

Course Outline: 5208 Radiation Protection

Winter Term 2024:

Monday 8 Jan 2024 – Classes begin.

Monday 19 to Friday 23 Feb 2024 – Carleton winter break, no classes this week.

Wednesday 10 Apr 2024 – Last day of winter term.

Location and Time:

Mondays and Wednesdays 17:35 – 18:55

For any portion of the course that is offered virtually, the instructor will send information with the class links directly to the students.

Instructor:

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Textbook(s):

(recommended only)

Introduction to Health Physics, 5th edition, Thomas E Johnson.
McGraw Hill, ISBN 978-0071835275

(other recommended)

The Essential Physics of Medical Imaging, 3rd edition, Bushberg, Seibert, Leidholdt Jr., and Boone. Lippincott, Williams & Wilkins, ISBN 978-0-7817-8057-5

Radiation Detection and Measurement, 3rd edition, Glenn F. Knoll. ISBN 0-471-07338-5

In lecture recommendations may be provided as needed. Such as; Nuclear Safety and Control Act (S. C. 1997, c.9) <https://laws-lois.justice.gc.ca/eng/acts/N-28.3/index.html>

Lecture Weeks (2024):

1. 8 and 10 January
2. 15 and 17 January
3. 22 and 24 January
4. 29 and 31 January
5. 5 and 7 February – **Field visit, mobile response unit**
6. 12 and 14 February – **Midterm week, decide on Project**

7. 19 February – **Winter Break**
8. 26 February and 28 February
9. 4 and 6 March
10. 11 and 13 March
11. 18 and 20 March – **Project Presentation week**

12. 25 and 27 March
 13. 1 and 3 April
 14. 8 and 10 April
- ≥13 April – Final Examination (TBD)

Marking scheme:

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|----------------------------------|-----|
| Class discussions / preparation: | 5% |
| Project and Presentation: | 15% |
| Assignments (5): | 25% |
| Mid-Term exam: | 25% |
| Final exam: | 30% |

Topics: (order and exact content of lectures may be subject to change)

Week 1: Basis for radiation protection. Overview of organizations. Whole body acute exposures, LD50, radiation death syndromes. ICRP103, risk-based approach, dose quantities, dose limits.

Week 2: **Project options/suggestions handed out.** Background radiation, radon. Biological mechanisms and risk of cancer induction by radiation. Secondary cancers from radiation exposure. Radiation risks to fetus.

Week 3: Shielding in radiation therapy, bunker design, safety systems in radiation therapy

Week 4: Isotope identification. Contamination monitoring. Environmental monitoring. Gamma and beta spectroscopy. Counting statistics.

Week 5: **Field visit exercise and demo.** Overview of radiation detectors for radiation safety. Survey meters, proper survey techniques. Survey meter calibration.

Week 6: **(i) Midterm exam week (ii) Project decisions finalised.** CNSC licensing structure, philosophies. Comprehensive quality management. Provincial X-Ray regulatory structure. Overview of CNSC licence application process. Security of radioactive materials. Risk analysis. Incidents and accidents in radiation therapy part I.

Week 7: **Winter Break** – No classes this week. Relax and recharge.

Week 8: Incidents and accidents in radiation protection.

Week 9: NEW designation, personnel monitoring, dose records. Permit systems. ALARA in the real world. Action levels, investigation levels. Pregnant NEWs.

Week 10: Nuclear substances in medicine. Cobalt teletherapy. HDR brachytherapy. Working with radioactive materials. Brachytherapy sources, leak testing. Waste handling.

Week 11: **Student presentations**

Week 12: Shielding for X-ray facilities. Dose from CT. Diagnostic imaging and interventional procedures.

Possible demo – TBD (safety systems, other related field visit)

Week 13: Class I nuclear facilities, industrial radiation protection, military applications of radiation protection.

Week 14: Radioactive patients, out-patient I-131. Dose from CT. Nuclear medicine departments. Dosimetry of internal emitters, MIRD

Project and Presentation:

Each student will complete a written report (roughly 6-8 pages, ~1800 words) and make a class presentation (15 min) on a topic related to radiation protection. The report should include any relevant figures and/or graphics required to fully convey issue. The details of the project and a list of suggested topics will be provided to the students during second week of course. The topic should be discussed with the instructor prior to beginning work on the project. The presentations will be scheduled during the 11th week of lectures and the report will be due at that time.

Midterm and Final exams:

A midterm exam will be scheduled in-class during week 6. The midterm will be approximately 1.5 hours in duration and will cover material from weeks 1 through 5.

A final exam will be scheduled during the exam period in April and will cover material from the entire term. The final exam will be 3 hours in duration.

Inadequate Term Work:

In order to write the final exam, students must complete the Project, Presentation, and at least two assignments **or** the mid-term exam. Failure to complete these minimum required work components will result in the grade of “Fail – No Deferral (FND)”.

Academic Accommodation Policy

For more information about academic accommodation policies please visit the Equity Services website: www.carleton.ca/equity/accommodation. If you require academic accommodation you must contact the instructor during the first two weeks of classes or as soon as possible after the need for accommodation is known.

Academic Integrity Policy

Students should read and follow the Carleton University Academic Integrity Policy (<https://carleton.ca/secretariat/wp-content/uploads/Academic-Integrity-Policy-2021.pdf>).

This policy is binding on all students and is strictly enforced. Students who violate the standards described in this policy may be subject to one of the following penalties: assignment of a Failure grade (F) for the course; academic probation; or suspension from all studies at Carleton and notation in your transcript of suspension for academic misconduct. Academic dishonesty in any form, including cheating on exams and copying assignment answers, will not be tolerated.

Policy Regarding Course Material

Assignments and exams created for this course remain the intellectual property of the instructor (and previous instructors). They are intended for personal use and may not be reproduced or redistributed without prior written consent of the instructor.