McGILL UNIVERSITY

Radiation Physics: MDPH 601

FALL SEMESTER 2020

Tentative Schedule Version Dated: June 8, 2020

Lecturer: J. Seuntjens, Ph.D.
Cedars Cancer Centre, DS1-7133
McGill University Health Centre – Glen Campus
Email: jan.seuntjens@mcgill.ca

Time: **TBD**

Place: Meeting Room DS1.5034 (Medical Physics Meeting Room - TBD)
Zoom link to be confirmed

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,*** Second edition, Springer, 2nd edition or 3rd edition

TAs: **Mr. Julien Bancheri, Mr. Chris Lund (Ph.D. graduate students)**

Office hours: Always reachable by email (jan.seuntjens@mcgill.ca) and meeting can be arranged

Exams: **Midterm** (written): **TBD**
Final (written): **TBD** (Oral tentative**:** TBD)

IF ATTENDING CLASSES PHYSICALLY, DO NOT PLAN TRAVEL FOR THE HOLIDAY SEASON BEFORE DEC 20, 2020 !!

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
September 7	What is medical physics and role of radiation physics?	Overview of medical physics, education, certification, profession
September 9	Background and Essentials (I)	Overview of rules, dates, concepts and quantities in medical physics
September 14	Background and Essentials (II)	Overview of modern physics and some uncertainty concepts
September 16	Charged particle physics (I)	Rutherford scattering derivation
September 21	Charged particle physics (II)	Screening effects and finite size effects
September 23	Charged particle physics (III)	Multiple scattering, scattering power, properties
September 25	Atom structure and models (I)	Bohr model, COM correction
September 26	Assignment 1 submission deadline	Content: up to scattering power
September 28	Atom structure and models (II)	Multielectron atoms and experimental validation of atom models
October 30	Radiation production (I)	Atomic relaxation. Fluorescence yield. Auger effect.
October 5	Radiation production (II)	Accelerated charges, bremsstrahlung, synchrotron radiation
October 7	Exponential attenuation	Attenuation and energy absorption
October 12	Photon interactions (I)	Thomson, Rayleigh scattering
October 14	Photon interactions (II)	Compton, kinematics properties
October 19	Photon interactions (III)	Klein Nishina cross section properties, binding and impulse approximation, energy transfer
October 21	Photon interactions (IV)	Photoelectric effect, energy transfer
October 23	Assignment 2 submission deadline	Content: up to Compton effect and energy transfer
October 26	Photon interactions (V)	Pair and triplet, photo nuclear reactions
October 28	Attenuation and energy absorption – revisited *Review for midterm (could be organized separately)*	Tying together the photon interactions with the concept of energy transfer
October 31	**Midterm**	
November 2	Introduction to Monte Carlo	General principles of MC, sampling, photon transport, electron transport
November 4	Stopping power for heavy charged particles	Derivation of electronic stopping power for heavy charged particles, soft and hard collisions, shell corrections, density effect corrections.
November 9	Stopping power for electrons and positrons, restricted stopping power	Properties of stopping power for electrons and positrons
November 11	Radiation dosimetry concepts (I)	Energy transferred, net energy transferred, kerma, electronic kerma, relation to energy-transfer coefficients, exposure, CPE
November 13	Assignment 3 submission deadline	Content up to Radiation dosimetry concepts (I)
November 16	Radiation dosimetry concepts (II)	Free-air chamber, CPE, energy imparted, CEMA, absorbed dose
November 18	Cavity theory (I)	Equilibrium fluence, Fano theorem, Bragg Gray cavity theory.
November 23	Cavity theory (II)	Spencer Attix cavity theory, large cavities, small cavities, Burlin cavity theory.

November 25	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.
December 30	Radiation Standards for absorbed dose	Radiation chemistry in water. Fricke dosimetry. Water calorimeters. Graphite calorimeters.
December 2	*Review of course material*	
December 4	Assignment 4 submission deadline	Content up to Radiation Chemistry and primary standards
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.
- Yellow dates are planned travel dates of professor and arrangements are made to either teach the class on an alternative date, have a pre-recorded class or have the class taught by TA or colleague.
- Light blue are assignment deadline dates. Upload assignment documents to my courses by the stated deadline.
- Pink dates are midterm and final exam dates.
- Regular quizzes are also organized and are announced in advance.
- 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