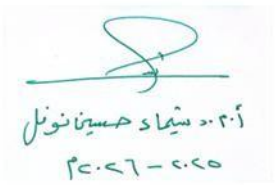
MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	medical imaging			**Module Delivery**	
Module Type	Core			☐ **Theory**	
Module Code	MPH36026			☐ **Lecture**	
ECTS Credits	6 ECTS			☐ **Lab**	
SWL (hr/sem)				☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Level	UG III		**Semester of Delivery**	2	
Administering Department	MPH		**College**	AMS	
Module Leader	Ismail Mohammed El-Desouki		**e-mail**	ismail.m@uowa.edu.iq	
Module Leader's Acad. Title	Assistant Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Ismail Mohammed El-Desouki		**e-mail**	ismail.m@uowa.edu.iq	
Peer Reviewer Name	Assist. Prof. Dr. Shaimaa Hussein Nofal		**e-mail**	shaymaa@uowa.edu.iq	
Scientific Committee Approval Date	February 7, 2026		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	None
Co-requisites module	None	**Semester**	None



Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. Introduce the fundamental physical principles underlying the main medical imaging modalities including X-ray, ultrasound, computed tomography (CT), magnetic resonance imaging (MRI), and nuclear medicine. 2. Familiarize students with the history and development of medical imaging technologies. 3. Explain the mechanisms of image formation and the types of physical signals used in medical imaging. 4. Develop understanding of system components and technical parameters that influence image quality. 5. Enable students to critically assess the strengths, limitations, and appropriate clinical applications of each imaging modality. 6. Highlight the importance of safety and radiation protection in diagnostic imaging practices.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. **Describe** the historical evolution and current landscape of medical imaging modalities. 2. **Classify** the physical signals (e.g., X-rays, sound waves, magnetic fields, radioactive emissions) used in different imaging systems. 3. **Explain** the physical principles, system architecture, and image acquisition processes in: • Projection radiography • Fluoroscopy • Mammography • Computed Tomography (CT) • Ultrasound Imaging • Magnetic Resonance Imaging (MRI) • Nuclear Medicine (Planar Scintigraphy and Emission Computed Tomography) 4. **Interpret** key concepts of image quality, including spatial resolution, contrast, noise, and artifacts. 5. **Apply** principles of signals and systems to understand image formation and reconstruction processes. a. **Differentiate** between imaging modalities in terms of technology, diagnostic applications, and limitations. b. **Evaluate** the factors affecting image quality and their impact on clinical diagnosis. c. **Discuss** safety considerations including radiation dose, biological effects, and protection measures relevant to each imaging modality. d. **Analyze** medical images in terms of their technical characteristics and diagnostic information. 6. **Demonstrate** a foundational understanding that prepares students for further study or clinical training in medical imaging.
Indicative Contents المحتويات الإرشادية	Theory Lectures Learning concepts of each theoretical lecture or groups of lectures. [SSWL= 28] Lab. Lectures Learning concepts of each laboratory lecture or groups of lectures. [SSWL= 30] Total hrs = ∑SSWL + (Mid Exam hrs+ Final Exam hrs) Total hrs = 28 +30 + 1 +3 = 62

Learning and Teaching Strategies

اس رتاتيجيات التعلم والتعليم

Strategies	**1.** Lecture **2.** Problem-based learning (PBL) **3.** Peer teaching and collaborative learning **4.** Reflective practice **5.** Workshops **6.** Laboratory sessions **7.** Student groups. **8.** Emphasis will be placed on linking physical principles to clinical imaging scenarios. **9.** Multimedia presentations (animations, videos, diagnostic images) will be used to illustrate complex concepts. **10.** Discussion. **11.** Giving students assignments to solve problems. **12.** Assigning students to prepare reports related to the course.

Student Workload (SWL)

الحمل الدرا يس للطالب محسوب لـ ١٥ أسبوعا

Structured SWL (h/sem) الحمل الدرا يس المنتظم للطالب خلال الفصل	76	**Structured SWL (h/w)** الحمل الدرا يس المنتظم للطالب أسبوعيا	5.07
Unstructured SWL (h/sem) الحمل الدرا يس غ رت المنتظم للطالب خلال الفصل	124	**Unstructured SWL (h/w)** الحمل الدرا يس غ رت المنتظم للطالب أسبوعيا	8.27
Total SWL (h/sem) الحمل الدرا يس الك يل للطالب خلال الفصل	**200**		

Module Evaluation

تقييم المادة الدراسية

		Time Number	Weight (Marks)	Week Due															Relevant Learning Outcome									
				W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10
Formative	Quizzes	2	10%				x				x											x							
	Report	2	10%					x						x					x				x						
	Lab Report	1	5%									x														(			
	Project	1	5%												x								x			(			
	Online Assig.	-	-																										
	Onsite Assig.	1	10%										x								(			(					
	Seminar	-	-																										

Summative	Mid. Exam	1hr	10% (10)	
	Final Exam	3hr	50% (50)	Week 16
Total assessment			100%	

Delivery Plan (Weekly Syllabus)

المنهاج الاسبو يع النظري

	Material Covered
Week 1	Introduction, History of Medical Imaging, Physical Signals, Imaging Modalities
Week 2	Image Quality, Signals and Systems
Week 3	Physics of Radiography
Week 4	Projection Radiography
Week 5	Fluoroscopy
Week 6	Mammography
Week 7	Computed Tomography
Week 8	Mid-term exam
Week 9	The Physics of Ultrasound
Week 10	Ultrasound Imaging Systems
Week 11	Physics of Magnetic Resonance
Week 12	Magnetic Resonance Imaging
Week 13	The Physics of Nuclear Medicine
Week 14	Planar Scintigraphy
Week 15	Emission Computed Tomography

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبو يع للمخت.ت

	Material Covered
Week 1	**Introduction to Medical Imaging Lab & Safety Orientation** • Overview of imaging lab rules and equipment • Introduction to ionizing vs. non-ionizing radiation • Radiation safety procedures (ALARA, shielding, exposure limits)
Week 2	**Image Quality – Resolution, Contrast, Noise** • Use of phantoms to measure image quality (e.g., line pair resolution phantom, contrast-detail phantom) • Evaluate noise, resolution, and artifacts in sample images • SNR and CNR calculations
Week 3	**Basic Signal and System Analysis in Imaging**

	• Simulating basic signal acquisition and reconstruction • Time-domain and frequency-domain signal analysis (using MATLAB or Python) • Explore sampling, aliasing, and system transfer functions (MTF)
Week 4	**Digital Radiography (Projection X-Ray)** • Operation of a digital X-ray system or simulation software • Acquire and analyze radiographs of standard imaging phantoms • Effects of exposure settings (kVp, mAs) on image quality and dose
Week 5	**Fluoroscopy** • Simulated fluoroscopic imaging • Temporal resolution vs. spatial resolution trade-offs • Radiation dose tracking in real-time systems
Week 6	**Mammography** • Comparison of image quality requirements in mammography vs. general radiography
Week 7	**Computed Tomography (CT)** • CT image acquisition simulation or scanner interface demo • Reconstruct slices from raw projection data (FBP method) • Analyze CT number (HU), spatial resolution, and dose-length product (DLP) • Radiation dose mapping in CT
Week 8	Mid-term exam
Week 9	**Ultrasound Physics and Scanning Basics** • Use of diagnostic ultrasound scanner with tissue-mimicking phantoms • B-mode image acquisition and interpretation • Explore depth, frequency, and gain effects • Doppler basics (if equipment available)
Week 10	**Ultrasound Imaging Analysis** • Measurement of distances, velocities (Doppler), and tissue characterization • Use of software to segment and enhance ultrasound images • Discuss acoustic impedance, attenuation, and speckle
Week 11	**Magnetic Resonance Imaging (MRI) – Simulations** • MR signal generation and pulse sequence simulation (e.g., Spin Echo, Gradient Echo) • T1 and T2 contrast demonstration using simulated phantoms • Understanding k-space and reconstruction steps
Week 12	**Nuclear Medicine – Planar Imaging** • Simulate gamma camera imaging using educational software • Understand radiopharmaceutical distributions using phantom data • Image artifacts (e.g., septal penetration, scatter)
Week 13	**SPECT and PET Imaging** • Reconstruction of tomographic nuclear medicine images (iterative algorithms) • Resolution vs. sensitivity in SPECT/PET • Attenuation correction and co-registration with CT/MRI
Week 14	**Image Fusion & Multi-modality Imaging** • Practice aligning and fusing PET/CT or SPECT/CT data • Image registration tools and ROI analysis Explore clinical benefits and challenges of hybrid systems
Week 15	**Project-Based Lab or Case Review** • Mini-group project (e.g., comparing image quality or dosimetry across modalities) • Clinical case analysis: modality selection and diagnostic reasoning • Presentation of lab findings and protocol recommendations

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	The Essential Physics of Medical Imaging, 3rd ed Bushberg, J T., Seibert, J. A, Boone, J M., Leidholdt Jr., E M, Lippincott Williams and Wilkins, 2011. ISBN: 9780781780575	No
Recommended Texts	1. Medical Imaging: Techniques, Reflection and Evaluation. Carver, Elizabeth, and Barry Carver. Elsevier Health Sciences, 2012. 2. Diagnostic Radiology Physics: A Handbook for Teachers and Students" International atomic energy agency, Vienna, 2014	No
Websites	https://library.icc.edu/c.php?g=345378&p=2327371 https://www.sciencedirect.com/ https://www.udemy.com/topic/medical-imaging/	

Grading Scheme
مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.