The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

2016-2017

MEDRADSC 1C03
INTRODUCTION to PHYSICS for MEDICAL RADIATION SCIENCES

Term 1
C01 Mo Th 3:30PM - 4:20PM ITB 137
      Tu 4:30PM - 5:20PM ITB 137
T01 Mo 4:30PM - 5:20PM BSB 115
T02 Th 8:30AM - 9:20AM GS 102
T03 We 8:30AM - 9:20AM ETB 228
T04 Th 8:30AM - 9:20AM GS 101

M. FARQUHARSON GSB-105
E-mail: farquhm@mcmaster.ca
Ext.: 23021

COURSE STATEMENT
Provide understanding of basic physics concepts relevant to medical radiation sciences and prepare students for upper level physics they will encounter in their chosen specialization.

COURSE CONTENT
(The course may not necessarily be taught in this order.)

- Vibrations and Waves
  Motion in a circle, Simple Harmonic Motion (SHM), Transverse and longitudinal waves
  Wavelength and wave number, Wavelength and frequency, Velocity of waves, The wave equation, Principle of superposition, Constructive and destructive interference, Standing waves

- Atomic Structure
  Properties of fundamental particles, Rutherford model, Bohr model, Binding energies and energy levels, Multi electron atoms and energy shells

- Light

- X-ray Interactions

(MRSc 1C03) page 1 of 3
Introduction, Attenuation of an x-ray beam, Linear attenuation coefficient, Mass attenuation coefficient, Half value layer, Thompson scatter, Coherent (Rayleigh) scatter, Incoherent (Compton) scatter, Photoelectric absorption, Effects on imaging, Pair Production

- **Electricity**
  Charge, Electric force and the electric field, Coulombs law, Electric potential, Capacitance
  Ohm’s law, RC circuits

- **Effects of Radiation**
  Dose (terminology and units), Protons and electrons, Charged particle interactions, Charged particle tracks, Linear Energy Transfer (LET), Relative Biological Effectiveness (RBE), Cell survival curves, Effects of Radiation on Tissue, Acute radiation syndrome, Lethal Dose, Local tissue damage, Late effects and risk

- **Fluids**
  Pressure, Buoyancy, Surface tension, Capillary action, Fluid dynamics

- **Imaging with sound**
  Sound waves, Speed of sound Waves, Attenuation of Sound waves, Acoustic impedance, Focussed beam of sound, Pulse echo principle, Linear scan, Sector scan, Combination scan
  Doppler effect, Doppler imaging

9 **Radioactivity**
Properties of the Nucleus, The decay equation, Half life, Activity, Beta(-) decay, Internal conversion, Positron beta(+) decay, Electron capture, Alpha decay, Fission, Gamma camera, Thyroid imaging, SPET, PET, Uses in brachytherapy

10 **An Introduction to Magnetic Resonance Imaging**
Introduction to MRI and its uses, Properties of the proton, Formation of the bulk magnetisation vector in an external magnetic field, Free induction decay and FIS, Relaxation mechanisms T1 and T2 (T2*), Spin echo pulse sequence (TR and TE times), T1 and T2 weighting, Slice select gradient, Frequency encoding gradient, Phase encoding gradient, Image formation

Text
There are numerous books covering physics for life sciences but there is not a perfect one. If you wish to purchase a text then I would recommend, “*Introduction to Biological Physics for the Health and Life Sciences*”. Kirsten Franklin et al. Wiley ISBN 978-0-470-66593-0. The course is based around a lot of the material in this text.

Clickers will be used during this course
EVALUATION:
Mid-term class test 25%
Tutorial participation including problem sets and quizzes 25%
Lecture participation, iClickers 5%
Final exam 45%

ACADEMIC DISHONESTY

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at:

http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicIntegrity.pdf#page=20

The following illustrates only two forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
2. Improper collaboration in group work. Copying or using unauthorized aids in tests and examinations.

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MSAF

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar “Requests for Relief for Missed Academic Term Work”.

https://www.science.mcmaster.ca/associatedean/images/Procedure_1 - MSAF for website - Effective_Sep_2015.pdf

If you have any questions about the MSAF, please contact your Associate Dean’s office.