



Course Specification

DIPLOMA

Course Title: Engineering Measurements

Course Code: APRT2209

Program: Renewable energy technologies

Department: Diploma Department

College: The Applied College

Institution: Umm Al-Qura University

Version: 1

Last Revision Date: 10 February 2025



Table of Contents

A. General information about the course:	3
B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods	4
C. Course Content.....	4
D. Students Assessment Activities	5
E. Learning Resources and Facilities.....	5
F. Assessment of Course Quality	5
G. Specification Approval	6



A. General information about the course:

1. Course Identification

1. Credit hours: (3)

2. Course type

A. ☐ University ☐ College ☒ Department ☐ Track ☐ Others
B. ☒ Required ☐ Elective

3. Level/year at which this course is offered: (2nd Level / 1st Year)

4. Course General Description:

1. Course Description

This course introduces the basic concept of measuring system of major subjects related to mechanical engineering. The course is divided into two parts: the first one is to understand the basic concept of engineering measurements and instrumentations. This includes the basic definitions, characteristics of the input and output of signal, types of errors and uncertainty analysis, types of sensors and their working principles, calibration, data acquisition system, data analysis and representation. The second part of the course is dedicated to implement the gained knowledge to understand the measurements of physical variables such as length, angle, stress and strain, force and vibration.

5. Pre-requirements for this course (if any):

6. Co-requisites for this course (if any):

7. Course Main Objective(s):



Course Main Objective

1. The main objective of this course

- To give sufficient knowledge about the basics of a measuring system.
- To be able to perform statistical analysis on the measurements and estimate the random error.
- To be able to perform uncertainty analysis.
- Apply continuously theoretical and practical knowledge to select different measuring techniques.
- To equip students in working with projects and to take up research work in connected areas

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	5	100%
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> • Traditional classroom • E-learning 		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	30
2.	Laboratory/Studio	45
3.	Field	
4.	Tutorial	
5.	Others (specify)	
Total		75

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	To give sufficient knowledge about the basics of a measuring system.	K1	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
1.2	Understand deeply one or more areas of specific specialization in relation to the latest theories, research and professional practice in measurements.	K2	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
2.0	Skills			
2.1	Apply continuously theoretical and practical knowledge in dealing with a variety of contexts, new and unexpected scientific, and provide authentic and innovative responses to problems and issues. Make convincing and informed judgments in situations where complete or consistent information is not available.	S1	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
2.2	Extracts from published research or professional reports in mechanical measurements and can apply them, develops important new ideas and integrates them into their knowledge or	S2	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam



Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	experiences. Applies specialized and general research methods in the creative analysis of complex issues and in the development of results and proposals related to its academic field.			
2.3	Plan and execute large projects or part of scientific research independently, applying his theoretical and practical knowledge and using research methods to arrive at valuable conclusions that lead to important additions to current knowledge or professional practices in certain field of thermal measurements.	S3	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
3.0	Values, autonomy, and responsibility			





Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
3.1	Practice knowledge and skills to identify, independently and responsibly, the real problem by realizing a given problem statement in real selection of different measurements, perform Literature Review to establish the need to solve the problem, define the real problem and develop technical objectives and a mission statement based on assumptions and realistic constraints to guide him to solve the problem.	V3	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
3.2	Communicate individual work well in written / oral form for diversified audience.	V4	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
3.3	Conduct professionally and perform research in his engineering discipline to write / publish a scholarly article.	V4	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam

C. Course Content

No	List of Topics	Contact Hours
1. 1	<p>Introduction and basic definitions.</p> <ul style="list-style-type: none"> Stages of a measuring system. The significance of mechanical measurement Fundamental methods of measurement The generalized measuring system Types of input signal Measurement standards 	3



	<ul style="list-style-type: none"> • Characteristics of measuring system <p>Classification of measuring errors</p>	
2.2	<p>Statistical Analysis and Random Error Estimation</p> <ul style="list-style-type: none"> • Average, deviation, standard deviation. • Probable error for a population measurement • Probable error for a sample of measurements • Standard Deviation of the Means for a sample • Checking for outliers using Chauvenet's Criterion • Introduction to Regression Analysis <p>Data representation</p>	6
3	<p>Uncertainty Analysis</p> <ul style="list-style-type: none"> • Measurement Errors • Combining elemental errors: RSS method • Design-Stage Uncertainty • Zero order and systematic uncertainty <p>Error propagation to a result</p>	6
4	<p>Linear and angular Measurements</p> <ul style="list-style-type: none"> • Introduction • Gauge blocks • Vernier caliper • Micrometers • Dial Indicators • Vernier Protractor • Sine Bar • Sensitive (Spirit) Levels • Pendulum Clinometer <p>Autocollimator</p>	6
5	<p>Stress, Strain and Force Measurements</p> <ul style="list-style-type: none"> • Resistance Strain Gauges • Strain Gauge Construction and Bonding • Strain Gauge Material • Specification of Strain Gauges • Strain Gauge Electrical Circuits • Elastic Elements for Force Measurements <p>Torque Measurements</p>	6
6	<p>Motion and Vibration Measurements</p> <ul style="list-style-type: none"> • Measurement of Angular Velocity • Power Measurements • Vibration measurements <p>Principles of the Seismic Instrument</p>	3
7	Lab Work	45
Total		75



D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1. 1	Quizzes and Exercise	3-8	%10
2. 2	Report & Presentation	3-8	%20
3. 3	Mid-term	9	%20
4	Final exam	17/18	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	
Supportive References	
Electronic Materials	<ul style="list-style-type: none"> All the lecture notes
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (projector, smart board, software)	Data show
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Faculty	Direct (project, HW, Quiz, midterm and final exam)
Effectiveness of Students assessment	Students	Indirect (Student Survey)
Quality of learning resources	Program Coordinator	Direct analysis
The extent to which CLOs have been achieved	Program Coordinator	Direct analysis
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify))



Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Umm Al-Qura University Council
REFERENCE NO.	851141114462/190394
DATE	22/11/1446

