AL IMAM MOHAMMAD IBN SAUD ISLAMIC UNIVERSITY
COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRICAL ENGINEERING

# Course Syllabus (CS) Spring 2019

| **Course Information:** | | | | |
|---|---|---|---|---|
| **Code and Title:** | EE 371 Electric Drives | | | |
| **Prerequisites:** | EE222 Electrical Circuit Analysis & EE 271 Electromagnetics | | | |
| **Credit Hours:** | Theory Hrs. (**3**), Tutorial Hrs. (**1**), Lab. / Practical Hrs. (**0**), **Total Credits** (**3**) | | | |
| **Schedule:** | 10:15 AM to 11:05 AM | Sunday, Monday Wednesday,Thursday | **Lecture Hall:** | GR 55 |
| **Instructor's Information:** | Assoc. Prof. Mohamed Shalaby<br>Office: SR146, Ext.: 2586556<br>Email: myshalaby@imamu.edu.sa | | **Department:** | Electrical Engineering |
| **Office Hours:** | 2: 30 AM – 3:20AM Sunday, Monday and Thursday | | **Teaching Assistant:** | |

## Course Description:

Transformers: performance characteristics, three phase connections, autotransformers, DC machines: performance equations, generator and motor characteristics, starting and speed control of motors. Synchronous machines: generator and motor operation. Three phase induction motors: operation, performance calculations, starting and speed control. Single phase induction motors. Small synchronous motors. Universal motors.

## Course Objectives:

The course is intended to introduce to the students the following important aspects of Electric Drives:

1. Provide students with main features of three phase AC circuits.
2. Understand different ways of electric energy generation.
3. Learn structures of electric generators.
4. Understand electric generator and motor specifications and operation
5. Provide students with information related to different applications of transformers.

## *Course Learning Outcomes (CLOs)*

| After successful completion of the course, students should be able to … | | KPI |
|---|---|---|
| **CLO1** | Solve electrical engineering problems related to electrical machines. | **1.3** |
| **CLO2** | Recall the main methods to analyze and explain the performance of electric drives and describe the specs and their meanings of electrical machines and be able to summarize the characteristics of transformers. | **1.1** |
| **CLO3** | Calculate the efficiency of electric machines, and design a three phase machine and evaluate its performance. | **1.3** |
| **CLO4** | Evaluate the performance of an electrical machine. | **1.6** |
| **CLO5** | Apply information related to the new aspects of electric machines, and calculate the performance specs of a given electric machine. | **2.1** |
| **CLO6** | Criticize the use of a given electric machine in an inappropriate application. | **1.8** |

| **Textbook:** | | | |
|---|---|---|---|
| **Title:** | Electromechanical Energy Devices and Power Systems | | |
| **Author(s):** | Zia A. Yamayee & Juan L. Bala. Jr | | |
| **Publisher:** | John Wiley & Sons, Inc | **Year and Edition:** | |

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| **Other Useful Resources:** | Syed Nasar, "Electric Machines and Electromechanics", second edition, Schaum's Outlines, McGraw Hill, 1988. |

**Teaching and Learning Methods:**

- Lectures / discussions / handouts and few multimedia presentations
- Introduction to computer-aided analysis and design

**Course Contents:**

| Week | Topics to be Covered | Chapters |
|---|---|---|
| 1 | Introduction to Electric Drives. | |
| 2 | **AC circuit concepts:** Single phase AC circuits, Balanced 3 phase circuits, Delta and Wye connections, 3 phase power measurements. | |
| 3 | **Magnetic circuits:** Introduction, Magnetic Circuits Faraday's law, Inductance and magnetic energy.. | 2 |
| 4,5 | **Transformers**: Ideal transformer, Actual transformer | 2 |
| 6 | Approximate equivalent circuits, voltage regulation, efficiency. | 2 |
| 7 | Determination of equivalent circuit (open circuit test & short circuit test) parameters. | 2 |
| 8 | Polarity, Autotransformer, three phase transformers. | 2 |
| 9 | **DC Machines**: Introduction, Basic principles of operation, generation of unidirectional voltage, types of DC machines. | 2 |
| 10 | Voltage and torque equations, No load characteristics of DC generator, Voltage buildup in shunt generator, load characteristics, voltage regulation, DC generator efficiency . | 3 |
| 11 | Speed regulation of DC motor, DC motor efficiency, Speed Torque characteristics of DC motor, motor starting, Applications of DC motors.. | 3 |
| 12 | **Synchronous Machines:** Introduction, equivalent circuit of 3-Phase Induction motor, open circuit characteristics, short circuit characteristics, voltage regulation, Power angle characteristics, efficiency, Synchronous motor performance. | 3 |
| 13 | **Induction Motors:** Introduction, equivalent circuit of 3-Phase Induction motor, No load test, DC test, Blocked-Rotor test | 3 |
| 14 | Performance analysis of an Induction motor, Starting torque, Torque vs Speed | |
| 15 | Single phase Induction motors equivalent circuit and Performance analysis, starting of single phase motors | |

**Assessment Method:**

| Assessment Type | Nos. | Tentative Schedule | Weightage % |
|---|---|---|---|
| First Exam | 1 | At the end of the 6$^{th}$ week | 20 |
| Second Exam | 1 | At the end of the 12$^{th}$ week | 20 |
| Quizzes | 4 | At the end of Every chapter | 20 |
| Participation | | | 5 (Bonus) |
| Final Exam | 1 | At the end of the semester as per the university schedule | 40 |
| | | **Total = Coursework (60) + Final Exam (40) =** | **100** |

**General Policy and Code of Conduct:**

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| **Attendance:** | Minimum attendance requirement is 80%. Student should notify the instructor for any planned absence. University regulations regarding absence will be strictly applied. |

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| **Students' Conduct:** | Cheating and academic dishonesty will absolutely not be tolerated. University regulations will be enforced and applied on anyone found involved in it. |
| **Students' Homework:** | Will be assigned with their due times during lectures. Late submissions will not be accepted. Assignments will be corrected, graded and handed back to the students. |
| **Mobile Phones:** | Avoid using mobile phones during the lectures and exams. Use of mobile phones and other similar electronic devices (other than scientific calculators, as and when needed) is strictly prohibited. |

*Last Updated: Dr. M. Shalaby (May 2019)*