MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Medical Diagnostic Instrumentation I**			**Module Delivery**	
Module Type	**Core**			☒**Theory** **Lecture** ☒**Lab** ☐**Tutorial** ☒ **Practical** ☐**Seminar**	
Module Code	**UOMU024051**				
ECTS Credits	**7**				
SWL (hr/sem)	**175**				
Module Level		UGIII	**Semester of Delivery**		5
Administering Department		MIET	**College**	EETC	
Module Leader	Saad mother abbas		**e-mail**	ghaidaakhalid@mtu.edu.iq	
Module Leader's Acad. Title		Assistant Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor			**e-mail**		
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Scientific Committee Approval Date	8/11/2023		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Anatomy & Physiology	**Semester**	UGII - S3
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The module aims: 1. To generate a grounding knowledge base for the students which allows them understanding the technology and principles applied in a medical environment. 2. To understand the nature of physiological signals and how they can be acquired, analysed and visualised. 3. To provide a grounding in the theory of biomedical measurement systems, including sensors, signal conditioning methods, measurement techniques, patient interfacing and instrumentation used in biomedicine. 4. To introduce students to design strategies of biomedical devices. 5. To develop prototypes of medical instruments in an accompanying laboratory session. 6. To demonstrate how modern biomedical instruments combine traditional instrumentation techniques and technological innovation, including software presentation and analysis of data. 7. To be able to enter a wide range of medical related industries, clinical environments or professional biomedical research programs.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of the module, students should be able to: 1. (a). Understanding the principles of operation of important sensors used in biomedical instrumentation and measurement. (b). Understanding the technical specifications of commercially produced sensors used for this purposes. 2. (a). Being able to specify and design instrumentation and measurement systems that employ these sensors and which, as appropriate, enable safe interface with the human body.(b). Recognised and understand the characteristics of the physiological signals being measured; 3. (a). Being able to offer realistic solutions to clinical measurement problems and to justify the choices. (b). Having a sufficient knowledge in the subject to be able to investigate and evaluate new designs of biomedical sensors and instruments. (c) Explain the operating principles of biomedical transducers for the measurement of biopotentials (ECG, EMG, EEG, EOG) and other critical physiological variables such as blood pressure, flow, and temperature. 4. (a) Design and build analog signal conditioning circuits that provide reliable biopotentialmeasurements, e.g.ECG .(b) Explain the physical principles underlying the function of biopotential electrodes; (c) Demonstrate knowledge of electrical safety considerations in the medical

	environment. 5. (a) A respirometer is a device used to measure the rate of respiration of a living organism by measuring its rate of exchange of oxygen and/or carbon dioxide. They allow investigation into how factors such as age, or chemicals affect the rate of respiration. (b).The patient monitoring systems in healthcare are collections of machines or equipment used to constantly monitor patients through various vital signs and warning systems to detect and record changes in patient wellbeing. 6. Ambulatory monitors are devices that record the electrical activity in your heart. These are used to detect heart rhythm problems over a longer period of time, and you can take them home with you. They're an invaluable tool when it comes to diagnosing problems that happen unpredictably and outside of a medical setting. 7. Electronic fetal monitoring is a procedure in which instruments are used to continuously record the heartbeat of the fetus and the contractions of the woman's uterus during labor. 8. An endoscope is an inspection instrument composed of image sensor, optical lens, light source and mechanical device, which is used to look deep into the body by way of openings such as the mouth or anus. 9. There are many direct and indirect (noninvasive) methods of measuring cardiac output. Several instruments can measure blood pressure quickly and with little discomfort. A sphygmomanometer is commonly used. 10. There are three different types of eye exams, including a comprehensive eye exam, a routine eye exam, and a contact lens exam. 11. Pulmonary function tests (PFTs) are noninvasive tests that show how well the lungs are working. The tests measure lung volume, capacity, rates of flow, and gas exchange. 12. Patients who have a tumor in or around the ear may undergo audiometry testing to determine whether hearing loss has occurred or to monitor their hearing before and after surgery. 13. (a). An arterial blood gas (ABG) test measures the levels of oxygen and carbon dioxide in your blood as well as the pH balance in your blood. (b). The blood cell counter measure of the number of red blood cells, white blood cells, and platelets in the blood. 14. (a). Hospitals can ensure patient safety and prevent untoward harm to patients who seek treatment with these steps. (b). Apply safety standards and select disposal method and procedures for electrical diagnostic equipment.
Indicative Contents المحتويات الإرشادية	The indicative contents of module include: <u>Biopotential amplifiers:</u> Physiological quantities, basic concepts and principles of medical

	instrumentation Bio-potentials, electrodes and amplifiers, static and dynamic characteristics of measurement systems, noise and noise reduction, sensor characterization. [5 hr.] <u>Instrumentation amplifier:</u> Signal conditioning. Digital/analog conversion Electrodes (Oxidation/reduction, electrolytes, electrode electrical models) Advanced conditioning circuits (noise, interference, shielding, active shielding, driven right leg active ground). Sensing displacement (strain gauges, LVDTs, piezocrystals, MEMS accelerometers and gyroscopes, optical sensors) * Bridges (no bridge; 1/4, 1/2, full bridge) * Electrical safety [10 hrs] <u>Introduction to sensors and signal processing:</u> transducers, sensors and instruments; calibration; accuracy and error; amplifiers; filters; software and hardware signal processing. Nature of biomedical signals: physical signals (force, torque, flow, pressure as well as thermal, geometric and kinematic quantities); biopotentials; chemical signals. [10 hr.] <u>Medical measurement systems:</u> (EEG, ECG, EMG, EOG,...) Measurement constraints in the clinical environment, invasive and non-invasive measurements, Biomedical and chemical biosensors, Measurement of blood pressure, flow and volume, pulse oximetry and respiratory performance; Clinical laboratory instrumentation, and applications in patient monitoring. [15 hrs] <u>Protection and safety:</u> medical ethics; mechanical safety; electrical safety; biological hazards; chemical safety; radiation protection. [5 hrs] <u>Introduction to sensors and signal processing:</u> transducers, sensors and instruments; calibration; accuracy and error; amplifiers; filters; software and hardware signal processing. (b). Nature of biomedical signals: physical signals (force, torque, flow, pressure as well as thermal, geometric and kinematic quantities); biopotentials; chemical signals. Transducers of biomedical signals and their application: biopotential electrodes and amplifiers; pressure sensors; flow sensors; optical sensors; electrochemical sensors. [15 hrs].

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The learning and teaching strategies employed in this module can vary depending on the specific course. However, here are some common strategies that may be used with this course: **Teaching methods include:** • lectures • seminars • tutorials • lab experiments • design assignments • industrial visits • professional training • a variety of projects **Assessment :** methods of assessment include a combination of: • coursework • group project reports • lab reports • written exams.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	79	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	96	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	10% (10)	5, 10	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab.	12	15% (10)	Continuous	
	Report	1	5% (10)	13	LO # 5, 8 and 10
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-7
	Final Exam	4 hr	50 % (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Fundamentals of Medical Instrumentation.
Week 2	Bioelectric Signals and Electrodes, Physiological Transducers, Recording System.
Week 3	Biomedical Recorders.(ECG, EMG,EEG,EOG,VCG,PCG,…….etc.).
Week 4	Respiratory System Measurements, Respiration Monitoring and Apnea Detection, Oximeters.
Week 5	Patient Monitoring Systems, Coronary Care Unit (CCU).
Week 6	Arrhythmia and Ambulatory Monitoring Instruments.
Week 7	Midterm exam
Week 8	Foetal Monitoring Instruments/Systems.
Week 9	Blood Flow and Cardiac Output Measurements and Devices. Endoscopy.
Week 10	Advanced Vision and Eye Testing Instruments
Week 11	Pulmonary Function System.
Week 12	Pulmonary Function System.
Week 13	Equipment for Diagnostic Audiology and Hearing Tests.
Week 14	Patient Safety, Regulations and Safety Measures.
Week 15	Recap and Final Assessments: Review of the Entire Syllabus, Revision Sessions, and **Preparing for final exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Introduction to the Medical diagnostic instrumentation lab.
Week2	Biomedical signals recorders (ECG)
Week3	Biomedical signals recorders (ECG)
Week 4	Biomedical signals recorders (EMG, EEG , ERG, EOG).
Week 5	Equipments for patient monitoring systems, (CCU), and ambulatory monitoring instruments.
Week 6	Equipments for foetal monitoring system.
Week 7	Equipments for cardiac output measurements..
Week 8	Equipments for blood flow measurement.
Week 9	Endoscopy.
Week 10	Advanced vision and eye testing instruments (Ophthalmoscopy, Retinoscopy, Ocular tonometry, Slit lamp, Optical coherence tomography,…..etc).
Week 11	Advanced vision and eye testing instruments (Ophthalmoscopy, Retinoscopy, Ocular tonometry, Slit lamp, Optical coherence tomography,…..etc).
Week 12	Pulmonary function testing equipments and machines (Spirometer, Body plethysmograph., Pulmonary gas analyzer, Gas-conditioning device, Blood gas analyzer, Silverman pneumotachometer, Pulse oximeter,…..etc).
Week 13	Equipments for diagnostic audiology (ABR, AOE, Audiometers, Tympanometer, Hearing aid fitting systems, Balance testing equipment….. etc).
Week 14	Equipments for diagnostic audiology (ABR, AOE, Audiometers, Tympanometer, Hearing aid fitting systems, Balance testing equipment….. etc).
Week 15	Preparatory week before the final exam.
Week 16	Final test.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. Khandpur , R. S. (1990) . Handbook of Biomedical	**Yes**

	Instrumentation , Tata McGraw Hill Publishing Co. 2. Joseph D. Bronzino (2006). The Biomedical Engineering Handbook, 3rd. Edition. Germany: Taylor & Francis.	
Recommended Texts	1. Press.Joseph D. Bronzino (2006). Medical Devices and Human Engineering. (2017). United Kingdom: CRC Press. 2. Khandpur, R. S. (2004). Biomedical Instrumentation: Technology and Applications. India: McGraw Hill LLC. ***3.*** Brown, J. M., Carr, J. J. (2001). Introduction to Biomedical Equipment Technology. India: Prentice Hall.	**No**
Websites		

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.