

Academic Course Description

King Saud University  
Electrical Engineering Department  
**EE331 Electromechanical Energy Conversion II**  
*First Semester 1426/27 (2005/2006)*

**Instructor:** Dr. Ali M. Eltamaly  
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**Textbook:** Electric Machinery Fundamentals, S.J. Chapman, McGraw-Hill, 1998.

**Support references:** Principles of Electric Machines and Power Electronics, P. C. Sen, John Wiley & Sons, Second Edition, 1997.

**Prerequisites:** EE330.

**Co-requisites by Topics:**

- Concepts of electrical conductivity and resistivity.
- Concepts of magnetic flux production.
- Magnetic circuit analysis.

**Course Objectives:**

- The student will be able to understand the operation of electromechanical devices and a realistic expectation of their performance.
- Students will have a working knowledge of magnetic circuits (linear and nonlinear).
- Students will be able to analyze synchronous and DC machines and.
- Students will understand principle operations, equivalent circuits, and basic tests for synchronous generators and motors.
- Students will understand principle operations, classifications and characteristics of DC machine.

**Topics Covered:** Synchronous machines (construction, internal voltage, equivalent circuit, phasor diagram, performance of turbo-alternator, generator operating alone, parallel operation of AC generators, synchronous motor, steady-state operation, starting), DC machines (construction, classifications, performance, motor characteristics, starting of DC motors, speed control of DC motors).

**Class Tutorial Schedule:** Class is held two times per week in 50 minute lecture sessions. There is also a 50 min weekly tutorial associated with this course.

**Professional Component Contributions:** Students learn the basic theory, characteristics, construction, operation and application of rotating electrical machines. It includes the study of alternators, synchronous motors, direct current generators, and direct current motors. Students will demonstrate the ability to identify, formulate, and solve AC and DC machines related engineering problems found in energy conversion systems. Students utilize the concepts of mathematics, physics, circuits, control and basic engineering sciences to effectively analyze these problems.

**Relationship to Program Objectives:** This course contributes to the general objectives listed for an Electrical Engineering Department.

**Relationship to the Program:**

**Objective A:** Students will have the ability to apply knowledge of mathematics, physics, and circuit analysis, this course supports the objective of producing graduates with a strong foundation in basic science.

**Objective B:** Students will have the ability to identify, formulate, and solve engineering problems by applying methodologies learned in the course to actual design problems, this course supports the objective of producing graduates with a strong foundation in electrical engineering.

**Objective C:** By encouraging the students to participate in the class; acquire and develop a communication skills; problem solving skills in both an individual and team environment, this course supports the objective of producing graduates with good communication skills.

**Objective D:** Students will have the ability to learn ethical and professional standards in dealing with real life, and to develop an awareness of the impact of electrical machines on society.

**Objective E:** By teaching student how to design a speed control schemes of AC and DC motors, this course supports the objective of producing graduates with the relevant engineering design experience.

**Laboratory Experiments:** None

**Evaluation:** Method of Evaluation is as follows:

Category	Percentage
First Exam	20 %
Second Exam	20%
Attendance in class	10%
Quizzes and tutorial home-work.	10%
Final Exam	40 %

**Attendance Policy:** According to KSU policy, every student should attend at least 75% of the course classes (Including the tutorials). Those who fail to fulfill this condition will fail in the course.

**Weekly Teaching Plan**

Week #	Topics
1	Introduction to Synchronous Machine and its Construction.
2	Voltage Induced in the Armature Winding of Synchronous Machine.
3	Equivalent Circuit of Synchronous Machine and its Phasor Diagram.
4	Performance of Turbo Alternator.
5	Synchronous Generator Operating Alone.
6	Parallel Operation of Synchronous Machine.
7	Synchronous Motor Analysis, Operation And Starting.
8	Introduction to DC Machines and its Construction.
9	Classification of DC Machines.
10	DC Generator Operation and Performance.
11	DC Motor Characteristics.
12	Starting of DC Motors.
13	Speed Control of DC Motors Part I.
14	Speed Control of DC Motors Part II.