BRITISH COLUMBIA INSTITUTE OF TECHNOLOGY

Program: Medical Radiography
Course Delivered by: Physics Department
School of Computing and Academic Studies

Instructor: Darlene Starratt

Course Outline For:
PHYS 2285
Physics: Medical Radiography II

Hours/Week:	3	**Total Hours:**	21	**Term/Level:**	2
Lecture:	1	**Total Weeks:**	7	**Credits:**	1.5
Lab:	2		7		

Prerequisites

PHYS 1275

Course Record

Developed by: Darlene Starratt — Date: August, 2001
Instructor

Approved by: M. Filippelli — Date: Aug 2001
Program Head of Technology

Course Description and Goals

Physics of Medical Radiography (1275/2285/3285) is an introductory level course that emphasizes the application of physical phenomena in medical radiography. Topics include structural and physical properties of matter, static electricity, direct and alternating current, magnetism, energy, heat, wave motion, electromagnetic radiation, quantum concepts, production of X-rays, interaction of x-rays with matter, and digital imaging. Wherever appropriate, the physics of devises such as x-ray tubes, generators, photomultiplier tubes, TLDs, imaging devices, etc., will be used to demonstrate applied physics concepts.

Evaluation

Students will be evaluated through a combination of tests, assignments, projects, examinations, or other means as specified by the instructor. See Course Specifications for evaluation details. BCIT Policy 5410 "Evaluation of Students" will apply.

Course Learning Outcomes

At the end of this course, the student will be able to:

- define relevant physics terms with units,
- explain and discuss relevant x-ray physics concepts with defined terminology,
- draw and label diagrams for relevant applied x-ray physics topics,
- demonstrate conceptual understanding of x-ray physics by solving subjective and objective problems,
- explain the radiographic image formation process to a patient

Competency profile

This course provides a foundation of applied science for the Radiography program, and in the process, covers a portion of the following competencies:

- A2.6, A4.2, A4.10, A5.4, A5.6, A5.7, A5.8, A7.5, A7.7
- B1.5, B1.6, B1.7, B1.8, B2.1, B2.2, B2.3, B2.5, B3.2, B3.3, B4.1, B4.2, B5.1, B5.2, B5.3
- C2.4,C2.7
- D1.13, D1.14, D2.2, D3.1, D3.2

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Course Specifications For:
PHYS 2285
Physics: Medical Radiography II

Effective Date

This course outline takes effect September 5, 2001.

Instructor

Office No:	SW3-4081	Phone:	451-7151
E-mail:	dstarrat@bcit.ca	Fax:	433-2132

Office Hours	Monday	Tuesday	Wednesday	Thursday	Friday
	open (PLC 12:30 – 1:30)	open	open (PLC 11:30 –1:30)	open	open

Text(s) and Equipment

Required:

- Bushong, Stewart C., *Radiologic Science for Technologists: Physics, Biology and Protection*, sixth edition, Mosby, (1997).
- A Manual of Experiments in Medical Radiography Technology

Recommended References (Not Required):

- Ball, J.L. and A.D. Moore, *Essential Physics for Radiographers*, second edition, Blackwell, (1986).
- Carlton, R.R. and A.M. Adler, *Principles of Radiographic Imaging: an art and a science*, Delmar Publishers, (1992).
- Hay and Hughes, *First-Year Physics for Radiographers*, second, Bailliere Tindall, (1978).
- Thompson, Hall, Hattaway and Dowd, *Principles of Imaging Science and Protection*, W.B. Saunders, 1994.
- Wilks, *Principles of Radiological Physics*, Churchill Livingston, (1981).
- Wolbarst, A.B., *Physics of Radiology*, Appleton and Lange, 1993.

Evaluation

Term Test	35	%
Laboratory Reports	25	%
Final Examination	40	%
	100	%

Evaluation Policies

- ***Passing Grade:*** The passing grade in this course is 60%. The final mark is a weighted average of all tests and lab work.
- ***Term Tests*:** will be related to problems and concepts covered in classes.
- ***Laboratory Reports*:** will be completed each week and graded by an instructor. **Students must complete the laboratory exercises and hand in finished reports on time to obtain a grade.** No marks will be given for experiments from which you were absent, except by special arrangement with instructor.
- ***Final Exam:*** will test material covered in the whole term.

Other Course Policies and Information

- ***Attendance*:** Students are expected to attend classes regularly in accordance with the current BCIT Calendar attendance policy.
- ***Class Conduct*:** Students are expected to act professionally during class. Students disrupting classes or disturbing others during class will be asked to leave and their behaviour will be reported to their program head.
- ***Course Outline Changes*:** The material specified in this course outline may be changed by the instructor. If changes are required, they will be announced in class.
- ***Ethics*:** BCIT assumes that all students attending the Institute will follow a high standard of ethics. Incidents of cheating or plagiarism will be dealt with in accordance with BCIT's Conduct and Attendance Policy in the calendar and, may result in a grade of zero for the assignment, quiz, test, exam, or project for all parties involved and/or expulsion from the course.
- ***Illness*:** A doctor's note is required for any illness causing you to miss an assignment, quiz, test, or exam. At the discretion of the instructor, you may complete the work missed or have an agrotat mark (i.e. an average is given according to your performance on other tests or assignments).
- ***Lab Reports*:** Late lab reports will not be accepted for marking, except under special circumstances.
- ***Labs*:** Lab attendance is mandatory.
- ***Makeup Tests, Exams or Quizzes*:** There will be no makeup tests, exams or quizzes. If you miss a test, exam or quiz, you will receive zero marks. Exceptions **may** be made for documented medical reasons or extenuating circumstances.

Other Course Policies and Information, cont'd

- ***Physics Learning Centre***: Additional help may be obtained in the Physics Learning Centre, Room SW3-4785, during posted hours.
- ***Workload:*** The time that you will need to succeed in this course depends on your own background and abilities. It is very important to study regularly, keep up with the work and seek the assistance of the instructor when problems arise. The course load is quite heavy and to succeed you must be prepared to make the appropriate personal time commitment.

I.D. Required in Examination Centres

Effective December 2000, in order to write exams, students will be required to produce photo-identification at examination centres. Photo I.D. must be placed on the desk before an exam will be issued to the student. The I.D. must remain in view on the desk while writing the exam, for inspection by invigilators. Students should bring a BCIT OneCard or alternatively two pieces of identification, one of which must be a government photo I.D. such as a drivers license. Please see BCIT Policy #5300, Formal Invigilation Procedures.

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Schedule For:
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* This schedule is subject to change at the discretion of the instructor.

Chapter in Notes	Topics	Reference /Reading

1	**X-ray Production** **2 periods**
	• Review:
	  • Electron-Target Interactions
	  Heat production
	  Back-scatter
	  Brems x-ray production
	  Characteristic x-ray production
	  • X-ray Spectrum
	  Brems
	  Characteristic
	  Total x-ray spectrum
	  • Energy Level Diagram
	• Relative Importance of Brems and Characteristic
	• Total X-ray Power (X-ray Output)
	• X-ray Production Efficiency
	• The 15% Rule
	• X-ray Beam Quality and Quantity (Review)
	• Changing the X-ray Spectrum (Review)
	  mA
	  kV
	  target
	  filtration
	  voltage wave-form
		Bushong:
		• Chapter 11, pp. 126-138
		• Chapter 12, pp. 139-148
		• Related topics

Chapter in Notes	Topics	Reference /Reading
2	**X-ray Attenuation** **4 periods** • Subject Contrast • Attenuation, Absorption and Scatter • Exponential Attenuation First attenuation equation (linear attenuation coefficient) Half-value layer Second attenuation equation (in terms of the HVL) • Heterogeneous X-ray Beams • X-ray Beam Filtration • Anode Heel Effect • Attenuation Mechanisms Compton scatter Photoelectric attenuation • Dominant Attenuation Process • Attenuation Events and Absorbed Dose • Absorption Edges K-edge filters Intensifying screen phosphors (rare earth elements) • Screen Speed • Quantum Mottle • Measurement of Radiation	Bushong: • Chapter 13, pp. 149-161 • Related topics