Philadelphia University

Faculty of Engineering - Department of Electrical Engineering
First Semester 2022/2023

Course Details:

Title:	Electrical Machine- II, (0610514)
Prerequisite:	Electrical Machine (1) - (0610314)
Credit Hours:	3 credit hours (16 weeks per semester, approximately 45 contact hours)
Textbook:	- Electric Machinery 6th Edition, A. E. Fitzgerald , Charles Kingsley Jr. Stephen, D. Umans.. McGraw-Hill Higher Education 2003.
References:	- Electric machine analysis and design applying MATLAB, Jimmie j.Cathy, McGraw-Hill, 2001. - Electric Machines, Theory, Operation, Application, Adjustment, & Control ", Charles I . Hubert, Maxwell Macmillan, 2002. - An Introduction to Electrical Machine & Transformer, George McPherson and Robert D. Laramore, John Wiley. - Analysis of Electric Machinery and Drive Systems, 3rd Edition, Oleg Wasynczuk, Paul C. Krause, Scott D. Sudhoff, and Steven Pekarek, IEEE Press, NJ, USA 2013.
Course Description:	The course is a requirement for all electrical engineering students. It introduces the basic principles and fundamental concepts of operation of various types of electrical AC machines, to be familiar with basic experimental and modeling skills for handling problems associated with electrical AC machines and operational problems in the electrical power industry.
Website:	http://www.philadelphia.edu.jo/academics/aagha/
Instructor:	Dr. Ayman Agha **Email**: alomoush@philadelphia.edu.com **Office**: Engineering building, Office No.: 811, ext: 2504 **Office hours**: As indicated in the timetable.

Course Outlines:

Week	Topic
1,2	Review of basic electromagnetic formulas and magnetic circuits.
3	Induced EMF in AC machines, 3-phase induction motors (IM), introduction, construction, types & operation and rotating magnetic field theory.
4,5	Slip & rotor speed, rotor induced voltage & frequency. Equivalent circuit. Determination of equivalent circuit parameters, IM performance & characteristics. Power flow in IM. Effects of rotor resistance. Torque – Speed characteristic.
6	Speed control of IM. Starting and braking methods of IM. Induction Generator, construction and principle of operations, types, generated voltage. A brief outline of motor rewinds.
7,8	3-Phase synchronous machines, introduction, construction & principle of operations, types, generated voltage. Synchronous generators, equivalent circuit model , pharos diagrams, voltage regulation, Synchronous generator on infinite bus,
9,10	Power flow of 3-Phase synchronous machines, losses and efficiency. Synchronous impedance and reactance. 3-Phase synchronous motors, equivalent circuit model, determination of synchronous reactance, pharos diagram. Power flow, power & torque characteristics, V – Curves, PF control.

11,12	Synchronous condenser, salient pole synchronous machines, determination of X_d & Xq. power flow, power & torque –speed characteristics.
13	Speed control of synchronous motor, starting & braking methods.
14,15	Single phase induction motors, construction, double revolving field theory, equivalent circuit, determination of equivalent circuit parameters. Starting methods and types of single phase IM, single phase series (universal) motor, braking of single phase IM. Speed control of single phase IM
16	Single phase Synchronous motor, Reluctance motors, Hysteresis motors.

Course Learning Outcomes with reference to ABET Student Outcomes:

Upon successful completion of this course, student should:

1.	Be able to understand the basic electromagnetic & magnetic circuits' problems. Magnetics materials, Magnetic hysteresis characteristic. The power losses in magnetic circuit.	[1]
2.	Have the ability to understand electromechanical energy conversion theory, drops and power losses calculation.	[1,6]
3	Understanding the principles of operation of electrical AC generators and AC motors, single phase and three phases machine.	[1 ,2, 6]
4	Understand the concept of the equivalent circuit electrical machine.	[1 ,6]
5.	Understand the concept of fundamental torque equation and rotating and oscillating fields.	[1, 6]
6.	Understanding the starting, braking, speed control and other problems associated with three phase machines.	[1,6]
7.	Understanding the principles, construction, starting of single phase AC machine, types, torque –speed characteristic and applications.	[1,6]

Assessment Guidance:

Evaluation of the student performance during the semester (total final mark) will be conducted according to the following activities:

Sub-Exams: The students will be subjected to midterm written exams during the semester. Each exam will cover materials given in lectures in the previous 3-4 weeks.

Quizzes: (3-4) quizzes of (10) minutes will be conducted during the semester. The materials of the quizzes are set by the lecturer.

Homework and projects: Tutorials sheets will be assigned to the students and homework should be solved individually and submitted before or on a set agreed date.

Cheating by copying homework from others is strictly forbidden and punishable by awarding the work with zero mark.

Final Exam: The students will undergo a scheduled final exam at the end of the semester covering the whole materials taught in the course.

Grading policy:

Midterm Exam	30%
Quizzes and Homework	30%
Final Exam	40%
Total:	100%

Attendance Regulation:

The semester has in total 45 credit hours. Total absence hours from classes and tutorials must not exceed 15% of the total credit hours. Exceeding this limit without a medical or emergency excuse approved by the deanship will prohibit the student from sitting the final exam and a zero mark will be recorded for the course. If the excuse is approved by the deanship the student will be considered withdrawn from the course.