McGill University
Medical Physics Unit
Radiotherapy Physics: MDPH 602 (3 credits)
Winter 2019

Lecturers:

Part 1: Jan Seuntjens, Ph.D.
McGill University Health Centre (Glen site), DS1.7133, (514) 934-1934 x44124

Part 2: Piotr Pater, Ph.D. and Monica Serban, M.Sc.
McGill University Health Centre (Glen site), DS1.5116, (514) 934-1934 x45303

Teaching assistant:

TBD
McGill University Health Centre (Glen site), DS1.xxxx, (514) 934-1934 xTBD

Time:

Monday/Wednesday 09:00-10:30

Place:

McGill University Health Centre (Glen site), DS1.7001

Office hours:

Monday 15:00-16:00, McGill University Health Centre (Glen site), DS1.7133/DS1.5116

Textbook:

E. B. Podgorsak (editor), *Radiation Oncology Physics: A Handbook for Teachers and Students* (16 chapters, 696 pages), International Atomic Energy Agency; Vienna, Austria, 2005, STI/PUB/1196 (ISBN 92-0-107304-6). Also available online at:
http://www-naweb.iaea.org/nahu/DMRP/syllabus.html

Also available online in a set of 2600 slides prepared by E. B. Podgorsak and G. Hartmann at:
http://www-naweb.iaea.org/nahu/DMRP/slides.html

P Andreo et al *Fundamentals of Ionizing Radiation Dosimetry*, Wiley, New York, 2017

Reference books:

Faiz M. Khan, *The Physics of Radiation Therapy*, Lippincott Williams & Wilkins, Baltimore, Maryland.

William R. Hendee, Geoffrey S. Ibbott, and Eric G. Hendee, *Radiation Therapy Physics*, John Wiley & Sons, Inc., Hoboken, New Jersey.

Examinations:

Quizzes every 1–3 weeks

Midterm written examination after 7 weeks of lectures

Final examination (written and oral) after 13 weeks of lectures

Grading:

Assignments: 20%
Quizzes: 10%

Midterm examination: 25%
Final examination (written): 25%
Final examination (oral): 20%

Minimum requirement to qualify for the oral examination is 65% or more for written work.

"In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change."

"McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see www.mcgill.ca/students/srr/honest/ for more information)."

"In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded."

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Lecture #	Date	Topic
1	Mon Jan 7	Measurement dosimetry 1: Cavity theory, small and large cavities, radiation standards for absorbed dose, calibration chain
2	Wed Jan 9	Measurement dosimetry 2: Basic principle of most commonly used detectors. Ionization chambers: functioning, properties & recombination
3	Mon Jan 14	Basic concepts of radiotherapy physics and dosimetry; percent depth dose curves; brief overview of therapy devices; SSD vs. SAD setup; beam quality; basic properties of detectors used in RT
4	Wed Jan 16	Measurement dosimetry 3: Absorbed dose to water based dosimetry, TG-51 and Addendum
5	Mon Jan 21	Measurement dosimetry 4: Small and nonstandard field dosimetry
6	Wed Jan 23	Measurement dosimetry 5: Air-kerma based dosimetry and AAPM TG-61, kilovoltage radiotherapy, historical applications; current clinical applications
7	Mon Jan 28	Radiation therapy equipment 1: Therapy devices; Co-60, X-ray, linear accelerator components
8	Wed Jan 30	Radiation therapy equipment 2: Linear accelerator components; other medical accelerators; beam quality revisited
9	Mon. Feb. 4	Dosimetric functions 1: Equivalent field size; inverse-square law; collimator factor; scatter factor; relative dose factor; peak scatter factor
9	Wed. Feb. 6	Dosimetric functions 2: Output at reference conditions; tissue-air ratio; scatter-air ratio; relationship between PDD and TAR; Mayneord factor;
10	Mon. Feb. 11	Dosimetric functions 3: Tissue-phantom ratio; tissue-maximum ratio; relationship between PDD and TPR
11	Wed. Feb 13	Dosimetric functions 4: Calculation of dose to water under changing conditions (field size, SSD, depth) using PDD and TPR methods;
12	Mon Feb 18	Dosimetric functions 5: Monitor Unit calculations for SSD and SAD setups
13	Wed Feb 20	Fundamentals of Monte Carlo transport calculations
14	Mon. Feb. 24	Treatment planning 1: Off-axis ratios; beam profiles; flatness and symmetry; isodose lines; dose distributions for single and multiple fields, Missing tissue compensation; wedges; bolus; compensators
15	Wed. Feb. 26	Treatment planning 2: Dose-volume histograms; beam weighting; dose normalization; radiotherapy prescriptions
	Thurs Feb. 28	**Midterm examination**

	Mar 4 – 8	**McGill Study break**
16	Mon. Mar 11	Electron therapy 1: PDD; beam quality; practical range; low vs. high energies
17	Wed. Mar 13	Electron therapy 2: Effect of obliquity; electron cutouts; shielding; bolus; electron prescriptions; virtual source; field matching; electron arc therapy; total skin electron irradiation
18	Mon. Mar. 18	Brachytherapy 1: Definitions; typical sources; calibration of brachytherapy sources, brachytherapy dose calculations (TG-43)
19	Wed. Mar. 20	Brachytherapy 2: Clinical applications
	Mon. Mar 25	Treatment planning 3: CT simulation; digitally-reconstructed radiographs, Image guidance and verification in radiotherapy; image registration; adaptive radiotherapy
20	Wed. Mar. 27	Dose-calculation algorithms 1: Heterogeneity corrections; Clarkson integration
21	Mon. Apr. 1	Dose-calculation algorithms 2: Model based algorithms for external beam dose calculations
22	Wed. Apr. 3	Dose-calculation algorithms 3: Monte Carlo applications in fundamental dosimetry, external beam dose calculations, and brachytherapy dose calculations
23	Mon. Apr. 8	Forward vs. inverse planning; optimization; intensity-modulated radiation therapy
25	Wed. Apr. 10	Special techniques in RT, TBI, TSEI, protons, IMRT, IGRT, VMAT, CSI, SRS, SBRT
	Mon Apr **22**	**Final examination (written)**
	Week of Apr 22	**Final examination (oral)**