WESTERN UNIVERSITY Schulich School of Medicine and Dentistry

Department of Medical Biophysics

MEDBIO 4475, BIOPHYS 9515, and BME 9513

1. LEARNING OBJECTIVES and OUTCOMES

Through this introductory course the student will learn the physics and methods of how medical images are formed. By the end of the term the student will understand how images are formed for the following different imaging modalities: ultrasound, x-rays, computed tomography, nuclear medicine, positron-emission tomography, and magnetic resonance imaging. To understand the tomographic imaging modalities, the student will also gain knowledge of the Fourier Transform and its applications in medical imaging. A basic understanding of the sources of noise and artifacts in the different modalities will also be attained, along with an understanding of the limits to the achievable resolution.

Learning outcomes and expectations for students who complete this course include:

- Understanding the foundational physics and underlying methods used to generate medical images based on ultrasound, x-rays, computed tomography, nuclear medicine methods, positron-emission tomography, and magnetic resonance imaging.
- To understand the underlying principles for tomographic imaging modalities, including how to manipulate and use the Fourier Transform and how it is used in applications in medical imaging.
- A basic understanding of the sources of noise and artifacts in the different imaging modalities discussed
- Understanding the fundamental limits for each of the imaging methods with respect to spatial and temporal resolution.

Lectures:

3 lecture hours/week, 0.5 credit course

Monday	3:30-5:30 p.m.
Friday	09:30-10:30 a.m.
Room:	1056 B&GS building

Tutorials:

Additional help sessions may be scheduled at times suitable to students' schedules prior to the midterm and exam.

Prerequisite(s):

(Medical Biophysics 3503G or the former Medical Biophysics 3302E); or
(Medical Biophysics 3505F and 3507G), or the former Medical Biophysics 3303E; and
1.0 course from (Medical Biophysics 2128A/B and 2129A/B), or
(Physics 2128A/B and 2129A/B, or Physics 2101A/B and 2102A/B), or
permission of the department.

Senate regulation regarding the student's responsibility regarding requisites:

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation

2. INSTRUCTOR INFORMATION

- material related to each modality will be presented by instructors with expertise in the appropriate area

Instructor	**Lectures**
Dr. Maria Drangova (Course Coordinator) mdrangova@robarts.ca	Magnetic Resonance Imaging (MRI)
Dr. Ian Cunningham	Diagnostic Radiology (DR)
Dr. David Holdsworth	Computed Tomography (CT) Nuclear Medicine (Nuc Med) Positron Emission Tomography (PET)
Dr. James Lacefield	Ultrasound (US)
Dr. Keith St. Lawrence	Fourier Transforms (FT)

Teaching Assistants	
TBA	

3. COURSE OUTLINE – tentative schedule

Day	Date	Topic	Instructor	Assignments	
				to class	hand in
Fri	06-Sep	Intro/US	MD / JL		
Mon	09-Sep	US	JL		
Fri	13-Sep	US	JL	US	
Mon	16-Sep	US/DR	JL / IAC		
Fri	20-Sep	DR	IAC		US
Mon	23-Sep	DR	IAC		
Fri	27-Sep	DR	IAC	DR	
Mon	30-Sep	FT	KSTL		
Fri	04-Oct	FT	KSTL	FT	DR
Mon	07-Oct	FT	KSTL		
Fri	11-Oct	MRI	MD		FT
Mon	14-Oct	Thanksgiving			
Fri	18-Oct	MRI	MD		
Mon	21-Oct	Midterm			
Fri	25-Oct	MRI	MD		
Mon	28-Oct	MRI			
Fri	01-Nov	MRI	MD	MRI	
Mon	04-Nov	Fall Reading Week			
Fri	08-Nov	Fall Reading Week			
Mon	11-Nov	CT	DWH		MRI
Fri	15-Nov	CT	DWH	CT	
Mon	18-Nov	CT	DWH		
Fri	22-Nov	NucMed	DWH		CT
Mon	25-Nov	NucMed	DWH	NucMed	
Fri	29-Nov	PET	DWH		
Mon	02-Dec	PET	DWH		NucMed

4. COURSE MATERIALS

- Electronic notes for each section will be provided on OWL, along with additional information and reading materials

Additional helpful material

1. The Essential Physics of Medical Imaging. Bushberg, Seibert, Leidholdt, 2002
2. The Fourier Transform and its applications, 3rd ed., McGraw-Hill. RN Bracewell, 2000
3. The Physics of Medical Imaging. S Webb, Institute of Physics Pub; 1998
4. Physics in Nuclear Medicine. SR Cherry, JA Sorenson, ME Phelps, 2003
5. MRI the basics. Ray H. Hashemi, William G. Bradley, Jr., Williams & Wilkins, 2004

5. EVALUATION

Marking Scheme:

Assignments (6 total)	**40%**	
Mid-Term (covers US/DR/FT)	**24%**	**1 hr 45 min**
Exam (covers CT/MRI/NucMed & PET)	**36%**	**2 hrs**

Grading Assignments

- Assignments must be handed in at the beginning of class on the due day. Late assignments should be submitted electronically, as an uploaded PDF file, through OWL.
- All assignments will be given the same weight.
- The assignments are due one week after they are handed out or as specified by the section instructor.
- 10% of maximum grade/day will be deducted for every calendar day late.
- Extensions may be granted in case of illness, provided permission is requested at least 24 hours prior to the due date; a doctor's notice may be required for extended illnesses.
- Extensions will also be given for extenuating circumstances, such as attendance of a conference; in this case, permission to hand in an assignment late without penalty must be requested at least 5 days prior to the assignment due date.
- To request an extension, contact the course coordinator by e-mail.

6. ADMINISTRATIVE POLICIES

Academic Honesty and Statement on Academic Offences

- Breaches of academic honesty are unacceptable and will not be tolerated in this course.
- Students who submit for remarking any material that has been modified in any manner to misrepresent the original assessment will be given a grade of zero for that assignment;
- Scholastic offences are taken seriously and both graduate and undergraduate students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, for undergraduates at the following website: http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf and for graduate students: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf

Attendance Policy:

All classes, laboratories, and tutorials are mandatory, unless otherwise stated. Any student who, in the opinion of the course co-ordinator is absent too frequently from class or laboratory periods in any course, will receive a failing grade after due warning has been given in writing from the course co-ordinator and Graduate/Undergraduate Chair, as appropriate.

Cheating and Plagiarism Policy:

Students are encouraged to work together when appropriate, but each student must take total responsibility for his/her submitted work. Students must write their reports and assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If a student is caught cheating, there will be no second warning.

All written reports and projects may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All reports will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (http://www.turnitin.com).

Use of Electronic Devices Policy:

No electronic devices (e.g., cell phones, MP3 players) may be used during lectures or examinations. The use of non-programmable calculators is permitted during examinations; programmable calculators are prohibited during examinations.

OWL Internet/Bulletin Board Policy:

It is the student's responsibility to read the course website posted on Western's on-line learning management system, OWL (https://owl.uwo.ca/portal). This includes the course bulletin board and all information and/or assignments posted about the course. If the student fails to act on information that has been posted on the course site and does so without a legitimate explanation (i.e., those covered under the illness/compassionate form), then there are NO grounds for an appeal.

Request for Assignments Extensions:

Students are advised to inform the course co-ordinator as soon as possible regarding an extension for assignment submissions due to medical reasons or other compassionate reasons. Extensions will only be granted by the course co-ordinators at their discretion.

Absence Due to Medical Illness:

Students must familiarize themselves with the Policy on Accommodation for Medical Illness: https://studentservices.uwo.ca/secure/index.cfm
If you are unable to meet a course requirement due to illness or other serious or compassionate circumstances, you must provide valid medical or other supporting documentation to the course coordinator immediately. It is the student's responsibility to make alternative arrangements with the co-ordinator to complete missing course requirements.

A student requiring academic accommodation due to illness, should use the Student Medical Certificate: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf when visiting an off-campus medical facility or request a Record's Release Form for visits to Student Health Services. The form is available at: http://www.health.uwo.ca/services/students/policies.html.

The release form will allow the course co-ordinator to confirm with Student Health Services that a student's absence from regular attendance or inability to meet scheduled course commitments is due to medical reasons. The nature of the illness will not be divulged by Student Health Services.

Students' Mental Health and Physical Wellness:

As part of a successful graduate student experience at Western, students are encouraged to make their health and wellness a priority. Western provides several on campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western's Campus Recreation Centre: http://www.uwo.ca/campus_life/athletics.html

All facets of extracurricular campus life in which graduate students can participate are available on this URL: http://www.uwo.ca/campus_life/arts_culture.html

Information regarding health and wellness-related services available to students may be found at https://www.uwo.ca/health/. Students seeking help regarding mental health concerns are advised to speak to someone in whom they feel comfortable confiding, such as their graduate supervisor, their program director (Graduate Chair), Undergraduate Chair, or other relevant administrators in their unit. Campus mental health resources may be found at: https://www.uwo.ca/health/mental_wellbeing/

Accessibility to the Course and Course Materials:

Please contact the course co-ordinator if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 519 - 661- 2147 for any specific question regarding an accommodation.