COURSE PLAN

FIRST: BASIC INFORMATION

College	
College	: Faculty of Karak – AL-Balqa Applied University
Department	: Mechanical Engineering
Course	
Course Title	: Mechanical Measurements
Course Code	: 020209213
Credit Hours	: 2 (1 Theoretical, 1 Practical)
Prerequisite	: 020209111
Instructor	
Name	: Dr. Jamil Haddad
Office No.	:
Tel (Ext)	:
E-mail	: drjamil@bau.edu.jo
Office Hours	:

Class Times

The building	Today	Start time	End time	Hall number

Text Book	
Title	: J.P. Holman, Experimental Methods for Engineers, McGraw-Hill, 7th Edition, 2010

References

1. Alan S Morris; Measurement and Instrumentation Principles, Butterworth-Heinemann. Third Edition, 2001
2. Allan R. Hambley, Electrical Engineering Principles and Applications, Third Edition, 2009

SECOND: PROFESSIONAL INFORMATION

COURSE DESCRIPTION

This course deals with definitions and terms applicable to mechanical measurements, process or the act of measurement, good measurement practice, international system of units (SI), uncertainty analysis, geometrical tolerance, measurement instruments for length and mass, temperature and pressure measurement. the force, torque, strain, motion and vibration measurement, visual and nondestructive testing.

COURSE OBJECTIVES

The objectives of this course are to enable the student to do the following:

- Explain definitions and terms applicable to mechanical measurements
- Explain how to measure steady-state and dynamic phenomena.
- Explain the dynamic response and the calibration of instruments for such measurements.
- Ability to apply simple statistical methods to experimental data to quantify it accordingly.

- Ability to use computer-assisted/computer-controlled instrumentation and data acquisition systems.
- Explain about various measurement devices, their characteristics, their operation and their limitations.

COURSE LEARNING OUTCOMES

On successful completion of this course, students are expected to be able to:

CLO1. Explain definitions, terms and international system of units (SI) applicable to mechanical measurements
CLO2. Explain process or the act of measurement
CLO3. Describe the application of metrology in engineering and manufacturing
CLO4. Plan measurements of products or parts and calibration of instruments at specified levels of accuracy
CLO5. Identify and specify appropriate geometric or dimensional features of products or parts to be measured or inspected
CLO6. Explain measurement instruments for length and mass, temperature and pressure measurements
CLO7. Identify the force, torque, strain, motion and vibration measurement
CLO8. Explain visual and nondestructive testing

COURSE SYLLABUS

Week	Unit	Content	Related L.O. and reference (Chapter)	Proposed assignments
1	Basic concepts of definitions, terms and mechanical measurements processes	• Definition of Terms • Calibration • Standards • Dimensions and Units • The generalized measurement system • Basic concepts in dynamic measurements	CLO1	
2	Analysis of experimental data	• Causes and types of experimental errors • Error analysis on a commonsense basis • Uncertainty analysis and propagation of uncertainty • Evaluation of uncertainties for complicated data reduction • Statistical analysis of experimental data • Probability distributions • The gaussian or normal error distribution • Comparison of data with normal distribution • The chi-square test of goodness of fit	CLO2	
3	Analysis of experimental data	• Method of least squares • The correlation coefficient • Multivariable regression • Standard deviation of the mean • Student’s t-distribution	CLO2	

Week	Unit	Content	Related L.O. and reference (Chapter)	Proposed assignments
		• Graphical analysis and curve fitting • Choice of graph formats • Causation, correlations, and curve-fits • General considerations in data analysis		
4	Basic electrical measurements and sensing devices	• Forces of electromagnetic origin • Waveform measures • Basic analog and digital meters • Basic input circuits • Amplifiers • Transformers • Power supplies • Signal conditioning	CLO3	
5	Basic electrical measurements and sensing devices	• The electronic and digital voltmeters • The oscilloscope • Output recorders • Counters—time and frequency Measurements • Transducers • Photoelectric effects • Photovoltaic cells • Magnetometer search coil • Comparison of analog and digital Instruments	CLO3	
6	Displacement and area measurement	• Dimensional measurements • Gage blocks • Optical methods • Pneumatic displacement gage • Area measurements • The planimeter, a device of historical Interest • Graphical and numerical methods for area measurement • Surface areas	CLO4	
7	Pressure measurement	• Dynamic response considerations • Mechanical pressure-measurement devices • Dead-weight tester • Bourdon-tube pressure gage • Diaphragm and bellows gages • The bridgman gage • Low-pressure measurement • The McLeod gage • Pirani thermal-conductivity gage • The knudsen and ionization gages • The alphatron	CLO5	

Week	Unit	Content	Related L.O. and reference (Chapter)	Proposed assignments
8	**Midterm Exam**			
9	Flow measurement	• Introduction • Positive-displacement methods • Flow-obstruction methods • Practical considerations for obstruction meters	CLO5	
10	The temperature measurements	• Introduction • Temperature scales • The ideal-gas thermometer • Temperature measurement by mechanical effects • Temperature measurement by electrical effects	CLO5	
11	The temperature measurements	• Temperature measurement by radiation effect of heat transfer on temperature measurement • Transient response of thermal systems thermocouple compensation • Temperature measurements in high-speed flow	CLO5	
12	The force, torque and strain	• Mass balance measurements • Elastic elements for force measurements • Torque measurements • Stress and strain measurements • Electrical-resistance strain gages	CLO6	
13	The force, torque and strain	• Measurement of resistance strain-gage outputs • Temperature compensation • Strain-gage rosettes • The unbonded resistance strain gage	CLO6	
14	Motion and vibration measurement	• Introduction • Two simple vibration instruments • Principles of the seismic instrument • Practical considerations for seismic instruments • Sound measurements	CLO6	
15	Visual and nondestructive testing	• Practical experiments	CLO7	
16	**Final Exam**			

COURSE LEARNING RESOURCES

The effectiveness of teaching in this course depends on making students familiar with definitions and terms applicable to mechanical measurements, process or the act of measurement, good measurement practice, International system of units (SI), Uncertainty analysis, geometrical tolerance, measurement instruments for length and mass, temperature and pressure measurement. The force, torque, strain, motion and vibration measurement visual and nondestructive testing.

Teaching methods:

- Problem-solving skills: through application of these principles to basic engineering problems.
- Online research skills on topics related to course objectives and recent developments in the field of mechanical engineering (welding and plumbing).
- Learning skills and adaptability: Developed by transferring students and reconfiguring work teams to enable them to adapt to other individuals from time to time.

ONLINE RESOURCES

1) http://www.npl.co.uk/upload/pdf/beg-guide-measurement-mech-eng.pdf
2) http://www.kelm.ftn.uns.ac.rs/literatura/si/pdf/Measurement%20Instrumentation%20Sensors.pdf

ASSESSMANT TOOLS

Assessment Tools	%
Projects and Quizzes	20%
MID Exam	30%
Final Exam	50%
Total Marks	100%

THIRD: COURSE RULES

ATTENDANCE RULES

Attendance and participation are extremely important, and the usual University rules will apply. Attendance will be recorded for each class. Absence of 10% will result in a first written warning. Absence of 15% of the course will result in a second warning. Absence of 20% or more will result in forfeiting the course and the student will not be permitted to attend the final examination. Should a student encounter any special circumstances (i.e. medical or personal), he/she is encouraged to discuss this with the instructor and written proof will be required to delete any absences from his/her attendance records.

GRADING SYSTEM

Example:

Average	Maximum	Minimum
Excellent	100%	90%
Very Good	89%	80%
Good	79%	70%
Satisfactory	69%	60%
Weak	59%	50%
Failed	49%	35%

REMARKS

{The instructor can add any comments and directives such as the attendance policy and topics related to ethics}

COURSE COORDINATOR

Course Coordinator	**Department Head:**
Signature:	**Signature:**
Date:	**Date:**