

**The University of Jordan**  
**School of Engineering**  
**Department of Mechatronics Engineering**  
First Semester – 2019/2020



**Course:** Electrical Actuators – 0908323 (3 Cr. – Core Course)

**Instructor:** Dr. Ahmad Malkawi  
*Office:* Mechatronics Engineering Department.  
*Office Hours:* Wed 11:00-12:00AM, Tue 9:00 – 10:00 AM  
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**Course Website:** <http://academic.ju.edu.jo/ah.malkawi>

**Catalog Data:** Magnetic circuits; single-phase transformers: Principles, analysis, performance characteristics and testing; electromechanical energy conversion; principles and classification of DC generators; DC motors: analysis, performance characteristics, starting, testing and speed control; synchronous motors: analysis, performance characteristics, applications, starting, and testing; three-phase induction motors: analysis, performance characteristics, testing, starting and speed control.

**Prerequisites by**

**Course:** Electric circuits (2) 0903212

**Prerequisites By Topic:** The students are expected to have a good grounding in the principles of Electromagnetic and Electrical circuits theory.

**Textbook:**

- Electric Machinery Fundamentals, Stephen J. Chapman 4th Edition McGraw-HillMaterial.

**References:**

- Lectur note

**Schedule & Duration:** 15 Weeks, 30 lectures (90 minutes each) plus exams.

**Minimum StudentMaterial:** Textbook, class handouts, scientific calculator, and an access to a personal computer.

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

**Facilities:**

**Course Objectives:** This is the main course in which mechatronics engineering students study the discipline of electrical actuators (mainly rotary electromagnetic actuators). It is designed to achieve the following objectives:

**Course Learning Outcomes and Relation to ABET Student Outcomes:**

Upon successful completion of this course, a student should:

- Understand electromagnetic and electromechanical conversion principles including the motor effect and the generator effect.
- Understand single phase transformers; Principles, analysis; performance characteristics and tests to establish parameters.
- Understand DC Motors; Principles, analysis; performance characteristics.
- Understand the concept of 3-phase rotating field magnetic field that is necessary for all AC motors (induction and synchronous).
- Understand 3-phase induction Motors; Principles, analysis; performance characteristics.
- Understand 3-phase synchronous Motors and generators; Principles, analysis; performance characteristics.
- Be able to obtain the nameplate for a motor and analyse its parameters. (4)
- Be aware of the modern issues regarding the energy efficiency design of motors and rare earth metal permanent magnets. (4)

## Course Topics:

Topic Description	Hrs
1. Electromagnetic Circuits Review Basic Laws and relationships of electro-magnetic structures: Ampere Law, B/H Characteristics.	9
2. Single phase transformer:	6
3. Principles and classification of DC generators; Dc motors; Analysis, performance characteristics, Starting, testing and speed control;	9
4. Three phase induction motors; Analysis, performance characteristics, applications, Starting and speed control; tests to establish parameters.	12
5. Synchronous machines; Analysis, performance characteristics, applications, Starting and testing;	9

**Ground Rules:** **Attendance is required** and strictly enforced. 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.

**Assessments:** Exams and Projects.  
Midterm exam on November 18.

### Grading Structure:

Project	20 %
Midterm Exam	30 %
Final Exam	50 %
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Total	100%

Last updated: Sep. 2019