The Hashemite University









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عمادة التطوير الأكاديمي والتواصل الدولي

Deanship of Academic Development and International Outreach

# Syllabus

# Magnetic Resonance Imaging (2) (140508435)

## First Semester 2022 /2023

COURSE INFORMATION							
Course Name: Semester: Department: Faculty:	Magnetic Resonance Imaging (2) First Department of Medical Imaging Applied Medical Sciences	Course Code: 140508435 Section: Advanced Medical Imaging Applications Core Curriculum: Radiological and Medical Imaging					
Day(s) and Time(s): Monday: 11:00-12:00       Credit Hours:       3 (2 Theory +1 Lab)         Wednesday: 11:00-12:00       Prerequisites:       140508332         Classroom:       204 ב       2							
COURSE DESCRIPTION This course covers advanced and clinical MRI topics such as fast imaging techniques (fast gradient echo, fast spin echo, Echo planar imaging EPI, parallel imaging), tissue suppression techniques, MR artifacts, MR contrast agents, chemical shift imaging, magnetization transfer imaging, diffusion imaging, functional MRI, flow imaging, MR angiography, cardiac gated imaging, clinical imaging protocols,							
	DELIVERY	METHODS					
<ul> <li>The course will be delivered through a combination of active learning strategies. These will include:</li> <li>PowerPoint lectures and active classroom based discussion.</li> <li>Collaborative learning through small groups acting in an interdisciplinary context.</li> <li>Relevant films and documentaries.</li> <li>Video lectures.</li> <li>E-learning resources: e-reading assignments and practice quizzes through Model and Microsoft Team.</li> </ul>							

FACULTY INFORMATION					
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Monday/Wednesday: 12-1: Sunday: 10-11 Please send an e-mail (ali.radaideh@hu.edu.jo) to meet at any other time.

## **REFERENCES AND LEARNING RESOURCES**

#### **Required Textbook:**

There is no required textbook for purchase.

All compulsory weekly readings are available electronically on Microsoft Teams and "Dr-Ali Al-Radaideh\_Teaching files" on Facebook group.

#### Suggested textbook for reading:

MRI in practice Catherine Westbrook. Carolyn Roth, John Talbot, Blackwell, 3rd Edition 2018.

MRI from picture to proton, Donald McRobbie, Elizabeth Moore, Martin Graves, Martin Prince. Cambridge, 2nd Edition 2017

MRI the Basics, Ray Hashemi, William Bradlly, Christopher Lisanti. Lippincott Williams and Wilkins, 3rd Edition 2017

#### Useful Web Resources:

http://mrimaster.com/index-3.html http://www.cis.rit.edu/htbooks/mri/

#### http://www.revisemri.com/

http://mriquestions.com/

http://www.mrisafety.com/

## **STUDENT LEARNING OUTCOMES MATRIX\***

Core Curriculum Learning Outcomes	Program Learning Outcomes	Course Objectives	Course Student Learning Outcomes	Assessment Method
Think critically and creatively in a variety of methods in order to make diagnostic decisions and solve problems.	KP1: Develop an understanding of human anatomy and physiology as it relates to health and disease and acquire	<ul> <li>Understanding the different approaches of the fast MR imaging techniques.</li> <li>Understanding the</li> </ul>	<ul> <li>Know the main parameters for fast imaging in MRI.</li> <li>Know the main advantages and disadvantages of using fast imaging MR techniques.</li> <li>Explain the different saturation</li> </ul>	<ul> <li>Exams</li> <li>Quizzes</li> <li>"On-line' reading assignments</li> <li>homework assignments</li> <li>Exams</li> </ul>
Communicate competently with others using oral and	competency in medical terminology, documentation KP2: Understand the principles and	operation modes of different saturation techniques.	<ul> <li>Explain the differences between the different saturation techniques.</li> <li>Know the main advantages and disadvantages of using different saturation techniques.</li> </ul>	<ul> <li>Quizzes</li> <li>"On-line' reading assignments</li> <li>homework assignments</li> </ul>
written English skills	physics of medical imaging technologies such as general X-ray, CT, MRI, ultrasound, fluoroscopy,	3. Understanding the basic principles of different advanced imaging techniques.	<ul> <li>Explain the principles of each advance clinical MRI application.</li> <li>Know the uses of each advance clinical MRI application.</li> </ul>	<ul> <li>Exams</li> <li>Quizzes</li> <li>"On-line' reading assignments</li> <li>homework assignments</li> </ul>
	nuclear medicine, dental radiography, and mammography and relate medical research KP3: Develop and implement protocols for	4. Linking different clinical situations with their suitable imaging procedures.	<ul> <li>Know the clinical indication for each imaging protocol.</li> <li>Understand the patient preparation, positioning and centering</li> <li>Understand the correct slice planning and measurement parameters.</li> </ul>	<ul> <li>Exams</li> <li>Quizzes</li> <li>"On-line' reading assignments</li> <li>homework assignments</li> </ul>

medical imaging		
procedures		
including notiont		
positioning,		
patient care,		
proper exposure		
factor selection,		
appropriate		
radiation		
protection		
maggurag		
daman at a sting		
demonstrating		
technical		
competence, and		
the use of		
contrast agents		
SP1:		
Demonstrate		
depth of		
knowledge and		
integrate it of the		
hasic scientific		
principles of all		
modical imaging		
technologies for		
the		
implementation		
of various		
protocols and		
techniques and to		
conduct scientific		
research in this		
field		
SD2. Use		
SP2: Use		
creativity, critical		
thinking,		
analysis, and		
research skills to		
modify standard		
procedures to		
adapt to new		
circumstances.		
difficult cases, or		
unusual situations		
while		
maintaining		
annannanning		
medical imaging		
quality.		
SP3: Evaluate		
and criticize all		
types of medical		
images		
č		
	1	

CP1 · Access		
evaluate and		
provide medical		
imaging		
requirements		
CD2.		
CF 2. Becognizing the		
need to learn		
from professional		
leannig,		
inanaging		
field of modical		
imaging in an		
integrated		
manner, and		
acquiring		
continuous		
learning skills		
CP3:		
Demonstrate		
professional		
identity and		
responsibility		
with patients,		
colleagues,		
employers, and		
society, with		
ethical and		
professional		
behaviors and		
attitudes in the		
practice of health		
care.		
CP4: Produces		
high quality,		
diagnosable		
medical images		
by applying		
positioning skills,		
selecting		
technical		
parameters, and		
using radiation		
protection.		

## ACADEMIC SUPPORT

It is The Hashemite University policy to provide educational opportunities that ensure fair, appropriate and reasonable accommodation to students who have disabilities that may affect their ability to participate in course activities or meet course requirements. Students with disabilities are encouraged to contact their Instructor to ensure that their individual needs are met. The University through its Special Need section will exert all efforts to accommodate for individual's needs.

#### **COURSE REGULATIONS**

#### **Participation**

Class participation and attendance are important elements of every student's learning experience at The Hashemite University, and the student is expected to attend all classes. A student <u>should not miss more than 15%</u> of the classes during a semester. *Those exceeding this limit of 15% will receive a failing grade regardless of their performance*. It is a student's responsibility to monitor the frequency of their own absences. Attendance record begins on the first day of class irrespective of the period allotted to drop/add and late registration. It is a student's responsibility to sign-in; failure to do so will result in a non-attendance being recorded.

In exceptional cases, the student, with the instructor's prior permission, could be exempted from attending a class provided that the number of such occasions does not exceed the limit allowed by the University. The instructor will determine the acceptability of an absence for being absent. A student who misses more than 25% of classes and has a valid excuse for being absent will be allowed to withdraw from the course.

#### Plagiarism

Plagiarism is considered a serious academic offence and can result in your work losing marks or being failed. HU expects its students to adopt and abide by the highest standards of conduct in their interaction with their professors, peers, and the wider University community. As such, a student is expected not to engage in behaviours that compromise his/her own integrity as well as that of the Hashemite University.

Plagiarism includes the following examples and it applies to all student assignments or submitted work:

- Use of the work, ideas, images or words of someone else without his/her permission or reference to them.
- Use of someone else's wording, name, phrase, sentence, paragraph or essay without using quotation marks.
- Misrepresentation of the sources that were used.

#### The instructor has the right to fail the coursework or deduct marks where plagiarism is detected

#### Late or Missed Assignments

In all cases of assessment, students who fails to attend an exam, class project or deliver a presentation on the scheduled date without prior permission, and/or are unable to provide a medical note, will automatically receive a fail grade for this part of the assessment.

- Submitting a term paper on time is a key part of the assessment process. Students who fail to submit their work by the deadline specified will automatically receive a 10% penalty. Assignments handed in more than 24 hours late will receive a further 10% penalty. Each subsequent 24 hours will result in a further 10% penalty.
- In cases where a student misses an assessment on account of a medical reason or with prior permission; in line with University regulations an incomplete grade for the specific assessment will be awarded and an alternative assessment or extension can be arranged.

#### Student Complaints Policy

Students at The Hashemite University have the right to pursue complaints related to faculty, staff, and other

students. The nature of the complaints may be either academic or non-academic. For more information about the policy and processes related to this policy, you may refer to the students' handbook.

### **COURSE ASSESSMENT**

#### Course Calendar and Assessment

Students will be graded through the following means of assessment and their final grade will be calculated from the forms of assessment as listed below with their grade weighting taken into account. The criteria for grading are listed at the end of the syllabus

Assessment	Grade Weighting	Deadline Assessment
Exam 1	20%	<b>09/11/2022</b> 11:00 – 12:00
Exam 2	20%	<b>21/12/2021</b> 11:00 - 12:00
Quizzes	5%	
Lab	15%	
Final Exam	40%	To be arranged later

#### **Description of Exams**

Test questions will predominately come from material presented in the lectures. Semester exams will be conducted during the regularly scheduled lecture period. Exam will consist of a combination of multiple choice, short answer, match, true and false and/or descriptive questions.

#### Homework:

Will be given for each chapter, while the chapter in progress you are supposed to work on them continuously and submit in next lecture when I finish the chapter.

You are also expected to work on in-chapter examples, self-tests and representative number of end of chapter problems. The answers of self-tests and end of chapter exercises are given at the end of the book.

#### Quizzes:

Unannounced quizzes will be given during or/and at the end of each chapter based upon the previous lectures. It will enforce that you come prepared to the class.

No make-up exams, homework or quizzes will be given. Only documented absences will be considered as per HU guidelines.

Grades are not negotiable and are awarded according to the following criteria\*:

Letter Grade	Description	<b>Grade Points</b>
A+	Excellent	4.00
А		3.75
A-		3.50
B+	Very Good	3.25
В		3.00
B-		2.75
C+	Good	2.50
С		2.25
C-		2.00
D+	Pass	1.75
D	Pass	1.50
F	Fail	0.00

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# WEEKLY LECTURE SCHEDULE AND CONTENT DISTRIBUTION "Lecture hours and weeks are approximate and may change as needed"

Part One 1 Imaging Pulse Sequences and Image Artifacts	Week 1- 8	24 lecture hours
1.1 Fast Gradient echo-Based Imaging Sequences		
1.2   Fast Spin echo-Based Imaging Sequences		
1.3 Echo Planar Imaging (EPI)		
1.4 Parallel Imaging		
1.5 Tissue suppression techniques		
1.6 MR image artifacts		
Part Two: MR Advanced Applications	Week 9-14	18 lecture hours
2.1 Magnetization Transfer (MT) Imaging		
2.2 Diffusion Imaging		
2.3 Flow, Cardiac Imaging and MR Angiography		
2.4 Functional MRI (fMRI)		
2.5 MR spectroscopy (MRS)		
Part Three Practical Lab	Week 1-14	52 lecture hours
A) MRI Protocols		
Brain / Head Protocols	Week 1 - 4	
<ul> <li>Brain</li> </ul>		
<ul> <li>Posterior Fossa and Internal Auditory Meati</li> <li>Dituitory Gland (Sella Turcica)</li> </ul>		
<ul> <li>Orbit and Ontic Nerves</li> </ul>		
<ul> <li>Para Nasal Sinuses</li> </ul>		
<ul> <li>Spine Protocols</li> </ul>	Week 5 - 6	
Cervical Spine		
Thoracic Spine		
Lumbar Spine	XV 1- 7	
Knee Protocols	Week /	
Shoulder Protocols	Week 8	
◆ MRCP	Week 9	
B) MRI device and Measurement Parameters	Week 10 - 1	14
<u>Review</u>	<u>Week 15</u>	
University Exams	<u>week 16</u>	

	Classroom l	Participation: Assessme	ent Criteria		
		Qua	lity		Score
Criteria	Excellent (5 points)	Good (4 points)	Satisfactory (3 points)	Needs Improvement (2 points)	
Degree to which student integrates course readings into classroom participation	often cites from readings; uses readings to support points; - often articulates "fit" of readings with topic at hand.	-occasionally cites from readings; - sometimes uses readings to support points; -occasionally articulates "fit" of readings with topic at hand.	<ul> <li>-rarely able to cite</li> <li>from readings;</li> <li>- rarely uses</li> <li>readings to</li> <li>support points;</li> <li>- rarely articulates</li> <li>"fit" of readings</li> <li>with topic at hand</li> </ul>	-unable to cite from readings; -cannot use readings to support points; cannot articulates "fit" of readings with topic at hand .	
Interaction/ participation in classroom discussions	-always a willing participant, responds frequently to questions; - routinely volunteers point of view .	<ul> <li>-often a willing participant,</li> <li>- responds occasionally to questions;</li> <li>- occasionally volunteers point of view .</li> </ul>	<ul> <li>-rarely a willing participant,</li> <li>- rarely able to respond to questions;</li> <li>- rarely volunteers point of view .</li> </ul>	<ul> <li>-never a willing participant.,</li> <li>- never able to respond to questions;</li> <li>- never volunteers point of view .</li> </ul>	
Interaction/partici pation in classroom learning activities	-always a willing participant; -acts appropriately during all role plays; - responds frequently to questions; - routinely volunteers point of view.	-often a willing participant; -acts appropriately during role plays; - responds occasionally to questions; -occasionally volunteers point of view.	-rarely a willing participant. -occasionally acts inappropriately during role plays; - rarely able to respond to direct questions; -rarely volunteers point of view .	<ul> <li>-never a willing participant</li> <li>- often acts inappropriately during role plays;,</li> <li>- never able to respond to direct questions;</li> <li>- never volunteers point of view.</li> </ul>	
Demonstration of professional attitude and demeanor	-always demonstrates commitment through thorough preparation; - always arrives on time; - often solicits instructors' perspective outside class.	rarely unprepared; rarely arrives late; - occasionally solicits instructors' perspective outside class .	-often unprepared; occasionally arrives late; - rarely solicits instructors' perspective outside class .	-rarely prepared; - often arrives late; -never solicits instructors' perspective outside class	

Classroom Participation: Oral Presentation											
Element	Excellent		Satisfactory		Needs Improvement			Points			
	8	7	6	5	4	3		2	1	0	
Organization	<ul> <li>There seque inform</li> <li>Title slide approximation</li> </ul>	is a logical ence of nation. slide and cl- are included opriately.	osing 1	<ul> <li>There sequing information</li> <li>Title slide</li> </ul>	e is some lo ence of mation. slide and cl s are includ	ogical osing ed.	T     n     s     in     T     C     in	Ther o equanfor Title losi nclu	re is little o logica ence o rmation. slide and/ o ng slides are ided.	r ll f r e not	
Slide Design (text, colors, background, illustrations, size, titles, subtitles)	<ul> <li>Prese attrac appea</li> </ul>	ntation is tive and lling to view	/ers.	<ul> <li>Pres som view</li> </ul>	entation is ewhat appea vers.	ling to	• L h n a	Little as b nake ppe	e to no attem been made to e presentation aling to view	npt o on wers.	
Content	<ul> <li>Presentation covers topic completely and in depth.</li> <li>Information is clear,</li> <li>Some infor is somewhat</li> </ul>		entation incl e essential mation. ne informati mewhat	ludes	<ul> <li>P</li> <li>in</li> <li>in</li> </ul>	Presencture nclu ssen nfor nfor	entation ides little ntial rmation. rmation is				
	accur	ate.		conf incorrec	using, t, or flawed.	11	confusing, inaccurate, or flawed.				
Language	<ul> <li>Spelling, grammar, usage, and punctuation are accurate</li> <li>There are minor problem in spelling, grammar, usage, and/or punctuation.</li> </ul>		problems nmar,	I e g a	rror rror ram nd/o	e are persist rs in spelling mar, usage, or punctuatio	ent 5, on.				
	<ul> <li>Fluen</li> </ul>	it and effect	ive				L a	less nd e	or not fluen	t	
Delivery	<ul> <li>Ideas comm enthu voice clear</li> <li>There eye co audie</li> </ul>	were nunicated w siasm, prop projection delivery. e was suffici ontact with nce.	ith er and ent	<ul> <li>Thercomvoic prepworl eye</li> <li>Insuverb skill</li> </ul>	e was some municating e projection aration, inco c, and/or ins contact. fficient use of al communi s.	difficulty ideas due to , lack of omplete ufficient of non- cation	T     d     c     d     p     p     in     a     c	Ther liffic om lue t proje prepa ncon nd/o onta	re was great culty municating i to poor voice ection, lack of aration, mplete work or little or no act.	deas e of c, o eye	
	• There of oth comn	e were suffic her non-verb nunication s	bal balls.	<ul> <li>Deli som</li> </ul>	very pace is ewhat appro	priate.		vo u verba omi	al munication		

	<ul> <li>Appropriate delivery pace was used.</li> </ul>		<ul> <li>skills.</li> <li>Inappropriate delivery pace was used.</li> </ul>
Interaction with Audience	<ul> <li>Answers to questions are coherent and complete.</li> </ul>	<ul> <li>Most answers to questions are coherent and complete.</li> </ul>	<ul> <li>Answers to questions are neither coherent nor complete.</li> </ul>
	<ul> <li>Answers demonstrate confidence and extensive knowledge.</li> </ul>	<ul> <li>Answers somehow demonstrate confidence and extensive knowledge.</li> </ul>	<ul> <li>Is tentative or unclear in responses.</li> </ul>