



UNIVERSITY OF CALGARY
FACULTY OF SCIENCE
DEPARTMENT OF PHYSICS AND ASTRONOMY
COURSE OUTLINE

1. **Course:** MDPH 623 **Term:** Fall 2018

Instructor (Lead): Dr. Tyler Meyer | 403-521-3839 | email: Tyler.Meyer@ahs.ca | Office Hours: By appointment

Instructor: Dr. Philip McGeachy | 403-521-3790 | email: Philip.McGeachy@ahs.ca | Office Hours: By appointment

Lecture Sections: L01 | T, W: 15:00 - 16:30 | Medical Physics Multi-purpose room

Course Website: d2l.ucalgary.ca

Departmental Office: SB 605, 403-220-5385, phasugrd@ucalgary.ca

2. **Prerequisites:** None.

3. **Grading:** The University policy on grading and related matters is described in sections [F.1](#) and [F.2](#) of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Assignments	30%
Class participation	5%
Midterm Exam	30% (date TBD)
Final Examination	35% (To be scheduled by registrar)

Percentage to letter grade conversion scale:

> = 93 %	A +	> = 75 %	B +	> = 60 %	C +	> = 45 %	D +
> = 86 %	A	> = 70 %	B	> = 55 %	C	> = 40 %	D
> = 80 %	A -	> = 65 %	B -	> = 50 %	C -	< 40 %	F

Assignments are due on time as announced. Late assignments will be considered only in well-documented emergencies (e.g. a doctor's note should be provided in case of illness).

4. **Missed Components of Term Work:** The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in [Section 3.6](#). It is the student's responsibility to familiarize himself/herself with these regulations. See also [Section E.6](#) of the University Calendar

5. **Scheduled out-of-class activities:** There are no scheduled activities outside of class time.

6. Course Materials:

Main Reference:

F. Attix "Fundamentals of Ionizing Radiation Dosimetry" Page numbers in the course outline refer to the 2017 print by Wiley-VCH Publishers.

Other References:

J. E. Turner, Atoms, Radiation, and Radiation Protection, 3rd Ed., 2003, Wiley-VCH Publishers

H. E. Johns and J. R. Cunningham, "The Physics of Radiology," 1983, 4th edition.

F. M. Khan, "The Physics of Radiation Therapy," 2003, 3rd edition.

P. Metcalfe, T. Kron, P. Hoban, "The Physics of Radiotherapy X-Rays from Linear Accelerators," 1998.

AAPM. Task Group 21. Medical Physics, 10 (6), 1983.

Almond PR, Biggs PJ, Coursey BM, Hanson WF, Huq MS, Nath R, Rogers DW. AAPM's TG-51 protocol for clinical reference dosimetry of high-energy photon and electron beams. Med Phys. 1999 Sep;26(9):1847-70.

7. **Examination Policy:** Exams will be closed book. No aids allowed. Students should also read the Calendar, [Section G](#), on Examinations.

8. **Course fees:** none

9. **Writing across the curriculum:** In this course, the quality of the student's writing in laboratory reports will be a factor in the evaluation of those reports. See also [Section E.2](#) of the University Calendar.

10. **Human studies statement:** Students in this course are not expected to participate as subjects or researchers. See also [Section E.5](#) of the University Calendar.

11. OTHER IMPORTANT INFORMATION FOR STUDENTS:

(a) **Academic Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under [Section K](#). Student Misconduct to inform yourself of definitions, processes and penalties.

(b) **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).

(c) **Student Accommodations:** Students needing an Accommodation because of a Disability or medical condition should contact Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities available at http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities_0.pdf. Students needing an Accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, preferably in writing, to the Associate Head of the Department of Physics and Astronomy, Dr. Ann-Lise Norman, by email (alnorman@ucalgary.ca) or by phone (403.220.5405).

(d) **Safewalk:** Campus Security will escort individuals day or night (<http://www.ucalgary.ca/security/safewalk/>). Call 220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

- (e) **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). As one consequence, students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information see also <http://www.ucalgary.ca/secretariat/privacy>.
- (f) **Student Union Information:** [VP Academic](#) Phone: 220-3911 Email: suvpaca@ucalgary.ca.
SU Faculty Rep: Phone: 220-3913 Email: science1@su.ucalgary.ca, science2@su.ucalgary.ca and science3@su.ucalgary.ca
Student Ombuds Office: 403 220-6420
Email: ombuds@ucalgary.ca; <http://ucalgary.ca/provost/students/ombuds>
- (g) **Internet and Electronic Device Information:** You can assume that in all classes that you attend, your cell phone should be turned off unless instructed otherwise. Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.
- (h) **U.S.R.I.:** At the University of Calgary, feedback provided by students through the Universal Student Ratings of Instruction (USRI) survey provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses (www.ucalgary.ca/usri). Your responses make a difference - please participate in USRI Surveys.

12. OTHER COURSE RELATED INFORMATION:

(a) Course Description

This course will cover the fundamental concepts of radiation physics. The focus will be on how ionizing radiation interacts with matter, and how the energy that is deposited in the matter can be measured in theory and practice.

(b) Course Learning Incomes

This course will require an undergraduate background in physics. Specifically, previous exposure to electromagnetic theory and classical mechanics will be beneficial. Furthermore, an undergraduate level of mathematics (integrals, derivatives, statistics) is also required.

(c) Course Learning Outcomes

At the end of the course, students should have a clear mental picture on the different ways in which charged and uncharged radiation particles interact with matter. They should be familiar with the different approaches to modeling and calculating energy deposition by radiation in matter. Further, they should be familiar with the variety of dosimeters that can be used to measure energy deposited by radiation and the pros and cons to each dosimeter.

(d) Syllabus & class Schedule

Lecture	Date	Topic	Readings from Attix	Inst.
1	11-Sep	Introduction: Background and essentials	Ch1: 1-28	PM
2	12-Sep	Charged particle interactions: soft & hard collisions	Ch 2: 29-60	TM
3	18-Sep	Charged particle interactions: range and stopping powers	Ch 2: 61-118	TM
4	19-Sep	X-ray Interactions: Photoelectric	Ch 3: 143-157	PM
5	25-Sep	X-ray Interactions: Compton	Ch 3: 161-172	TM
6	26-Sep	X-ray Interactions: Pair Production, Rayleigh, Photonuclear, attenuation coefficients, Energy transfer coefficients	Ch 3: 178-204	TM
7	02-Oct	Radiation quantities, charged particle and radiation equilibrium, and exponential attenuation	Ch 4: 215-252 Ch 5: 259-276	TM
8	03-Oct	X-ray production: Bremsstrahlung radiation, Fluorescence, Filtration, beam quality specification	Ch 7: 315-345	TM
9	09-Oct	Radioactive material: Radioactive decay processes & the mathematics of radioactive decay	Ch 18: 753-805	TM
10	10-Oct	Cavity theory I	Ch 9: 397-440	PM
11	16-Oct	Cavity theory II	Ch 9: 397-440	PM
12	17-Oct	Radiation detectors and measurements overview	Ch 10: 443-471	PM
13	23-Oct	Ionization chambers and Primary radiation standards	Ch 11: 473-493 Ch 12: 497-531	PM
14	24-Oct	Chemical dosimeters I	Ch 13: 533-574	PM
15	30-Oct	Chemical Dosimeter II	Ch 13: 533-574	PM
16	31-Oct	Solid-State Detector Dosimetry I	Ch 14: 577-628	PM
17	06-Nov	Solid-State Detector Dosimetry II	Ch 14: 577-628	PM
18	07-Nov	Midterm		
19	13-Nov	No lecture – Fall semester break		
20	14-Nov	No lecture – Fall semester break		
21	20-Nov	Reference Dosimetry for External Beam Radiation Therapy I	Ch 15: 631–689, TG-21, TG-51	PM
22	21-Nov	Reference Dosimetry for External Beam Radiation Therapy II	Ch 15: 631–689, TG-21, TG-51	PM
23	27-Nov	Dosimetry of Small and Composite Radiotherapy Photon Beams	Ch 16: 693-726	TM/PM
24	28-Nov	The Monte Carlo Simulation of the Transport of Radiation Through Matter	Ch 8: 349-393	TM/PM
25	04-Dec	Neutron interactions & Neutron dosimetry	Ch 3: 204-211 Ch 19: 813-833	PM
26	05-Dec	Review		TM/PM
27	?11-Dec?	Final Examination (exact date/time TBA based on student availability)		TM/PM