

**KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS**  
**Department of Electrical Engineering**  
**EE-306 Electromechanical Devices**  
**Course syllabus 161**

**Dr. Ibrahim Omar Habiballah**

OFFICE	PHONE	OFFICE HOURS	E-MAIL
59-2080	4985	MTW 11:00-11:50 am	<a href="mailto:ibrahimh@kfupm.edu.sa">ibrahimh@kfupm.edu.sa</a>

**Course Timing:** MW 10:00 - 10:50 am ;

**Course Location:** 59-1009

**Textbook:** Principles of Electric Machines and Power Electronics, By: P.C. Sen, 2013, 3<sup>rd</sup> edition

**I. Three Phase AC Circuits: (Appendix B) (4 lectures)**

- B.1 Review of Single-Phase Circuits
- B.2 Balanced Three-Phase Circuits
- B.3 Balanced Three-Phase Load
- B.4 Delta-Wye Transformation of Load
- B.5 Per-Phase Equivalent Circuit

**II. Chapter one: Magnetic Circuits : (4 lectures)**

- 1.1.1 i-H Relation
- 1.1.2 B-H Relation
- 1.1.3 Magnetic Equivalent Circuit
- 1.1.4 Magnetization Curve
- 1.1.5 Magnetic Circuit with Air-Gap
- 1.2 Hysteresis

**III. Chapter two: Single Phase Transformers: (6 lectures)**

- 2.1 Ideal Transformer
- 2.2 Practical Transformer
  - 2.2.1 Referred Equivalent Circuits (exact and approximate equivalent)
  - 2.2.2 Determination of Equivalent Circuit Parameters
- 2.2 Voltage Regulation
- 2.4 Efficiency
  - 2.4.1 Maximum Efficiency

**IV. Chapter 4: DC Machines: ( 6 Lectures )**

- 4.1 Electromagnetic Conversion
- 4.2 DC Machines
  - 4.2.1 Construction
  - 4.2.2 Evolution of DC Machines
  - 4.2.3 Armature Windings
  - 4.2.4 Armature Voltage
  - 4.2.5 Developed (or Electromagnetic) Torque
  - 4.2.6 Magnetization Curve of a DC Machine
  - 4.2.7 Classification of DC Machines
- 4.3 DC Generators
- 4.4 DC Motors
  - 4.4.1 Shunt Motor
  - 4.4.2 Series Motor

## V. Chapter 6: Synchronous Machines: (5 Lectures)

- 6.1 Construction of 3-Phase Synchronous Machines
- 6.2 Synchronous Generators
- 6.3 Synchronous Motors
- 6.4 Equivalent Circuit Model
  - 6.4.1 Determination of the Synchronous Reactance
  - 6.4.2 Phasor Diagram
- 6.5 Power and Torque Characteristics
- 6.7 Power Factor Control

## VI Chapter 5: Three-Phase Induction Motors: (5 lectures)

- 5.1 Constructional Features
- 5.2 Rotating Magnetic Field
- 5.3 Induced Voltages
- 5.4.4 Running Operation
- 5.7 Equivalent Circuit Model
  - 5.7.1 Stator Winding
  - 5.7.2 Rotor Circuit
  - 5.7.3 Complete Equivalent Circuit

### Grading:

<b>Home Works (4), Quizzes (9), and Attendance (2)</b>	<b>:</b>	<b>15</b>
<b>Lab</b>	<b>:</b>	<b>20</b>
<b>Major-Exam I Wk5, Wed. 19<sup>th</sup> Oct. (6:00-7:30 pm)</b>	<b>:</b>	<b>15</b>
<b>Major-Exam II Wk11, Sun. 4<sup>th</sup> Dec. (6:00-7:30 pm)</b>	<b>:</b>	<b>15</b>
<b>Design Project</b>	<b>:</b>	<b>5</b>
<b>Final Exam Sat. 14<sup>th</sup> Jan. 2017 (8:00-11:00 am)</b>	<b>:</b>	<b>30</b>

### HW and Quizzes:

A homework assignment will be posted for each chapter about seven days ahead of the submission due date. There will be a quiz related to each homework assignment.

### Project:

A design project will be assigned after the 3<sup>rd</sup> quarter of the semester. The details of the project will be elaborated by the instructor.

### Attendance:

- ❖ A student is allowed a maximum of six absences before he deserves a DN grade. The first two absences will be counted, but will not be penalized. Starting from the 3<sup>rd</sup> absence, you will be penalized by -0.5 points for each absence.
- ❖ You are **encouraged to read the blackboard announcements on a regular basis** to follow up the course progress, and to remind yourself with due dates of the different course assignments (e.g., homeworks, quizzes, exams, projects, ..etc).
- ❖ **You are KINDLY requested to close your mobile before entering the class.**
- ❖ Your prompt availability at the beginning of the class is important. **Attendance after 3-minutes of the class starting will be marked LATE. Attendance after 5-minutes of the class starting will be marked APSENT.**

# Laboratory Schedule

Week #	Activity
<b>1</b> <b>(18 - 22 Sep)</b>	<b>NO LAB</b>
<b>2</b> <b>(25 - 29 Sep)</b>	<b>Exp.1: Introduction To CASSY Lab &amp; Lab Safety Measures and Guidelines</b>
<b>3</b> <b>(02 - 06 Oct)</b>	<b>Exp.2: Three Phase Circuits</b>
<b>4</b> <b>(09 - 13 Oct)</b>	<b>NO LAB</b>
<b>5</b> <b>(16 - 20 Oct)</b>	<b>Exp.3: Magnetic Circuits Characteristics</b>
<b>6</b> <b>(23 - 27 Oct)</b>	<b>Exp.4: Equivalent Circuit of Single-Phase Transformer</b>
<b>7</b> <b>(30 Oct - 03 Nov)</b>	<b>Experimental Test #1 (Exp 1 to Exp 4)</b>
<b>8</b> <b>(06 - 10 Nov)</b>	<b>Exp.5: Regulation and Efficiency of a Single Phase Transformer</b>
<b>(13 - 17 Nov)</b>	<b>Midterm Break</b>
<b>9</b> <b>(20 - 24 Nov)</b>	<b>Exp.6: Load Characteristics of Shunt and Compound DC Generators</b>
<b>10</b> <b>(27 Nov - 1 Dec)</b>	<b>Exp.7: Torque Speed Characteristics of DC Shunt and Compound Motors</b>
<b>11</b> <b>(04 - 08 Dec)</b>	<b>NO LAB</b>
<b>12</b> <b>(11 - 15 Dec)</b>	<b>Exp.8: Determination of Parameters of Synchronous Generators</b>
<b>13</b> <b>(18 - 22 Dec)</b>	<b>Experimental Test #2 (Exp 5 to Exp 8)</b>
<b>14</b> <b>(25 - 29 Dec)</b>	<b>Exp.9: Torque Speed Characteristics of a Three Phase Induction Motors</b>
<b>15</b> <b>(01 - 05 Jan)</b>	<b>Lab Final Exam</b>