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 1275
Physics: Medical Radiography I

Hours/Week:	3.5	**Total Hours:**	56	**Term/Level:**	1
Lecture:	2	**Total Weeks:**	16	**Credits:**	4.5
Lab:	2		8		

Prerequisites

Physics 12 and Math 12

Course Record

Developed by: Darlene Starratt — Date: January 3, 2001
Instructor

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

Course Description and Goals

Physics of Medical Radiography (1275/2275/3275) 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, the generator, ionization chamber, photomultiplier tube, TLD, imaging devices etc., will be used to demonstrate applied physics concepts.

Course Learning Outcomes

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

- define relevant physics terms with units,
- explain or discuss relevant physics concepts with defined terminology,
- draw and label diagrams for relevant applied physics topics,
- demonstrate conceptual understanding of physics by solving numerical, 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

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.

Evaluation

Term Tests	2 at 12%	24	%
Quizzes	4 at 4%	16	%
Laboratory Tests	1 at 10	10	%
Laboratory Reports		10	%
Final Examination		40	%
		100	%

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Effective Date

This course outline takes effect January 3, 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	open	open	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
- Physics Laboratory Notebook

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 Policies

- ***Passing Grade:*** The passing grade in this course is 60%. The final mark is a weighted average of all tests quizzes and lab work.
- ***Quizzes*:** will be directly related to assigned problems and class lecture notes.
- ***Term Tests*:** will be related to assigned problems and concepts covered in classes and tutorials. Each of the term tests will examine approximately the same amount of material.
- ***Laboratory Tests:*** will be directly related to the assigned laboratory sessions. You will be allowed to use your lab data book on lab tests.
- ***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

- ***Assignments*:** Late assignments or projects will not normally be accepted for marking. Assignments must be done on an individual basis unless otherwise specified by the instructor.
- ***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).
- ***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.
- ***Physics Learning Centre*:** Additional help may be obtained in the Physics Learning Centre, Room SW3-4785, during posted hours.

- ***Problem-Solving:*** Students are expected to show all work in solving problems. Equations should be rearranged solving for the unknown quantity; numbers and units must be substituted in equations and the answer must be written with proper significant figures and units. Marks will not be given for unsupported answers.
- ***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	Topics	Reference
1	**Introduction** 1 period • Course objectives • Measurements SI units accuracy and precision • Unit conversion	
2	**Radiological Physics** 2 periods • Historical background • X-ray generation (brief overview) simplified circuit definitions (mA, kV, time, collimator, grid and screen) x-ray production x-ray attenuation	
3	**Structure of Matter** 2 periods • Atomic structure protons, neutrons, electrons • Atomic energy level diagram binding energy ionization energy excited states electron transition • Photon energy • Tungsten atom • Radioactivity α, β and γ radiation biological effects • Applications gamma camera PET scanner	

Chapter	Topics	Reference
4	**Electrostatics** 3 periods • Electric charges (review) types of charges interaction of charges methods of ionization • Electrostatic field electric field lines of force • Electrostatic applications to Radiography x-ray tube focusing cup static marking of films operating room hazards • Electric potential (voltage) • Equipotential lines • Electron volt energy unit	
5	**Electric Current** 4 periods • Charge transfer battery electric current • Circuits current, voltage and resistance energy and power internal resistance • Line voltage drop	
6	**Capacitance** 2 periods • Capacitor definition construction • Charging and discharging a capacitor • Application filtration exposure timing	
7	**Magnetism** 3 periods • Nature of magnetism applications in radiography (MRI) • Electromagnetic induction • Transformers construction operating principle types of transformers	

Chapter	Topics	Reference
8	**AC Circuits** 2 periods • Ohm's Law and AC peak, average and effective (RMS) advantages of using AC • Rectification full wave	
9	**Solid State** 3 periods • Solids • Energy bands conductors insulators semiconductors • Solid state diodes rectifiers X-ray detectors • Applications fluorescence (scintillation) phosphorescence thermoluminescent dosimeters imaging plate	
10	**X-ray Generators** 3 periods • Single phase • Three phase voltage generator voltage wave-form • Three-phase rectification 6-pulse 12-pulse percent ripple • High-frequency generators constant kV • Grid controlled X-ray tubes	
11	**X-ray Production** 2 periods • Characteristic production • Brems Production • Spectral Intensity Curve x-ray quality x-ray quantity change produced by mA and kV	

Chapter	Topics	Reference
12	**X-ray Attenuation** 3 periods • Attenuation, absorption and scatter • Subject Contrast • Exponential attenuation linear attenuation coefficient • X-ray interaction with film chemistry	