وزارة التعليم العالي والبحث العلمي جـــهاز
الإشـــراف والتقـــويم العلـمي
دائرة ضمان الجودة والاعتماد الأكاديمي

استمارة وصف البرنامج الاكاديمي للعام الدراسي ٢٠٢٤_٢٠٢٥ للكليات والمعاهد

الجامعة : جامعة شط العرب الاهلية
الكلية /المعهد : الكلية التقنية الهندسية
القسم العلمي : قسم هندسة تقنيات الأجهزة الطبية
تاريخ ملء الملف : 2025/8/4

التوقيع :
اسم رئيس القسم : أ.م.د. نبيل حسين
التاريخ : 2025/8/4

التوقيع :
اسم المعاون العلمي: أ.د. كامل حسين السوداني
التاريخ : 4/8/2025

الاستاذ الدكتور
كامل حسين السوداني
كيمياء تحليلية

الكلية التقنية الهندسية
اللجنة الامتحانية
هندسة تقنيات الاجهزة الطبية

دقق الملف من قبل
شعبة ضمان الجودة والأداء الجامعي
اسم مدير شعبة ضمان الجودة والأداء الجامعي: التاريخ
/ /
التوقيع

مصادقة السيد العميد

أ.م.د. مازن عبدالاله علوان
عميد الكلية التقنية الهندسية

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Biomedical Transducers and Sensors**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MIET2205**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	UGII		**Semester of Delivery**	4	
Administering Department	MIET		**College**	EETC	
Module Leader	Dr. Mohammed Saeed Mohammed		**e-mail**	mohammedsaeed@mtu.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Asst . Lect Suha Sabeeh Ahmed		**e-mail**	suhasabeh@mtu.edu.iq	
Peer Reviewer Name	Prof. Dr. Sadik Kamel Gharghan		**e-mail**	sadik.gharghan@mtu.edu.iq	
Scientific Committee Approval Date	8/11/2023		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Fundamental of Electrical Engineering (AC) - MIET1201	**Semester**	UGI-S2
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. Analyze errors and uncertainty of experimental results obtained from biomedical sensors. 2. Understand requirements, calibration, characteristics, and parameters of biomedical sensors. 3. Design with confidence signal conditioning systems required for processing the sensors responses. 4. Understand the operating principle, types, parameters, signal conditioning, and applications of resistive, reactance variation and self-generating sensors. 5. Understand the operating principle of different types of optical sensors and their features. 6. Understand the operation, models, and parameters of ultrasound transducers. 7. Understand the design, main building blocks, features, and calibration of intelligent sensors.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Define biomedical sensors, biosensors, and biomedical transducers. 2. Classify the biomedical sensors. Acquire knowledge about sensor data processing and feature extraction. 3. Recognize the requirements of biomedical sensors. 4. Explain the Static and dynamic characteristics of biomedical sensors. 5. Explain the requirements of signal conditioning circuits suitable for biomedical sensors. 6. Identify design principles of conditioning circuits. 7. Identify the different types of resistive, reactance variation and self- 8. generating sensors. 9. Explain the operating principle, parameters, calibration and applications. of resistive, reactance variation and self-generating sensors. 10. Identify the different types of optical sensors. 11. Reveal the advantages of optical sensors. 12. Classify ultrasound transducers. 13. Recognize the main parts of ultrasound transducers. 14. List the main features of intelligent sensors.
Indicative Contents المحتويات الإرشادية	<u>Indicative Contents including the following:</u> General concept and terminology, Sensor classification and calibration, static and dynamic characteristics, errors [10 hrs] Resistive Temperature Detectors (RTD), Thermistors, light-dependent resistors, signal conditioning for resistive sensors [5hrs] Capacitive sensors, Inductive sensors,

	Electromagnetic sensors, signal conditioning for reactance variation sensors [5 hrs] Thermoelectric sensors, Piezoelectric sensors, Electrochemical sensors, Signal conditioning for self-generating sensors.[7 hrs] Optical techniques, General principles of optical sensing, Fiber-optic basics, Fiber-optic sensor technologies and applications[7 hrs] Fundamentals of ultrasonic-based sensors, Ultrasonic-based sensing methods and applications.[8 hrs] Definition, parameters, features, operating principle , main building blocks and applications.[5 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Active learning, where students should be active and involved in the learning process inside the classroom, will be emphasized in the delivery of this course. ➢ Different active learning methods/approaches such as: Engaged Learning, Project-Based Learning, Cooperative Learning, Problem-based Learning, Structured Problem-solving, will be used. ➢ The teaching method that will be used in this course will be composed of a series of mini lectures interrupted with frequent discussions and brainstorming exercises. PowerPoint presentations will be prepared for the course materials. ➢ Use software packages for design and simulation of signal conditioning circuits implemented using these sensors.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	64	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	61	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	1	10% (10)	6,9	LO # 1-4, and 5-8
	Assignments	2	10% (5)	5,12	LO # 1-4, 5-10
	Projects / Lab.	1	10% (10)	Continuous	Continuous
	Report	1	10% (10)	14	LO # 5-14
Summative assessment	**Midterm Exam**	2 hr	10% (10)	12	LO # 1-11
	Final Exam	4hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1,2	**Introduction to Biomedical Sensors** General concept and terminology, Sensor classification and calibration, static and dynamic characteristics, errors and uncertainty.
Week 3,4	**Resistive Sensors and their signal conditioning** Potentiometers, Strain gages, Resistive Temperature Detectors (RTD), Thermistors, light-dependent resistors, signal conditioning for resistive sensors
Week 5,6	**Reactance Variation and Electromagnetic Sensors** Capacitive sensors, Inductive sensors, Electromagnetic sensors, signal conditioning for reactance variation sensors,

Week 7	**Mid- Exam**
Week 8,9	**Self-Generating Sensors and Signal Conditioning** Thermoelectric sensors, Piezoelectric sensors, Electrochemical sensors, Signal conditioning for self-generating sensors.
Week 10,11	**Optical Sensors** Optical techniques, General principles of optical sensing, Fiber-optic basics, Fiber-optic sensor technologies and applications.
Week 12,13	**Ultrasound Transducers** Fundamentals of ultrasonic-based sensors, Ultrasonic-based sensing methods and applications.
Week 14	**Intelligent Sensors** Definition, parameters, features, operating principle , main building blocks and applications.
Week 15	Preparatory week before final exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1,2	Characteristics of various Biomedical sensors(Pulse sensor, Galvanic skin Response, Glucose sensor, EMG sensor).
Week 3,4	Measurement of Resistance, Inductance and Capacitance using bridge circuits.
Week 5	Measurement of temperature using thermistor and RTD.
Week 6	Design of preamplifiers to acquire bio-signals along with impedance matching circuit using suitable ICs.
Week 7,8	Design of EEG, ECG amplifiers and Measurement of heart rate.
Week 9,10	Acquire and display electrical and biological biosignals on a computer using the appropriate hardware and software tools.
Week 11	e-Health Sensor Platform V2.0 using Arduino and Raspberry Pi.
Week 12	Measurement of respiration rate.

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Sensors and Signal Conditioning, Ramon Pallas-Areny and John G. Webster, John Wiley & Sons, 2001,2nd Edition	No
Recommended Texts	Biosensors: An Introduction , Eggins, Brian, John Wiley & Sons, 1996,1st Edition	No
Websites	https://www.multisim.com/	

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.