Prerequisites
BME 100 and CHY 102 and CPS 125 and (ELE 202 or EES 512) and MTH 141 and MTH 240 and PCS 125 and PCS 211; Antirequisite: PCS 229

Calendar
Application of physics in medicine. This survey course will address basic concepts of medical imaging, nuclear medicine and radiation isotopes, radiation therapy, gamma spectroscopy and trace element analysis, and biomedical laser applications.
Lect: 3 hrs., Course Weight: 1.00

Compulsory Textbook
Introduction to Biomedical Physics, BME229 Course Pack, Ryerson University, Dr. Jahan Tavakkoli, John Wiley & Sons Canada Custom Services, 2014,
ISBN 9781118786826

Reference Textbooks

Course Organization
3 hours of lecture per week for 13 weeks

Learning Objectives
At the end of the course, the successful student will able to:
1. Understands, interprets, articulates, and applies a basic knowledge of science in the identification, formulation and solution of basic problems (1a: Natural Sciences - Knowledge Base for Engineering)
2. Makes accurate use of technical literature and other information sources, and distinguishes between the information relevant to the problem situation and irrelevant information (3a:...
Information Gathering - Investigation)
3. Demonstrates ability to conduct visual analysis (3c: Data Analysis – Investigation)
4. Identifies appropriate technical literature and other information sources to meet a need, and clearly attributes sources (12a: Information Sourcing and Evaluation - Life-long Learning)
5. Identifies resources and professional associations that address ongoing professional development (12b: Professional Development - Life-long Learning)

Note: Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board. For more information, see: http://www.ryerson.ca/feas/programs/qa/gradattributes.html

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<thead>
<tr>
<th>Course Evaluation</th>
<th>In-class Clicker Questions and Attendance (10% for Questions and 5% for Attendance)</th>
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<td>In-class Paper Quizzes 15%</td>
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<td>Midterm Test 25%</td>
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Clickers

i>clickers are used for in-class questions and taking attendance (http://www.iclicker.com/).
i>clickers are available at the Ryerson bookstore for purchase. **A clicker must be registered to the course before it could be used in the class.** Read and follow the instructions on BlackBoard to register your clicker to the class.

Evaluation Guidelines

- In-class quizzes, midterm test and final exam will contain multiple-choice, short-answer and problem questions.
- Sharing of calculators, pencils, pens or erasers is not permitted during any course examination.
- During evaluations, only non-programmable calculator models allowed. Examples are: Sharp EL-546, Casio FX-991 or similar models.
- PDAs, phones and any electronic devices must be turned off and out of reach during any course evaluation.
- Coats, jackets and bags must be placed out of reach during any course evaluation.
- Ryerson photo ID must be on the desk, at all times, during any course evaluation.
- Talking to another student, glancing over another student’s paper or being caught with non-allowed materials during an evaluation may result in a ZERO mark for that evaluation and a record of academic misconduct filed with the Registrar’s office.

Missed Evaluations

A student who could not attend the midterm test or final exam because of illness must contact the First Year Common Engineering Office (FYCEO) within a period of three days as stated in Ryerson policy 134, http://www.ryerson.ca/content/dam/senate/policies/pol134.pdf. The student must then submit a Ryerson-approved medical form, filled out, signed and stamped by a licensed physician, stating among other things that the student was too ill to attend on the day of the evaluation and giving the expected duration of the illness (blank medical forms can be obtained from the Ryerson Web site http://www.ryerson.ca/senate/forms/medical.pdf).

Besides illness, only very serious reasons, properly documented, can be considered as valid excuses for missing an evaluation. For more information on this, consult the calendar.

If the mid-term test is missed for a valid reason (as described above), a make-up test will be scheduled within a reasonable period in the same semester. The make-up test covers the same
materials as the original assessment but need not be of an identical format. If it is not possible to schedule such a make-up, the weight of the missed test will be transferred to the final exam. Missing the make-up test will result in a ZERO for that component of the evaluation. Students who miss the final exam for a valid reason and who cannot be given a make-up exam prior to the submission of course final grades, will be given a grade of INC (as outlined in the Grading Promotion and Academic Standing Policy) and a make-up exam will be scheduled (not later than the third week of the beginning of the next semester). The make-up exam carries the same weight and measures the same knowledge as the exam missed.

If proper documentation is not received within the time prescribed, the mark for the missed evaluation will be ZERO!

Ryerson’s email policy [http://www.ryerson.ca/content/dam/senate/policies/pol157.pdf](http://www.ryerson.ca/content/dam/senate/policies/pol157.pdf) states that only Ryerson e-mail accounts are to be used for communication with students. All students, including continuing education students, have access to Ryerson email through their [my.ryerson.ca](http://my.ryerson.ca) site, and this is the official way in which they receive communication. All students are required to register for and maintain this account. Emails sent from other accounts may not be answered!

### Topics (approximate hours)

Course Introduction (1 hour)
Biomedical Engineering as a Career (1 hour)
Basics of Nuclear Physics (4 hours)
Atomic Structure and Radioactive Decay (3 hours)
Radiation Interactions with Biological Matter- Radiobiology (4 hours)
Production of X-ryas and X-ray Imaging (4 hours)
An Introduction to Radiation Therapy (4 hours)
Hyperthermia and Thermal Ablation for Cancer Treatment (4 hours)
Nuclear Medicine and Nuclear Imaging (4 hours)
Basic Concepts of Medical Instrumentation and Signals (3 hours)

Guest Lectures:
- Biomedical Diagnostic Ultrasound (1 hour)
- Image Reconstruction in X-ray Computerized Tomography (1 hour)
- MRI Fundamentals and Applications (1 hour)
- Radiotherapy in Cancer Treatment (1 hour)
- Biophotonics and Laser in Medicine (1 hour)
- Trace Element Analysis and its Applications in Biomedical Physics (1 hour)
- Computational Modelling and its Applications in Biomedical Physics (1 hour)

### Ryerson Policies of Interest

- Ryerson Senate Policies - [http://www.ryerson.ca/senate/policies/](http://www.ryerson.ca/senate/policies/)
- Ryerson Academic Integrity - [http://www.ryerson.ca/academicintegrity/](http://www.ryerson.ca/academicintegrity/)
- Policy 46 - Undergraduate Grading, Promotion and Academic Standing
- Policy 60 - [Student Code of Academic Conduct](http://www.ryerson.ca/content/dam/senate/policies/par33.pdf)
- Policy 61 - [Student Code of Non-academic Conduct](http://www.ryerson.ca/content/dam/senate/policies/pol296.pdf)
- Policy 134 - Undergraduate Academic Consideration and Appeals
Policies

Policy 135 - Examination Policy
Policy 150 - Accommodation of Student Religious Observance Obligations
Policy 157 - Student Email Accounts for Official University Communication

b. Obligations – Students need to inform faculty of any situation arising during the semester which may have an adverse effect upon their academic performance; they must request any necessary considerations (e.g. medical or compassionate), or accommodations [e.g. religious observance, disability (should be registered with the Access Center), etc.] according to policies and well in advance. Failure to do so will jeopardize any academic appeals.

c. Medical Certificates – When deadlines, tests and exams are missed due to illness, a medical certificate is required. See the Ryerson policy 134 for more details http://www.ryerson.ca/senate/policies/pol134.pdf. Such documents should be submitted within 3 working days of a missed assignment, test or exam.

d. Religious, Aboriginal or Spiritual Observance – Students should make formal request for these in the first two weeks of the semester.

e. Re-grading and Re-calculation – Must be requested within 10 working days of the return of the graded assignment to the class.

http://www.ryerson.ca/academicintegrity/

In order to create an environment conducive to learning and respectful of others’ rights, phones and pagers must be silenced during lectures, lab sessions and evaluations.

Students should refrain from disrupting the lectures by arriving late and/or leaving the classroom before the lecture is finished. Also, leaving the classroom during lecture time, to answer a phone call, is considered inappropriate class behavior!

Academic Conduct

According to the Ryerson policy 60 (http://www.ryerson.ca/content/dam/senate/policies/pol60.pdf), academic misconduct includes, but not limited to:

- Plagiarism which is the claiming of words, ideas, artistry, drawings or data of another person. This also includes submitting your own work in whole or in part for credit in two or more courses.
- Cheating
- Misrepresentation of personal identity or performance
- Submission of false information
- Contributing to academic misconduct
- Damaging, tampering, or interfering with the scholarly environment
- Unauthorized copying or use of copyrighted materials
- Violations of departmental policies or professional behavior
- Violations of specific departmental or course requirements

Committing academic misconduct will trigger academic penalties, including failing grades, suspension and possibly expulsion from the University. As a Ryerson student, you are responsible for familiarizing yourself with Ryerson conduct policies.

http://www.ryerson.ca/content/dam/senate/policies/pol61.pdf

Among many other infractions, the code specifically refers to the following as a violation: “Disruption of Learning and Teaching - Students shall not behave in disruptive ways that obstruct the learning and teaching environment”.

BME 229 – Course Outline
Non-Academic Conduct

Program Director's Signature: .......................................................... Date: .................................