McGILL UNIVERSITY

Radiation Physics: MDPH 601

FALL SEMESTER 2021

Tentative Schedule Version Dated: July 29, 2021

PLEASE EXPECT UPDATES and ADJUSTMENTS

Lecturers: Peter Watson, Ph.D., MCCPM
Cedars Cancer Centre, DS1-9327
McGill University Health Centre – Glen Campus
Email: peter.watson@mcgill.ca

Yannick Poirier, Ph.D., FCCPM
Cedars Cancer Centre, DS1-9335
McGill University Health Centre – Glen Campus
Email: yannick.poirier@mcgill.ca

Time: **11 am - 12:30 pm Eastern time Mondays and Wednesdays**

Place: ***Tentative*** Teaching in the Fall of 2021 will be **in-person** in room DS1.5034 (Glen Campus, Cedars Cancer Centre)

Textbooks: P. Andreo, D.T. Burns, A.E. Nahum, J. Seuntjens, F.H. Attix, ***Fundamentals of Ionizing Radiation Dosimetry*** (Wiley)

E.B. Podgorsak, ***Radiation Physics for Medical Physicists***, Springer, 2nd edition or 3rd edition

Teaching Ass. **Mr. David Santiago Ayala Alvarez, M.Sc.;** david.ayalaalvarez@mail.mcgill.ca

Office hours: Reachable by email and meeting can be arranged

Exams: **Midterm** (written): November 1, 2021
Final (written): During week of Dec 13 (Oral tentative**:** Early in week of Dec 20)

***Tentatively* Classes will be in-person for the Fall of 2021**
Plan to be available for ORAL examination until Dec 21, 2021

Note: To qualify for the final oral exam, the student must achieve at least 70 points for written work based on homework assignments (max. 15 points), quizzes (5 points), midterm exam (max. 30 points), and final written exam (max. 50 points).

Final grade:	***Weighted average between written work and oral exam grade.***

Date	Topic	Contents	Instructor
Sept 1	What is medical physics and role of radiation physics?	Overview of medical physics, education, certification, profession	Y. Poirier
Sept 6	Background and Essentials (I)	Overview of rules, dates, concepts and quantities in medical physics	P. Watson
Sept 8	Background and Essentials (II)	Overview of modern physics and some uncertainty concepts	P. Watson
Sept 13	Charged particle physics (I)	Rutherford scattering	P. Watson
Sept 15	Charged particle physics (II)	Screening effects and finite size effects	P. Watson
Sept 20	Assignment 1 due		
Sept 20	Charged particle physics (III)	Multiple scattering, scattering power, properties	P. Watson
Sept 22	Atom structure and models (I)	Bohr model, COM correction	P. Watson
Sept 27	Atom structure and models (II)	Multielectron atoms and experimental validation of atom models	P. Watson
Sept 29	Radiation production (I)	Atomic relaxation. Fluorescence yield. Auger effect.	P. Watson
Oct 4	Assignment 2 due		
Oct 4	Radiation production (II)	Accelerated charges, bremsstrahlung, synchrotron radiation	P. Watson
Oct 6	Exponential attenuation	Attenuation and energy absorption	Y. Poirier
Oct 11	Photon interactions (I)	Thomson, Rayleigh scattering	Y. Poirier
Oct 15 (Fri)	Photon interactions (II)	Compton, kinematics properties	Y. Poirier
Oct 18	Assignment 3 due		
Oct 18	Photon interactions (III)	Klein Nishina cross section properties, binding and impulse approximation, energy transfer	Y. Poirier
Oct 20	Photon interactions (IV)	Photoelectric effect, energy transfer	Y. Poirier
Oct 25	Photon interactions (V)	Pair and triplet, photo nuclear reactions	Y. Poirier
Oct 27	Attenuation and energy absorption – revisited *Review for midterm*	Tying together the photon interactions with the concept of energy transfer	Y. Poirier
Nov 1	**Midterm**		
Nov 3	Introduction to Monte Carlo	General principles of MC, sampling, photon transport, electron transport	P. Watson
Nov 8	Assignment 4 due		

Nov 8	Stopping power for heavy charged particles	Derivation of electronic stopping power for heavy charged particles, soft and hard collisions, shell corrections, density effect corrections.	P. Watson
Nov 10	Stopping power for electrons and positrons, restricted stopping power	Properties of stopping power for electrons and positrons	P. Watson
Nov 15	Radiation dosimetry concepts (I)	Energy transferred, net energy transferred, kerma, electronic kerma, relation to energy-transfer coefficients, exposure, CPE	Y. Poirier
Nov 17	Radiation dosimetry concepts (II)	Free-air chamber, CPE, energy imparted, CEMA, absorbed dose	Y. Poirier
Nov 22	Assignment 5 due		
Nov 22	Cavity theory (I)	Equilibrium fluence, Fano theorem, Bragg Gray cavity theory.	Y. Poirier
Nov 24	Cavity theory (II)	Spencer Attix cavity theory, large cavities, small cavities, Burlin cavity theory.	Y. Poirier
Nov 29	Radiation detector theory focused on ionization chambers	Ionization chamber functioning. N_gas concept. Deriving K_air from signal to cavity chamber. Cavity ionization chamber-based air kerma standard. Calibration chain.	Y. Poirier
Dec 1	Radiation Standards for absorbed dose	Radiation chemistry in water. Fricke dosimetry. Water calorimeters. Graphite calorimeters.	P. Watson
Dec 6	Assignment 6 due		
Dec 6	*Review of course material*		P. Watson Y. Poirier
TBD	Final written		
TBD	Oral exams		

Please note:

- This is the planned schedule and is subject to change with clear notice. If there is a modification an updated schedule will be posted and clearly communicated.
- Light blue are provisional assignment deadline dates. Upload assignment documents to MyCourses by the stated deadline.
- Pink dates are midterm and final exam dates.
- Regular quizzes are to be expected on myCourses and will be announced in advance. The frequency of these is about one every 3 classes.
- The material for the final exam comprises material taught during the entire semester.
- We follow the Academic Integrity Policy (Plagiarism and Cheating) posted at: https://www.mcgill.ca/students/srr/academicrights/integrity