BRITISH COLUMBIA INSTITUTE OF TECHNOLOGY

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

Course Outline For:
PHYS 1272
Physics: Medical Radiography I

Instructor: *Richard Saunders*

Hours/Week:	5	**Total Hours:**	80	**Term/Level:**	1
Lecture:	3	**Total Weeks:**	16	**Credits:**	5
Lab:	2				
Other:					

Prerequisites

Physics 12 and Math 12

Course Record

Developed by: Richard Saunders (Instructor) Date: Feb. 7/97

Approved by: Donna MacDuff (Physics Department) Date: Feb 11, 1997

Approved by: S Hendrick (Program Head of Technology) Date: Feb 11/97

Course Description and Goals

Physics of Medical Radiography is an introductory level course which 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 and interaction of X-rays with matter. 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.

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 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

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Effective Date

This course outline takes effect January 6, 1997.

Instructor

Office No:	SW3-4083	Phone:	5314
E-mail:		Fax:	451-6835

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*, fifth edition, Mosby, (1993).
- 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

Term Tests	2 at 12%	24	%
Quizzes	4 at 4%	16	%
Laboratory Tests	2 at 10	20	%
Laboratory Reports		5	%
Final Examination		35	%
		100	%

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 on 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.

Other Course Policies and Information, cont'd

- ***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.

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Chapter	Topics	Reference /Reading
1	**Introduction** • Course objectives • Measurements SI units • Unit conversion	
2	**Radiological Physics** • Historical background • X-ray generation simplified circuit definitions (mA, kV, attenuation, collimation, grid, etc)	
3	**Structure of Matter** • Atomic structure Evidence (review) Atomic size • Bohr model of the atom • Atomic energy level diagram binding energy ionization excitation electron transition • Photon energy • Tungsten atom	
4	**The Nucleus** • Radioactivity α, β and γ radiation • Nuclear structure protons, neutrons	

Chapter	Topics	Reference /Reading
	elements and isotopes nuclides • Nuclear Medicine gamma camera PET scanner	
5	**Electrostatics** • Electrostatic problems in Radiography static marking of films operating room hazards • Electric charges (review) types of charges interaction of charges methods of ionization • X-ray exposure dose • Ionization chamber • Absorbed Dose (definition) • electric potential (voltage) • Electrostatic field electric field lines of force • Equipotential lines • Electron volt	
6	**Electric Current** • Charge transfer battery electric current • Circuits current, voltage and resistance energy and power factors determining resistance internal resistance • line voltage drop	
7	**Capacitance** • Definition • Construction • Application portable X-ray machines filtration exposure timing	
8	**Magnetism** • Magnetic field	

Chapter	Topics	Reference /Reading
	permanent magnets direction of B field visualization interaction of poles • Electric current and magnetic field magnetic field around a wire electromagnet • Electron spin • Proton spin magnetic precession MRI (mention only)	
9	**Magnetic Induction** • Electromagnetic induction • Faraday's law • Lenz's law self induction and mutual induction • AC voltage period and frequency wave form advantages of using AC peak, average and effective (RMS) • Induction motor (rotating anode)	
10	**Transformers** • Transformers construction operating principle types of transformers efficiency • mA changes kV • Electrical safety	
11	**AC to DC Power** • Vacuum diodes thermionic emission principle of operation X-ray tubes Gassy X-ray tubes • Rectification full wave • Constant voltage	
12	**Solid State**	

Chapter	Topics	Reference /Reading
	• Solids • Energy bands conductors insulators semiconductors • Applications fluorescence phosphorescence thermoluminescent dosimeters imaging plate	
13	**X-ray Generators** • Single phase • Three phase voltage generator voltage wave form and phase • Three phase rectification 6 pulse 12 pulse (mention only) percent ripple • High frequency generators • Vacuum triode • Triode applications high voltage switching grid controlled X-ray tubes	
14	**Electromagnetic Radiation** • Wave motion • Wave equation • EM waves amplitude frequency, period velocity wavelength • Electromagnetic radiation sources wave nature particle nature (photon) wave particle duality photo diode • The electromagnetic spectrum	