

The University of Jordan
School of Engineering
Electrical Engineering Department
2nd Semester – A.Y. 2020/2021



Course: **Electrical Machines (II) – 0903471 (3 Cr. – Required Course)**

Instructor: Prof. Eyad A. Feilat

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Office Hours: Will be posted soon

Course website: <http://elearning.ju.edu.jo/>

Catalog description: Synchronous motors: analysis, performance characteristics, application in power factor correction, and starting methods. Testing of synchronous machines. Three-phase induction motors: classification, analysis, performance characteristics, starting methods, testing, and speed control. Single-phase induction motors. Special types of motors: stepper motor, universal motor, reluctance motor, and brushless DC motor.

Prerequisites by course: **EE 0903371** Electrical Machines (I) (pre-requisite)

Prerequisites by topic: Students are assumed to have a background in the following topics:
• Electromagnetics and electromechanical conversion.
• Three-phase rotating fields.

Textbook: **Electric Machinery Fundamentals by Stephen J. Chapman, McGraw-Hill Education, 5th edition, 2011.**

- References:**
1. Principles of Electric Machines and Power Electronics by P. C. Sen , Wiley, 3rd edition, 2013.
 2. Fitzgerald & Kingsley's Electric Machinery by Stephen D. Umans, McGraw-Hill Education, 7th edition, 2013.
 3. Electrical Machines, Drives and Power Systems by Theodore Wildi, Pearson, 6th edition, 2005.
 4. Electrical Transformers and Rotating Machines by Stephen L. Herman, Cengage Learning, 4th edition, 2016.
 5. Electric Machines and Drives by Ned Mohan, Wiley, 1st edition, 2012.
 6. Analysis of Electric Machinery and Drive Systems by Paul Krause, Oleg Wasynczuk, Scott D. Sudhoff, and Steven Pekarek, Wiley-IEEE Press, 3rd edition, 2013.
 7. Schaum's Outline of Electric Machines & Electromechanics by Syed A. Nasar, McGraw-Hill Education, 2nd edition, 1997.

Schedule: 16 Weeks, 42 lectures (50 minutes each) plus exams.

Course goals: The overall objective is to provide the student with the understanding of performance characteristics, analysis, starting and speed control of different types of motors, such as: three-phase synchronous and induction motors, single-phase induction motors and the most common types of special motors.

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

Upon successful completion of this course, a student will:	[SO]
1. Understand and analyze the equivalent circuit of three-phase synchronous motors, and become familiar with their torque-speed characteristics.	[1]
2. Realize the starting problems of synchronous motors, and be familiar with the common methods of their speed control. Also understand their use in power factor correction applications.	[1, 2]
3. Become familiar with the types, construction and the equivalent circuit of three-phase induction motors. Also realize the power flow diagram and basic characteristics of such motors.	[1]
4. Realize the starting problems of three-phase induction motors, and be familiar with the common methods of starting and speed control of such motors.	[1, 2]
5. Understand the concept of single-phase induction motors, and realize the starting problems of such motors.	[1, 2]
6. Become familiar with types, characteristics and applications of special types of motors. This includes stepper motors, universal motors, reluctance motors, and brushless DC motors.	[1]

Course topics:	Hrs
1. Synchronous Motors: principle of operation, equivalent circuit and phasor diagram, performance characteristics and pull-out torque, starting of synchronous motors, speed control of synchronous motors, V-curves and applications in power factor correction, testing of synchronous motors.	12
2. Three-Phase Induction (Asynchronous) Machines: types, construction and principle of operation, development of equivalent circuit, testing and parameters determination, power flow diagram and analysis, develop torque-speed characteristics, starting of 3-phase induction motors, speed control of 3-phase induction motors.	16
3. Single-phase Induction Motor: construction of single-phase induction motor, principle of operation. Equivalent circuit and its analysis. Starting single-phase induction motors: capacitor-start motors. Torque speed characteristics, speed control of single-phase induction motors. Capacitor-run motor.	8
4. Special Motors: reluctance motors, universal motors, brushless DC motors, stepper motors.	6

Ground rules: Attendance is required and highly encouraged. To that end, attendance will be taken every lecture. Eating and drinking are not allowed during class, 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.

**Assessment
&
grading
policy:**

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

Last Revised: March 2021