The University of Jordan
School of Engineering
Electrical Engineering Department

1st Semester – A.Y. 2025/2026

Course: **Instrumentation and Control Lab – 0943449 (1 Cr. – Required Course)**

Instructor: Prof. Mohammed Hawa + Eng. Sanaa Khawaldeh
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Office Hours: Will be posted soon

Platform: http://www.hawa.work/449 and Moodle (https://elearning.ju.edu.jo/)

Catalog description: Experiments on oscilloscope. Data acquisition systems and software data processing. Instrumentation and measurement errors. Signal generators. Measurement of earth resistance. Thermocouple and time constant measurements. Open and closed loop systems. Servomechanism principles. The effect of gain, integral and derivative control, and velocity feedback on system performance. Frequency response measurements. Electro-pneumatic control systems. Introduction to fuzzy-logic control. Introduction to programmable logic controllers (PLC) and ladder logic.

Prerequisites by course: **EE 0933441** Control Systems (pre- or co-requisite)

Prerequisites by topic: Students are assumed to have a background in the following topics:
- Electrical circuit analysis techniques.
- Basics of measurement and measurement errors.
- Control theory and analysis.

Textbook: **Lab Manual which can be obtained from the course website.**

References:
1. Modern Control Systems by Richard C. Dorf and Robert H. Bishop, Pearson, 13th edition, 2016.
2. Automatic Control Systems by Farid Golnaraghi and Benjamin C. Kuo, McGraw-Hill Education,10th Edition, 2017.
3. Electronic Instrumentation and Measurements by David A. Bell, Oxford University Press, 3rd edition, 2013.
4. Introduction to Instrumentation and Measurements by Robert B. Northrop, 3rd edition, CRC Press, 2017.
5. Electricity, Electronics, and Control Systems for HVAC with Lab Manual by Thomas E. Kissell, Pearson, 4th edition, 2007.
6. Automatic Control with Experiments by Victor M. Hernández-Guzmán and Ramón Silva-Ortigoza, Springer, 1st edition, 2018.
7. Motor Control: Theories, Experiments, and Applications by Frederic Danion , 1st edition, Oxford University Press, 2010.

Schedule: **On Campus** [16 Weeks, 10 lab sessions (3 hours each) plus exams.]

Course goals: The overall objective is to allow students to perform a set of experiments to examine basic aspects of instrumentation and control systems, thus relating theoretical knowledge with practical applications, and appreciating the difference between ideal and practical aspects. The student will also notice errors in measurements and identify their sources.

Course learning outcomes (CLO) and relation to ABET student outcomes (SO):

Upon successful completion of this course, a student will:	[SO]
1. Be able to conduct appropriate experimentation to validate fundamental theories in control and measurements, including the feedback concept, system behavior, sensors, programmable logic, data acquisition, measurement errors, etc.	[6]
2. Be able to analyze and interpret measured data, and use engineering judgment to draw conclusions.	[6]
3. Know the basics of electrical laboratory instruments (including multimeters, power supplies, function generators, oscilloscopes, speed sensors, temperature sensors, etc) and be able to properly use such instruments.	[6]
4. Understand the requirements and pre-requisites for technical reporting, and be able to properly report experimental results.	[3]
5. Be able to effectively function in a team in a collaborative and inclusive manner, to reach the lab goals and objectives.	[5]

Course topics:

		Hrs
1.	DC-servo motor and analogue servomechanisms.	3
2.	Introduction to fuzzy-logic control.	3
3.	Introduction to programmable logic controllers (PLC) and ladder logic.	3
4.	Electro-pneumatic control systems.	3
5.	Twin Rotor MIMO system, representing two rotors of a simple helicopter.	3
6.	Measuring resistance using voltmeter-ammeter method, and study the errors involved in the two different cases of measurement.	3
7.	Operational amplifier (Op-Amp) applications as a DC electronic milli-voltmeter using a permanent magnet moving coil meter (PMMC).	3
8.	Measuring earth resistance using the fall-of-potential method.	3
9.	Introduction to LabVIEW and Data Acquisition Systems (DAQ).	3
10.	Thermocouple and time constant measurement.	3

Ground rules: Attendance is required and highly encouraged. To that end, attendance will be taken every lab session. Eating and drinking are not allowed during the lab, and cell phones must be set to silent mode. All exams (including the final exam) should be considered cumulative. Exams are closed book. No scratch paper is allowed. You will be held responsible for all reading material assigned, even if it is not explicitly covered in lecture notes. Academic integrity must be maintained.

Assessment & grading policy:

First Exam	0%	Assignments	0%
Midterm Exam	30%	Projects	0%
Final Exam	40%	Lab Reports	13%
Quizzes	13%	Presentation	4%
		Total	**100%**

Last Revised: Feb 2025