

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
Module Title	Instruments and Measurements		Module Delivery
Module Type	C		☒ Theory ☒ Lecture ☒ Lab ☒ Tutorial ☒ Practical ☐ Seminar
Module Code	ENG1244		
ECTS Credits	5		
SWL (hr/sem)	110 H/Sem.		
Module Level	2	Semester of Delivery	
Administering Department	Artificial Intelligence Eng.	College	College of Engineering
Module Leader	Rasha Ahmad Atfah	e-mail	Rasha.atfah@alayen.edu.iq
Module Leader's Acad. Title	Asst. Lec.	Module Leader's Qualification	MSc
Module Tutor	Rasha Ahmad Atfah	e-mail	Rasha.atfah@alayen.edu.iq
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	1.0

Relation with other Modules			
Prerequisite module	----	Semester	
Co-requisites module	---	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	Fundamental principles of electrical and electronic measurements – concepts of accuracy, precision, sensitivity, and error – static and dynamic characteristics of instruments – types and classifications of transducers – measurement of electrical quantities (voltage, current, power, energy, resistance) – measurement of non-electrical quantities (temperature, pressure, flow, displacement) – bridge circuits – digital and analog instruments – data acquisition systems (DAQ) – signal conditioning – calibration techniques – error analysis – measurement systems using microcontrollers – LabVIEW and MATLAB applications.



 1



Module Learning Outcomes	Knowledge	A1	A1.1: Apply modern measurement instruments and software tools in laboratory experiments. A1.2: Describe digital and analog measuring devices appropriately. A1.3 : Define the concept of Modern Electronic Instrumentation and Measurement devices. A1.4 : Recognize types and elements of measurement systems
		A3	A3.1: Conduct standard measurement experiments using appropriate instruments A3.2: Interpret and evaluate experimental data and measurement results. A3.3: Measure Non-Electrical Quantities. A3.4: Analysis Errors and System Evaluation A3.5: Applying electrical circuits
	Skills	B1	B1.1: Function efficiently as an individual. B1.2: Function as a member of multidisciplinary and multicultural teams.
	Ethics	C1	C1.1: Define professional and ethical responsibilities. C1.2: Demonstrate diversity in their commitment to ethical responsibilities.
Indicative Contents	Indicative content includes the following. Unit 1: Introduction to Measurement Systems - Importance of measurement in engineering – types and elements of measurement systems – accuracy, precision, error, sensitivity – standards and calibration. (8 hours) Unit 2: Electrical Measurement Techniques - Measurement of voltage, current, resistance, power, and energy – bridge circuits (Wheatstone, Maxwell, Schering) – analog and digital meters. (8 hours) Unit 3: Sensors and Transducers - Classification of sensors and transducers – resistive, capacitive, inductive transducers – thermistors, strain gauges, and LVDTs – signal conditioning and data conversion. (6 hours) Unit 4: Measurement of Non-Electrical Quantities - Temperature, pressure, flow, and displacement measurement – instrumentation for industrial applications. (6 hours) Unit 5: Data Acquisition and Computer-Based Measurement Systems - Introduction to data acquisition (DAQ) – ADC and DAC – interfacing with microcontrollers (e.g., Arduino) – LabVIEW and MATLAB for measurement simulation. (6 hours)		



	Unit 6: Error Analysis and System Evaluation • Error types and propagation – uncertainty calculation – accuracy verification and system performance testing – documentation and reporting of results. (6 hours).		
Learning and Teaching Strategies			
Strategies	• Lectures • Laboratory Sessions • Interactive Learning • Simulation and Digital Tools • Group Projects and Presentations • Self-Learning and Assignments		
Student Workload (SWL)			
Structured SWL (h/sem)	78	Structured SWL (h/w)	5.2
Unstructured SWL (h/sem)	۳۲	Unstructured SWL (h/w)	2.1
Total SWL (h/sem)	110		



Delivery Plan (Weekly Syllabus)		
المنهاج الاسبوعي النظري		
	Material Covered	LOs
Week 1	Introduction: importance of measurement, basic definitions (accuracy, precision, error, sensitivity).	
Week 2	Measurement systems: functional elements and characteristics of instruments.	A1, B1
Week 3	Static and dynamic characteristics of instruments – errors, calibration, standards.	A1, A3
Week 4	Resistive, capacitive, and inductive sensors – principles and applications.	A1, B1
Week 5	Transducers: classification, selection criteria, and signal conditioning.	A1, B1
Week 6	DC and AC bridges: Wheatstone, Maxwell, Schering bridges.	A1, B1
Week 7	Digital measurement systems: ADC, DAC, and digital voltmeters.	A1, B1
Week 8	Mid-term Exam.	A1
Week 9	Measurement of electrical quantities: voltage, current, resistance, power, energy.	A1, B1
Week 10	Electronic instruments: cathode-ray oscilloscope (CRO), function generator.	A1, B1, B1
Week 11	Data acquisition systems (DAQ) and sensors interfacing with microcontrollers.	A1, B1, B1
Week 12	Measurement of non-electrical quantities: temperature, pressure, flow, displacement.	A1, B1
Week 13	Error analysis and uncertainty calculation in measurement systems.	A1, B2, C1
Week 14	Computer-based measurements and LabVIEW introduction.	A1, B1, B2
Week 15	Project presentations / Review session.	A1, B1, B2, C1
Week 16	Preparatory week before the final exam.	All



Delivery Plan (Weekly Lab. Syllabus)		
المنهاج الاسبوعي للمختبر		
	Material Covered	LOs
Week 1	Familiarization with laboratory instruments: multimeter, oscilloscope, signal generator, and safety procedures.	
Week 2	Calibration of analog and digital meters using standard references.	A3, B1
Week 3	Measurement of resistance using Wheatstone bridge and error calculation.	A3, A3
Week 4	Measurement of inductance and capacitance using Maxwell and Schering bridge circuits.	A3, B1
Week 5	Study of transducers: LVDT, thermistor, and strain gauge characteristics.	A3, B1
Week 6	Measurement of temperature using RTD and thermocouple sensors.	A3, B1
Week 7	Digital voltmeter principles and data acquisition basics using microcontroller (e.g., Arduino).	A3, B1
Week 8	Midterm Practical Exam.	A3
Week 9	Measurement of frequency and time using an oscilloscope.	A3, B1
Week 10	Power and energy measurement using wattmeter and energy meter.	A3, B1, B1
Week 11	Signal conditioning circuits and DAQ interfacing.	A3, B1, B1
Week 12	Simulation of measurement systems using LabVIEW or MATLAB.	A3, B1
Week 13	Group project: design and testing of a simple measurement and control system.	A3, B2, C1
Week 14	Practical project review and result presentation.	A3, B1, B2
Week 15	Final Lab preparation and troubleshooting exercises.	A3, B1, B2, C1
		All



Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	A1
	Assignments	2	10% (10)	2, 4,6,8,10 and 12	A1
	Projects / Lab.	1	10% (10)	14	A3
	Report	1	10% (10)	13	A1,A3
Summative assessment	Midterm Exam	1hr	10% (10)	7	A1,A3
	Final Exam	3hr	50% (50)	15	A1,A3
Total assessment			100% (100 Marks)		

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1. Electronic Instrumentation and Measurements – David A. Bell. 2. Principles of Measurement Systems – John P. Bentley	Yes
Recommended Texts	1. Modern Electronic Instrumentation and Measurement Techniques – Albert D. Helfrick & William D. Cooper. 2. Measurement and Instrumentation: Theory and Application – Alan S. Morris & Reza Langari.	NO
Websites	https://eng.alayen.edu.iq/colleges/e/42	



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.				

