KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS

Department of Electrical Engineering

EE-306 Electromechanical Devices

Course syllabus 132

Instructor	Section	E-mail
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Office Hours: MW 09:50-10:50 am & 12:30-1:00pm

Textbook:

Electrical Machinery Fundamentals
By: Stephen J. Chapman, 2012, 5th edition.

1) **Three-Phase Circuits (Appendix A)**: (4 lectures)

   A.1 Generation of Three-Phase Systems
   A.2 Voltages and Currents in a Three-Phase Circuit
   A.3 Power Relationships in Three-Phase Circuits
   A.4 Analysis of Balanced Three-Phase Systems
   A.5 One-Line Diagrams
   A.6 Using the Power Triangle

2) **Chapter1: Introduction to Magnetic Principle (Magnetic Circuits)**: (4 lectures)

   1.1 Electrical Machines, Transformers, and Daily Life
   1.4 The Magnetic Field
   1.5 Faraday's Law – Induced Voltage from a Time-Changing Magnetic Field

3) **Chapter2: Single Phase Transformer**: (5 lectures)

   2.1 Why Transformers Are Important to Modern Life
   2.2 Types and Construction of Transformers
   2.3 The Ideal Transformer
   2.4 Theory of Operation of Real Single-Phase Transformers
   2.5 The Equivalent Circuit of a Transformer
   2.7 Transformer Voltage Regulation and Efficiency

4) **Chapter 7 & 8: DC Machines**: (6 lectures)

   7.5 The Internal Generated Voltage and Induced Torque Equations of Real DC Machines
   7.6 The Construction of DC Machines
   7.7 Power Flow and Losses in DC Machines
   8.1 Introduction to DC Motors
   8.2 The Equivalent Circuit of a DC Motor (Generator)
   8.3 The Magnetization Curve of a DC Machine (Generator)
   8.4 Separately Excited and Shunt DC Motors (Generator)
   8.5 The Permanent-Magnet DC Motor
   8.6 The Series DC Motor (Generator)
   8.7 The Compounded DC Motor (Generator)

5) **Chapter 4 & 5 Synchronous Machines**: (6 lectures)

4.1 Synchronous Generator Construction
4.2 The Speed of Rotation of a Synchronous Generator
4.3 The Internal Generated Voltage of a Synchronous Generator
4.4 The Equivalent Circuit of a Synchronous Generator
4.5 The Phasor Diagram of a Synchronous Generator
4.6 Power and Torque in Synchronous Generators
4.7 Measuring Synchronous Generator Model Parameters.
5.1 Basic Principles of Motor Operation
5.2 Steady-State Synchronous Motor Operation

6) **Chapter 6: Three-Phase Induction Motors**: (5 lectures)

6.1 Induction Motor Construction
6.2 Basic Induction Motor Concepts
6.3 The Equivalent Circuit of an Induction Motor
6.4 Power and Torque in Induction Motors
6.5 Induction Motor Torque-Speed Characteristics

Major Exam Schedule

EXAM	DATE	TIME	LOCATION
MAJOR I	Thursday Feb. 27th, 2014	6:00-7:30 PM	TBA
MAJOR II	Sunday Apr. 13th, 2013	6:00-7:30 PM	TBA
FINAL	Tuesday May 20th, 2014	7:00-9:30 PM	**TBA**

Grading Distribution

Component	Percentage
Quizzes, Attendance and homework	15%
Two Major Exams	15%+15%
Lab	20%
Design Project	5%
Final Exam	30%

Week	Experiment Title
1	No Labs
2	Expt.1: Introduction to Cassy Lab
3	Expt.2: Three Phase Circuits
4	Expt.3: Magnetic Circuits
5	**Problem session # 1 in the lab (No experiment)- Major Exam I**
6	No Labs
7	Expt.4: Equivalent Circuit of a Transformer
8	Expt.5: Regulation and Efficiency of a Single Phase Transformer
9	No Labs
10	**Problem session # 2 in the lab (No experiment)**
11	Expt.6: Load Characteristics of Shunt and Compound DC Generators -**Major Exam II**
12	Expt.7: Torque Speed Characteristics of DC Shunt and Compound Motors
13	Expt.8: Determination of Parameters of Synchronous Generators
14	Expt.9: Torque Speed Characteristics of a Three Phase Induction Motors
15	**Lab final**

Note: Each must conduct the lab experiment before submitting the related report.

EE 306 LAB Grading Policy for 20%	
Lab report	**9**
Lab performance	**3**
Preparatory Quiz	**2**
Lab final (Questions(2)+Connection(4))	**6**
Total	**20**

Homework list

HW#	Assignment	Due
1	Appendix: **A-2, A-3, A-6**	First class of Week # 3
2	Chapter 1: **5, 6, 7, 12**	First class of Week # 5
3	Chapter 2: **1(a,c,d,e), 2,4, 6,7**	First class of Week # 8
4	Chapter 7: **3, 4**	First class of Week # 10
5	Chapter 8: **2,3,13(a,b),16(a,b,c),17(a,b,c),22(a,b)**	First class of Week # 12
6	Chapter 4: **2(g not included), 4, 6**	First class of Week # 13
7	Chapter 5: **1,3, 7, 10**	First class of Week # 14
8	Chapter 6: **1, 3, 5, 8, 10, 12, 15**	Second class of Week # 15

Course Objectives

After successfully completing the course, the students will be able to

- understand basic concepts of electrical machines
- will learn how to start and operate an electrical machine;
- learn the details of construction of different types of electrical machines;
- learn how to analyze the performance and design the components

Course Outcomes

1. An ability to apply knowledge of mathematics, science, and engineering to the analysis of electrical machineries.
2. Design and conduct experiments, as well as to analyze and interpret data
3. An ability to identify, to formulate, and solve engineering problems in the area of electromechanical energy conversion devices.
4. Acquire knowledge of contemporary issues
5. Use the techniques, skills, and modem engineering tools necessary for engineering practice.