The University of Jordan
School of Engineering
Department of Mechatronics Engineering
1st Semester – A.Y. 2019/2020

Course: Transducers and Sensors– 0908451 (3 Cr. – Core Course)
Blended Learning Course

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Course Website: Course page:
elearning.ju.edu.jo
YouTube link:
https://www.youtube.com/playlist?list=PLXr7LBwddhmL55bhl7RnkYI3hPBclnZlT

Catalog Data: Transducer Technologies. Signal Conditioning and Signal processing. The measurement of non-electrical quantities is discussed in detail, covering temperature, pressure, flow, humidity, displacement, force, strain, torque, acceleration and vibration.

Prerequisites by Course:
- Measurements and Signal Processing

Prerequisites By Topic: The students are expected to have a good grounding in the principles of measurement and instrumentation, including the characteristics of measurement systems, how to deal with errors and the use of measurement devices.

Textbook:
- Mechanical Measurements, Thomas Beckwith, Roy Marangoni, John Lienhard, Pearson Education, Pearson International Edition, Sixth Edition.

References:
- Measurement & Instrumentation Principles, Alan S. Morris, Elsevier, 2001.
- Experimental Methods for Engineers, J.P. Holman, 7th Edition, McGraw Hill International Edition.
- Principles of Measurement Systems, John P. Bentley, Pearson Prentice Hall, Fourth Edition 2005.
- Measurement Systems: Application and Design, Ernest O. Doebelin, Fifth Edition, McGraw Hill, 2003.

Schedule & Duration: 15 Weeks, 30 lectures (50 minutes each) including exams. In addition, 15 classes will be online.

Minimum Student Material: Textbook, class handouts, scientific calculator, and access to a personal computer with MATLAB.

Minimum College Facilities: Classroom with whiteboard and projection display facilities, library, computational facilities with MATLAB and other engineering programs.

Course Objectives: The course aims to introduce the candidate to the concepts and principles of transducers as the most important element of measurement systems.

Course Learning Outcomes and Relation to ABET Student Outcomes:

Upon successful completion of this course, a student should:

1. Be able to prepare an effective presentation for a full measurement system designed by a team to measure a mechanical variable(s). [3]
2. Be able to design a brochure to market for the designed measurement system and get introduced to technical marketing. [3]
3. Be able to produce a video that comprehensively describes the designed measurement system in technical terms. [3]

Course Topics:

	Topic Description	Hrs
1.	**Transducer Technologies:** Types of transducers; characteristics of transducers; resistive transducers; magnetic transformers (inductive); capacitive transducers; piezoelectric effect; photoelectric effect; photoconductive transducers; photovoltaic cells; Hall effect transducers.	3
	Online videos: Lesson 1.1, Lesson 1.2.	
2.	**Measurement of displacement, distance/range, and proximity detection:** potentiometer type transducers; Linear variable differential transformer (LVDT); Ultrasonic method; Laser distance transducers (time of flight; triangulation method).	5
	Online videos: Lesson 2.1, Lesson 2.2, Lesson 2.3.	
3.	**Measurememnt of level:** application of displacement measurement in level measurement; Inductive; capacitive; infra-red.	5
	Online videos: Lesson 3.1, Lesson 3.2.	5
4.	**Measurement of force, stress, and strain:** Force, torque, stress, and strain; introduction to strain gauges; characteristics of strain gauges; the sensitivity of strain gauges; selection and use in bridges.	4
	Online videos: Lesson 4.1, Lesson 4.2.	
5.	**Measurement of pressure:** Dead weight tester; Bourdon tube; diaphragm and bellows type; commercial examples of pressure transducers.	3
	Online videos: Lesson 5.1, Lesson 5.2, Lesson 5.3.	3
6.	**Measurement of flow:** Positive displacement methods; obstruction methods; drag effect methods; hot wire anemometers.	
	Online videos: Lesson 6.1, Lesson 6.2, Lesson 6.3, Lesson 6.4.	3
7.	**Measurement of temperature:** Mechanical means; Resistance Temperature Detector (RTD); thermistor; thermoelectric effect (thermocouple); radiation methods; dynamic response, dynamic compensation and calculation of time constant.	3
	Online videos: Lesson 7.1, Lesson 7.2, Lesson 7.3, Lesson 7.4, Lesson 7.5, Lesson 7.6, Lesson 7.7, Lesson 7.8.	3
8.	**Measurement of acceleration and vibration:** Seismic instruments; MEMS accelerometer; inertial methods of motion measurement.	
9.	**Measurement of moisture & humidity:** Definitions of humidity and related concepts; dry bulb and wet bulb; psychrometer method; Dunmore electrical method; monolithic integrated circuit capacitive transducers with temperature compensation.	
	Online videos: Lesson 9.1.	
10.	**MATLAB Simscape:** Learning the modeling using MATLAB/ Simulink/ Simscape platform.	
	Online videos: Lesson M.1, Lesson M.2, Lesson M.3, Lesson M.4.	

Ground Rules:

Attendance is required and highly encouraged. To that end, attendance will be taken every lecture; Absence of more than *7 hours* will result in the expulsion of the student from the course.

Makeup Examinations:
There will be no makeup exams for any exam that will be taken during the course. Exceptions to this rule are restricted only to the following cases:

1. Death of only first-order relatives (father, mother, sister, or brother).
2. Hospital entry (in-patient) during the time of the examination.

Any other cases will be given the zero mark in the corresponding exam.

Assessments: Exam and a term project.

Grading policy:

Midterm Exam	**20%**
Project	**20%**
Online Quizzes	**10%**
MATLAB	**10 %**
Final Exam (including MATLAB)	**40 %**
Total	**100%**

Last Updated: Sep. 2019