BRITISH COLUMBIA INSTITUTE OF TECHNOLOGY

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

Course Outline For:
PHYS 2272
Physics: Medical Radiography II

Instructor: *Richard Saunders*

Hours/Week:	2.4	**Total Hours:**	31	**Term/Level:**	2
Lecture:	3 or 2	**Total Weeks:**	16	**Credits:**	3.0
Lab:	0 or 2				
Other:					

Prerequisites

PHYS 1272

Course Record

Developed by: Richard Saunders (Instructor) Date: September 1997

Approved by: Donna MacDuff (Physics Department) Date: September 10, 1997

Approved by: J Hendrick (Program Head of Technology) Date: Sept. 11/97

Course Description and Goals

Physics of Medical Radiography (1272/2272) 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 September 2, 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

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 25%	50	%
Quizzes		0	%
Laboratory Tests		0	%
Laboratory Reports		10	%
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 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 ' 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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* This schedule is subject to change at the discretion of the instructor.

Chapter	Topics	Reference /Reading
1	**Electromagnetic Radiation** • Wave motion • Wave equation • EM waves amplitude frequency and period velocity wavelength • Electromagnetic radiation sources wave and particle nature photo diode and photomultiplier tube • EM spectrum	
2	**X-ray Production** • Definitions • Electron-target interaction, no X-rays heat production back scatter • Electron-target interaction, X-rays bremsstrahlung production characteristic production • X-ray spectrum brems characteristic alternate units for axes	

Chapter	Topics	Reference /Reading
	total X-ray spectrum • Energy level diagram • Relative importance of brems and characteristic • Total X-ray power output (x-ray quantity) • X-ray production efficiency • Changing the X-ray spectrum mA kV target filtration voltage wave form	
3	**X-ray Attenuation** • Subject Contrast • Attenuation, absorption and scatter • Exponential Attenuation linear attenuation coefficient half value layer alternate attenuation equation (in HVL) • Heterogeneous X-ray beams • X-ray beam filtration anode heel effect • Mass attenuation coefficient • Attenuation mechanisms unmodified scatter (Thomson) modified scatter (Compton) photoelectric pair production • Total mass attenuation graphically • Relative importance of attenuation mechanisms by number of attenuation events by absorbed dose • Attenuation edges (k-edge) best attenuator k-edge filters rare earth elements screen speed • Quantum mottle • Measurement of radiation	

Chapter	Topics	Reference /Reading
4	**Temperature and Heat** • Temperature and temperature scales (review) • Internal energy or heat units mechanical equivalent of heat specific heat capacity heat equation compound anode • Thermal expansion anode disk housing	
5	**Heat Transfer** • Thermal conductivity • Convection • Radiation	
6	**Heat and the x-ray Tube** • Fixed anode • Rotating anode • Heat units • Maximum power input curve • Heating and cooling curves	