

Academic Course Description

King Saud University
Electrical Engineering Department

EE-339: Electrical Machines

First Semester 1426/1427 (2005/2006)

Instructors: (1) **Dr. Yasin Khan**

Office: 2C-108/2

Phone: 467-9813

Text Books:

1. P.C. Sen, “*Principles of Electric Machines and Power Electronics*” 2nd Edition, Jhon Wiley Publishers, USA.
2. S.J. Chapman, “*Electric Machinery Fundamentals*” 2nd Edition, McGraw-Hill Intl. .

Support References : A collection of supplementary reading material is also provided.

Pre-requisites: EE-318

Co-requisites : - - - -

Course Objectives: To clearly understand the basic concepts of the electrical machines working in the modern power system. Furthermore, modeling and analysis of various types of generators and motors is also carried out.

Topics Covered: *Transformer* (Types, construction, operation, equivalent circuit), *DC machines* (Construction, performance, motor characteristics, starting, speed control), *Synchronous machines* (Construction, generator performance, motor characteristics, starting), *Induction machines* (Construction, 3-phase motors, types, operation, equivalent circuit, starting, speed control), *Small machines* (Single phase motors, control motors, tacho-generators).

Class / Tutorial Schedule: Three lectures are assigned per week with 50 minute for each lecture session. There is also a 50 minute weekly tutorial session associated with this course.

Professional Component Contribution: Students can learn the analytical methods and modern tools for solution of problems associated with design and operation of transformers, motors and generators. They acquire the basic skills of how to approach and deal with real life situations and solve operating problems. Students must also utilize knowledge of mathematics, physics, system’s control, circuits and basic engineering sciences in order to effectively analyze a diverse set of fundamental problems in electrical machines.

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

Objective A: By teaching the student how to formulate basic problems and model the associated configurations, circuits and systems related to electrical machines, this course support the objective of producing graduate with a strong foundation in basic sciences.

Objective B: By teaching students how to deal with electrical machines and solve basic problems in machines, the course helps in the department's production of students with a strong foundation in electrical engineering.

Objective C: By motivating and encouraging students in discussions during lectures and tutorials to get basic information and skills in a group environment and provide individual opinion on alternative solutions to the design and operating problem, this course supports the objective of producing graduate with good communication skills.

Objective D: By encouraging the students to learn professional standards in dealing with design of transformers, generators and motors and acquire mutual respect for diverse opinions, this course supports the objective of providing graduates with a broad based education so that they can appreciate diversity of opinion, better understand ethical issues and develop a more global perspective of the profession.

Objective E: By teaching how to design simple transformer, generators and motors and their individual components, this course supports the objective of producing graduates with relevant engineering design experience.

Evaluation: There are graded home works, two 2-hours mid-term exams and a three hour final exam. The grade distribution is as follows:

Two Mid-Term Exams:	45%
Home Works, Quizzes & Class Participation	15%
Final Exam	<u>40%</u>
Total	100%

Challenges and Actions taken to improve the Course: Some basic background and pre-requisite type material are often reviewed during the course, notably those related to the review of 3-phase systems, AC circuits and machines, etc. Visits are arranged to the Machines Laboratory of the Electrical Engineering Department during the course in order to expose students to real life practical electrical machines.

Weekly Teaching Plan

Week #	Deliverables
1	<i>Introduction to Transformers</i>
2	<i>Operation of Transformers</i>
3	<i>Types and Equivalent Circuit of Transformer</i>
4	<i>3-phase transformers principle and operations</i>
5	Introduction to DC machines (DC generator) Construction and Operations
6	Operation of DC Motor
7	Starting and Speed Control of DC Motors
8	<i>Synchronous machines (Generator construction and operations)</i>
9	<i>Synchronous machines (Motor construction, operations and its characteristics)</i>
10	Induction Motors (Construction and operations)
11	3-phase Induction motors (Types, operations)
12	Induction Motors (Starting, Equivalent circuit, speed control)
13	<i>Introduction to special small machines</i>
14	<i>Operation of special small machines</i>

September 20, 2005