A POLYTECHNIC INSTITUTION

Course Outline

School of Computing and Academic Studies
Program: Medical Radiography
Option:

**Physics 2285**
**Physics: Medical Radiography 2**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Start Date:** | September 4 | | | | | **End Date:** | December 12 | | |
| **Total Hours:** | 21 | **Total Weeks:** | 7 | | | **Term/Level:** | 2 | **Course Credits:** | 1.5 |
| **Hours/Week:** | 3 | **Lecture:** | 1 | **Lab:** | 2 | **Shop:** | | **Seminar:** | **Other:** |

**Prerequisites**

| Course No. | Course Name |
|---|---|
| Physics 1275 | Physics Medical Radiography 1 |

**Physics 2285 is a Prerequisite for:**

| Course No. | Course Name |
|---|---|
| Physics 3385 | Physics Medical Radiography 3 |

## Course Description (required)

Physics of Medical Radiography 2 (2285) is an introductory level course that emphasizes the application of physical phenomena in medical radiography. Topics include production of X-rays, interactions of X-rays with matter and measurement of radiation. The physics of such devices as X-ray tubes, K-edge filters, intensifying screens and ionization chambers will be discussed.

## Evaluation

| | | |
|---|---|---|
| Term Test | 35% | Comments: |
| Laboratory Reports | 25% | |
| Final Exam | 40% | |
| TOTAL | 100% | |

## Course Learning Outcomes/Competencies

Upon successful completion, the student will be able to:

- define relevant physics terms with units,
- explain and discuss concepts relevant to x-ray production, attenuation and measurement,
- draw and label diagrams for relevant 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

## Verification

I verify that the content of this course outline is current.

J Talman — Authoring Instructor

August 29/03 — Date

I verify that this course outline has been reviewed.

M. Filippelli — Program Head/Chief Instructor

August 29/03 — Date

I verify that this course outline complies with BCIT policy.

F. DiSpirito per — Dean/Associate Dean

August 29/03 — Date

Note: Should changes be required to the content of this course outline, students will be given reasonable notice.

## ■ Instructor(s)

J. Talman M.Sc. Office Location: SW3-4096 Office Phone: 451-7151
Office Hrs.: TBA E-mail Address: jtalman@bcit.ca

## ■ Learning Resources

*Required*:

- Bushong, Stewart C., *Radiologic Science for Technologists: Physics, Biology and Protection*, 7'th edition, Mosby, (2001).
- A Manual of Experiments in Medical Radiography Technology

*Recommended*:

- 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.

## ■ Information for Students

(*Information below can be adapted and supplemented as necessary.*)
**Passing Grade:** The passing grade in this course is 60%. The final mark is a weighted average of all tests and lab work.
**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.
**Assignments:** Late assignments, lab reports or projects will **not** be accepted for marking. Assignments must be done on an individual basis unless otherwise specified by the instructor.

**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. In such a case, it is the responsibility of the student to inform the instructor **immediately**.

**Ethics:** BCIT assumes that all students attending the Institute will follow a high standard of ethics. Incidents of cheating or plagiarism may, therefore, result in a grade of zero for the assignment, quiz, test, exam, or project for all parties involved and/or expulsion from the course.

**Attendance:** The attendance policy as outlined in the current BCIT Calendar will be enforced. Attendance will be taken at the beginning of each session. Students not present at that time will be recorded as absent.

**Illness:** A doctor's note is required for any illness causing you to miss assignments, quizzes, tests, projects, or exam. At the discretion of the instructor, you may complete the work missed or have the work prorated.

**Course Outline Changes:** The material or schedule specified in this course outline may be changed by the instructor. If changes are required, they will be announced in class.

## Schedule

| Chapter in Notes | Topics | Reference /Reading |
|---|---|---|
| 1 | **X-ray Production**<br>• Review:<br>  • Electron-Target Interactions<br>  Heat production<br>  Back-scatter<br>  Brems x-ray production<br>  Characteristic x-ray production<br>  • X-ray Spectrum<br>  Brems<br>  Characteristic<br>  Total x-ray spectrum<br>  • Energy Level Diagram<br>• Relative Importance of Brems and Characteristic<br>• Total X-ray Power (X-ray Output)<br>• X-ray Production Efficiency<br>• The 15% Rule<br>• X-ray Beam Quality and Quantity (Review)<br>• Changing the X-ray Spectrum (Review)<br>  mA<br>  kV<br>  target<br>  filtration<br>  voltage wave-form | Bushong:<br>• Chapter 11, pp. 141-152<br>• Chapter 12, pp. 154-163<br>• Related topics |
| 2 | **X-ray Attenuation**<br>• Subject Contrast<br>• Attenuation, Absorption and Scatter<br>• Exponential Attenuation<br>  Half-value layer<br>  Attenuation equation (in terms of the HVL)<br>  Linear attenuation coefficient<br>  Exponential attenuation equation<br>• Heterogeneous X-ray Beams<br>• X-ray Beam Filtration<br>• Anode Heel Effect<br>• Attenuation Mechanisms<br>  Compton scatter | Bushong:<br>• Chapter 13, pp. 164-175<br>• Related topics |

| Chapter in Notes | Topics | Reference /Reading |
|---|---|---|
| | Photoelectric attenuation<br>• Dominant Attenuation Process<br>• Attenuation Events and Absorbed Dose<br>• Absorption Edges<br>K-edge filters<br>Intensifying screen phosphors (rare earth elements)<br>• Impact of attenuation on:<br>Screen Speed<br>Quantum Mottle<br>• Measurement of Radiation (intro) | |