OWL).
Report: Each group will prepare a four-page report to be submitted via OWL by the deadline given under Important Dates (prior to the oral presentations). Reports are worth 5% of your final mark (approximately equivalent to one assignment) and will be evaluated by the instructor, but final copies will be posted for everyone’s reading.
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 OWL 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 OWL under the Research Project folder.
8. **ADMINISTRATIVE POLICIES**

Please refer to the UWO Academic Policies [http://www.uwo.ca/univsec/academic_policies/](http://www.uwo.ca/univsec/academic_policies/) for further details on the policies in practice here.

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/pdf/academic_policies/appeals/medical.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/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). Students who are in emotional or mental distress should refer to Mental Health@Western [http://www.uwo.ca/uwocom/mentalhealth/](http://www.uwo.ca/uwocom/mentalhealth/) for a complete list of options about how to obtain help.

**Accommodations for Religious Holidays**—When scheduling unavoidably conflicts with religious holidays which a) require an absence from the University or b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate department chair and, if necessary, the student's Dean.

It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action.

A student who, for either of the situations outlined in paragraph one above (a or b), is unable to write examinations and term tests on a Sabbath or Holy Day in a particular term shall give notice of this fact in writing to his or her Dean as early as possible, but not later than November 15 for mid-year examinations and March 1 for final examinations, i.e., approximately two weeks after the posting of the mid-year and final examination schedule respectively. In the case of mid-term tests, such notification is to be given in writing to the instructor within 48 hours of the announcement of the date of the mid-term test. If a Special Examination is offered as an alternative means to satisfy the academic requirements, the instructor(s) in the case of mid-term tests and the dean in the case of mid-year and Spring final examinations will arrange for special examination(s) to be written at another time. In the case of mid-year and Spring final examinations, the accommodation must occur no later than one month after the end of the examination period involved. It is mandatory that students seeking accommodations under this policy give notification before the deadlines and that the Faculty accommodate these requests.

For purposes of this policy the University has approved a list of dates which are recognized religious holidays which require members of those religions to be absent from the University; this list is updated annually and is available at Departmental, Deans' and Faculty advising offices.

**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.

2. **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.

3. 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 Academic Policies, “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).”