The University of Jordan
School of Engineering
Department of Mechatronics Engineering
Second Semester – A.Y. 2016/2017

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

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Office Hours: Mon-Thu 1:00 PM – 3:00 PM
Email: h.khasawneh@gmail.com

Course Website: elearning.ju.edu.jo

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:

References:

Schedule & Duration: 14 Weeks, 42 lectures (50 minutes each) plus exams.

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

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. Identify the different types of transducer technologies. (a)
2. Understand the working principles of transducers used for the measurement of displacement, level, distance/range and proximity detection. (a, c)
3. Understand the working principles of transducers used for the measurement of force, stress, and strain. (a, c)
4. Understand the working principles of transducers used for the measurement of temperature; resistance temperature detector (RTD), thermistor, and thermoelectric effect. (a, c)
5. Understand the working principles of transducers used for the measurement of pressure and their dynamical characteristics. (a, c)
6. Understand the working principles of transducers used for the measurement of flow. (a, c)
7. Understand the differences between humidity and moisture and the transducers used to measure them. (a, c)
8. Understand the working principles of transducers used for the measurement of acceleration and vibration and their applications. (a, c)
9. Understand the working principles of transducers used for the measurement of viscosity and their applications. (a, c)
10. Understand the working principles of transducers used for the measurement of viscosity. (a, c)
11. Design a full measurement system within a team to measure one mechanical variable and document and present the work effectively. (c, d, g)

12. Using Transducers and Sensors to discuss some of the national, regional and international contemporary issues. (j)

Mapping to Student Outcomes

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<td>Will be measured</td>
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Course Topics:

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<th>Topic Description</th>
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<tr>
<td>1. Transducer Technologies: Types of transducers; characteristics of transducers; resistive transducer; differential transformer (inductive); capacitive transducer; piezoelectric effect; photoelectric effect; photoconductive transducer; photovoltaic cell; ionisation transducer; magnetometer search coil; Hall effect transducer.</td>
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<td>2. Measurement of displacement, level, distance/range and proximity detection: potentiometer type transducers; Linear variable differential transformer (LVDT); Ultrasonic method; Laser distance transducers (time of flight; triangulation method); application to level measurement; Inductive; capacitive; infra-red.</td>
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<td>3. Measurement of force, stresses, and strain: Force, torque, stress and strain; introduction to strain gauges; characteristics of strain gauges; sensitivity of strain gauges; selection; use in bridges.</td>
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<td>4. Measurement of temperature: Mechanical means; Resistance Temperature Detector (RTD); thermistor; thermoelectric effect (thermocouple); radiation methods; dynamic response, dynamic compensation and calculation of time constant.</td>
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<td>5. Measurement of pressure: Dead weight tester; Bourdon tube; diaphragm and bellows type; commercial examples of pressure transducers.</td>
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<td>6. Measurement of flow: Positive displacement methods; obstruction methods; drag effect methods; hot wire anemometers.</td>
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<td>7. Measurement of moisture &amp; 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.</td>
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<td>8. Measurement of acceleration and vibration: Seismic instruments; MEMS accelerometer; inertial methods of motion measurement;</td>
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<td>9. Measurement of viscosity: Different methods of measurement of viscosity; relationship between temperature and viscosity in liquids and gases.</td>
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<td>10. Measurement of sound: Sound measurement; methods of measurement and units; introduction to frequency analysis in sound measurement.</td>
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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.

Make up Examinations: There will be no make up exams for any exam that will be taken during the course. exceptions to this rule is 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: Exams, Quizzes, Projects, and Assignments.

Grading policy:

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<td>Midterm Exam</td>
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<td>Project</td>
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<tr>
<td>Final Exam</td>
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<td><strong>Total</strong></td>
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Last Updated: Feb., 2018