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

Course Syllabus 071
Instructor

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

Lecture Schedule

1. **Three Phase Circuits: (4** Lectures)
   Phasor diagram,
   Balanced 3-phase circuits,
   Delta and Wye connections
   Power measurements.
2. **Magnetic Circuits: (4** Lectures)
   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: (9** Lectures)
   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: (9** Lectures)
   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: (7** Lectures)
   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 Motor: (7** Lectures)
   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 Line: (5** Lectures)
   Transmission line parameters.
   Transmission line representation.
   ABCD parameters.
   Voltage regulation and efficiency.

Tentative Laboratory & Problem Session Schedule

WEEK	TITLE	DATE
2	**EXP # 1**: INTRODUCTION TO CASSY LAB	15-19 SEP
3	OFF	22-26 SEP
4	**EXP # 2**: THREE PHASE CIRCUITS AND POWER MEASUREMENTS	29SEP-03 OCT
5	**PROBLEM SESSION # 1 (MAJOR I: WED 24-OCTOBER 6:30 to 8:30 PM)**	20-24 OCT
6	**EXP # 3**: MAGNETIC CIRCUITS CHARACTERISTICS	27-31 OCT
7	**EXP # 4**: EQUIVALENT CIRCUIT AND PERFORMANCE EVALUATION OF SINGLE-PHASE TRANSFORMER	03-07 NOV
8	**EXP # 5**: THREE PHASE TRANSFORMERS	10-14 NOV
9	OFF	17-21 NOV
10	**EXP # 6**: DC GENRATOR CHARACTERISTICS	24-28 NOV
11	**EXP # 7**: DC MOTOR CHARACTERISTICS	01-05 DEC
12	**EXP # 8**: DETERMINATION OF PARAMETERS OF THREE PHASE SYNCHRONOUS GENERATORS	08-12 DEC
13	**PROBLEM SESSION # 2 (MAJOR II: TUE 01-JANUARY 6:30 to 8:30 PM)**	29DEC-02 JAN
14	**EXP # 9**: EQUIVALENT CIRCUIT, PERFORMANCE, AND TORQUE-SPEED CHARACTERISTICS OF 3-Φ INDUCTION MOTORS	05-09 JAN
15	FINAL LAB EXAM	12-16 JAN

Major examination				
Exam #	**Date**	**Place**	**Time**	**Sec**
1	24 October, 2007	14-108	6:30 – 8:30 PM	All
2	01 Jan, 2008	06-125 & 04-125	6:30 – 8:30 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%

Homework List

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 + extra problems
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 (Generators)	6.1-6.6	6.3, 6.7, 6.9,6.13,
5	DC Machines (Motors)	6.7	6.18, 6.23,, 6.27, 6.32, 6..36
6	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
7	Three Phase Induction Motor	8.1-8.4	8.5, 8.11, 8.17,8.20, 8.23, 8.29, 8.33, 8.35
8	Transmission Lines	9.1-9.5	9.2, 9.4, 9.8, 9.19, 9.24, 9.29, 9.31, 9.34

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.

Tentative Assignment Calendar

Activity	*Due date*
HW1	Mon. September 17
HW2	Sat. September 29
PS1	20-24 OCT
HW3	Sat Nov 03
HW4	Sat Nov 17
HW5	Sat. Nov 24
HW6	Sat. Dec 08
PS2	29 DEC-02 JAN
Project	**Sat Jan 05**
HW7	Sat. Jan 07
HW8	Wed Jan 16