KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS
DEPARTMENT ELECTRICAL ENGINEERING
EE – 360 Electric Energy Engineering

Tentative Course Syllabus 081-2008/2009

Instructor

Name	*E-mail*	*Phone #*	*Location*	*Office Hour*
Ibrahim O Habiballah	ibrahimh@kfupm.edu.sa	4985	59-2080	11:15-11:45am UT

Textbook: **Electromechanical Energy Devices and Power Systems**
By: Zia A. Yamayee, Juan L. Bala. Jr., 1994.

Lecture Schedule

1. **Three Phase Circuits: (Week # 1)**
   Phasor diagram,
   Balanced 3-phase circuits,
   Delta and Wye connections
   Power measurements.
2. **Magnetic Circuits: (Week # 2 – 3)**
   Ampere's Law: Permeability, Magnetic Flux.
   Magnetic Circuit (Concept and Analogy).
   Magnetic Circuit Computations.
   Magnetization curves of ferromagnetic materials.
   Series and Parallel Circuits.
   Hysteresis and Eddy-current losses in ferromagnetic materials.
3. **Transformers: (Week # 3 – 6)**
   Introduction and construction.
   Theory of operation.
   Equivalent circuit.
   Parameters from No-Load and Short Circuit Tests
   Voltage regulation and efficiency.
   Auto-transformers and parallel operation of transformers
   3 Phase transformers connections and equivalent cirtciut.
4. **DC Machines: (Week # 6 – 9)**
   Introduction and construction
   Generation of Unidirectional Voltages
   Voltage and Torque equations, and energy losses.
   Equivalent circuit of DC generator, and DC generator types.
   Voltage-current characteristic and terminal voltage control.
   Equivalent circuit of DC motor, and DC motor types.
   Speed-Torque Characteristics and Speed Control (field and armature control).
5. **3-Phase Synchronous Machines: (Week # 9 – 12)**
   Introduction and Construction.
   Generation of a 3-phase voltage and Voltage equation.
   Linear Analysis, equivalent circuit and Voltage Regulation.

Power of Cylindrical-Rotor Machine.
Parallel operation of synchronous generators.
Synchronous motor.
Phasor diagram, equivalent circuit and power factor control.

6. 3-Phase Induction Motors: (Week # 12 – 14)

Introduction and Construction.
Revolving Magnetic Field (skip mathematical analysis).
IM as a transformer.
Equivalent Circuit.
Equivalent Circuit Parameters from Tests.
Computation of IM Performance.
Torque-Speed Characteristic, Starting Torque and Maximum Developed Torque.

7. Transmission Lines: (Week # 14 – 15)

Transmission line parameters.
Transmission line representation.
ABCD parameters.
Voltage regulation and efficiency.

Tentative Laboratory & Problem Session Schedule:

Week #	Lab. Activity
1	**No Experiment**
2	Exp # 1: Introduction to Cassy Lab
3	Exp # 2: Three Phase Circuits and Power Measurements
4	Exp # 3: Magnetic Circuits Characteristics
5	**No Experiment: Problem Session # 1**
6	**No Experiment**
7	Exp # 4: Equivalent Circuit and Performance Evaluation of Single-Phase Transformer
8	Exp # 5: Three Phase Transformers
9	**No Experiment**
10	Exp # 6: DC Genrator Characteristics
11	Exp # 7: DC Motor Characteristics
12	**No Experiment: Problem Session # 2**
13	Exp # 8: Determination Of Parameters of Three Phase Synchronous Generators
14	Exp # 9: Equivalent Circuit, Performance, and Torque-Speed Characteristics of 3-Φ Induction Motors
15	**Laboratory Final Exam**

Major examination				
Exam #	**Date**	**Place**	**Time**	**Sec**
1	Wednesday, 12 Nov., 2008	6-125	7 – 9 PM	All
2	Tuesday, 6 Jan., 2009	6-125	8 - 10 PM	All

Grading Policy	
Quizzes and Attendance	10%
Project and assingments	5%
Two major exams	30%
Lab: attendance, Performance, and reports	12%
Final lab examination	8%
Final comprehensive exam	35%

Training Problems List (Not to be submitted)

HW#	Topics	Text Section	H.W.
1	Three Phase Balanced Circuits	3..3,3.4	3.19, 3.22, 3.23, 3.25, 3.26, 3.27
2	Magnetic Circuits	4.1-4.4 +notes	4.2, 4.3, 4.4, 4.11
3	Transformers	4.5.1-4.5.6	4.14, 4.15, 4.19, 4.21, 4.23, 4.24, 4.29, 4.31, 4.35
4	DC Machines	6.1-6.7	6.3, 6.7, 6.9,6.13,6.18, 6.23,, 6.27, 6.32, 6..36
5	Synchronous Machines	7.1, 7.2, 7.6	7.3, 7.8, 7.10, 7.12, 7.21,7.25, 7.26, 7.33, 7.36
6	Three Phase Induction Motor	8.1-8.4	8.5, 8.11, 8.17,8.20, 8.23, 8.29, 8.33, 8.35
7	Transmission Lines	9.1-9.5	9.2, 9.4, 9.8, 9.19, 9.24, 9.29, 9.31, 9.34

External Homeworks Calendar

Activity	Topics	*Due date (During the last class of Week #)*
HW1	Three Phase Balanced Circuits	2
HW2	Magnetic Circuits	4
HW3	Transformers	7
HW4	DC Machines	10
HW5	Synchronous Machines	12
HW6	Three Phase Induction Motor	15

Course Objectives

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

- understand basic concepts of electrical machines and transmission lines
- 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 and transmission lines.
2. Design and conduct experiments, as well as to analyze and interpret data
3. An ability to identify, 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.