Zarqa University

Faculty of Engineering
Department: Electrical Engineering
Course title: Electrical Machines II (0904461)

Prerequisite:
Electrical Machines-I (0904361)

Instructor: Dr. Tareq El-Hasan
Lecture's time: multiple sections
Semester: Second, 2017.
Office Hours: morning

Course description:

This course covers rotating magnetic field; MMF and flux distribution; synchronous generators: classification; construction; equivalent circuit; power and torque relationships; parallel operation; performance and characteristics; synchronous motors: principles; power flow and efficiency; starting; power factor correction and V-curve; 3-phase induction motors: types; construction and basic concepts; equivalent circuit; power and torque relations; power flow and performance characteristics; starting; speed control; single-phase induction motors : construction; classification; starting; equivalent circuit; and performance characteristics; preventive maintenance. Universal motors and single phase motors.

Intended Learning Outcomes (ILOs):

At the completion of the course, students will be able to…

1) Recognize the classification and categorization of three phase machines.
2) Understand the fundamental principle of rotating magnetic field and AC machine operation.
3) Compare between 3-phase synchronous and induction machines in terms of construction and performance characteristics.
4) Design preliminary 3-phase AC machine and identify the machine parameters influencing the induced voltage and torque.
5) Calculate the power output, losses, voltage and speed regulation and understand the power flow and phasor diagrams for AC machines.
6) Sketch and compare different types of synchronous generators such as traditional brushed exciters, brushless exciters and pilot brushless exciters.
7) Develop and analyze equivalent circuit for synchronous generators, determine circuit model parameters and calculate its terminal characteristics.
8) Analyze the performance of synchronous generators at various conditions; e.g. when operating alone or parallel or when connected to infinite bus under various load power factors.
9) Understand the operation and starting of the synchronous motors and calculate their terminal characteristics at steady state operation and calculate their influence on system power factor.
10) Describe 3-phase induction machines construction and recognize the various types such as squirrel cage and wound rotor machines.
11) Develop the equivalent circuit of the 3-phase induction motor, determine its circuit model parameters and calculate its terminal characteristics and performance.

12) Design starting and speed control circuits and calculate the performance of the 3-phase induction machine at starting condition.

13) Recognize the construction, principle operation and speed control for the universal motors.

14) Understand the construction and performance operation for various type of single phase induction motors such as Shaded-poles motor, Split phase windings, Capacitor start and run (permanent split capacitor), Capacitor start motor, Capacitor start, capacitor run motor.

Course structures:

Week	C. Hrs	ILOs	Topics	Teaching Procedure	Assessment methods
Week 1		1, 2	Syllabus, Course Schedule; Theory of AC machinery and the different types of AC machines	PPT. lecture	**HWs**
Week 2		3	Concepts of 3phase synchronous machines	PPT. lecture	**HWs**
Week 3 - 6		4, 5 , 6, 7, 8	Induced voltages and torques in synchronous machines. Construction and operation of synchronous generators. Equivalent circuits of synchronous generators and their performance determination. Power flow diagram and understand the various types of losses in the synchronous generators. Performance operation of synchronous generators when operating alone, parallel and when connected to infinite bus under various load power factors.	PPT. lecture	**Quizes and 1st Exam**
Week 7 - 9		9	Construction of synchronous motors Basic operation of synchronous motors at various power factors Starting problems and starting techniques of synchronous motors Automatic starting circuit for synchronous motors	PPT. lecture	**HWs**
Week 10		10, 11	Construction of Induction machines Principle operation of induction machines Synchronous, slip speed and slip of induction machine Equivalent circuit of induction motors	PPT. lecture	**HWs and 2nd Exam**

Week	C. Hrs	ILOs	Topics	Teaching Procedure	Assessment methods
Week 11 - 15		12, 13, 14	Determination of circuit parameters of induction motor Development of torque speed equation for the induction machine Power flow diagram and losses determination Starting of induction machine Torque adaptation Universal Motors Single phase induction motors	PPT. lecture	**Final Exam (TBD)**

References:

Electric Machinery Fundamentals. Fourth edition (McGraw-Hill Series in Electrical and Computer Engineering) Stephen Chapman, 2005

Assessment Methods:

Methods	Grade	Date
Quizzes	5	Twice
HWs	5	weekly
First Exam	20	TBD
Second Exam	20	TBD
Final Exam	50	TBD