SYLLABUS

Date/ Revision	29 March 2017/ Rev.01
Faculty	Engineering
Approval	Dean of Engineering Faculty

SUBJECT : ELECTRIC MACHINES AND ELECTRIC DRIVES

1. Identification of Subject:

Name of Subject	: Electric Machine and Electric Drives
Code of Subject	: ELEC-3500
SKS	: 2
Semester	: 6
Study Program	: MTE
Lecturer	: To be announced

2. Competency

After studying the Introduction to Electrical Engineering course, the student able to:

- Describe the engineering profession and engineering ethics, including professional practice and licensure.
- Explain the engineering analysis and design processes
- Analyze data collected during laboratory exercises designed to expose
- Explain basic physical quantities in the electrical engineering, such as electric charge, electric current, electrical potential, electrical power, and energy;
- Explain the basic laws used in the electrical engineering and their relationship in the circuit analysis;
- describe the voltage to current relationship and current to voltage relationship in the resistors, capacitors, and inductors;
- describe the basic components used in the electrical engineering and their properties;
- Apply computer mathematical and simulation programs to solve circuit problems.

3. Description of Subject:

The purpose of the course is to teach principles of DC and AC motors and generators, and AC transformers and how they work. Basic concepts of electromagnetic circuits as they relate to voltages, currents, and physical forces induced in conductors are covered, including application to practical problems of machine design. Practical analytical models for most types of motors, generators, and transformers commonly used in industry are developed, and the models are used to analyze power requirements, power capability, efficiency, operating characteristics, control requirements, and electrical demands of these machines.
This course is also a "writing-intensive" course that teaches students to prepare formal, written technical documents. This goal is accomplished through extensive writing exercises performed in the context of laboratory exercises that accompany the course.

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4. Learning Approach

Approach : Combination of Expository - inquiry and colaborative
Method : Discussion, question answer, sample problem, group work
Student Task : Home work, presentation
Media : LCD projector, Teaching Aids (components), Simulation SW, film.

5. Evaluation

a) Absence maximum : 25%
b) Participation in discussion : 5 points
c) Homework, Classwork : 5 points
d) Presentation, Simulation : 10 points
e) Daily Quiz : 20 points
f) Final Examination : 60 points

Total : 100 points

6. Contents/ Topics of Lecturing:

Week	Content/ Topics of Lecturing	Text Book Chapter	Remark
1	**Magnetic Circuits and Magnetic Materials** • Introduction to Magnetic Circuits • Flux Linkage, Inductance, and Energy • Properties of Magnetic Materials • AC Excitation • Permanent Magnets • Application of Permanent Magnet Materials	CH-01	
2-3	**Transformers** • Introduction to Transformers • No-Load Conditions • Effect of Secondary Current; Ideal Transformer • Transformer Reactances and Equivalent Circuits • Engineering Aspects of Transformer Analysis • Autotransformers; Multiwinding Transformers • Transformers in Three-Phase Circuits • Voltage and Current Transformers • The Per-Unit System	CH-02	Quiz-1
4-5	**Electromechanical-Energy-Conversion Principles** • Forces and Torques in Magnetic • Field Systems • Energy Balance • Energy in Singly-Excited Magnetic Field Systems • Determination of Magnetic Force and Torque from Energy • Determination of Magnetic Force and Torque from Coenergy • Multiply-Excited Magnetic Field Systems • Forces and Torques in Systems with Permanent Magnets	CH-03	Quiz-2

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	• Dynamic Equations • Analytical Techniques		
6-7	**Introduction to Rotating Machines** • Elementary Concepts • Introduction to AC and DC Machines • MMF of Distributed Winding • Magnetic Fields in Rotating Machinery • Rotating MMF Waves in AC Machines • Generated Voltage • Torque in Nonsalient-Pole Machines • Linear Machines • Magnetic Saturation and Leakage Fluxe	CH-04	Quiz-3
8	**MID SEMESTER BREAK**		
9	**Synchronous Machines** • Introduction to Polyphase Synchronous Machines • Synchronous-Machine Inductances; Equivalent Circuits • Open- and Short-Circuit Characteristics • Steady-State Power-Angle Characteristics • Steady-State Operating Characteristics • Effects of Salient Poles; Introduction to • Direct- and Quadrature-Axis Theory • Power-Angle Characteristics of Salient-Pole Machines • Permanent-Magnet AC Motors	CH-05	
10	**Polyphase Induction Machines** • Introduction to Polyphase Induction Machines • Currents and Fluxes in Polyphase Induction Machines • Induction-Motor Equivalent Circuit • Analysis of the Equivalent Circuit • Torque and Power by Use of Thevenin's Theorem • Parameter Determination from No-Load and Blocked-Rotor Tests • Effects of Rotor Resistance; Wound and Double-Squirrel-Cage Rotors	CH-06	
11	**DC Machines** • Introduction • Commutator Action • Effect of Armature MMF • Analytical Fundamentals: Electric-Circuit Aspects • Analytical Fundamentals: Magnetic-Circuit Aspects • Analysis of Steady-State Performance • Permanent-Magnet DC Machine • Commutation and Interpoles • Compensating Windings • Series Universal Motors	CH-07	
12	**Electric Drives Laboratory** • Experiment DC – Motor and induction motor • Leybold - COM3LAB : Electric Machine • Leybold - Drive control with TP	Supplement Instruction Manual	
13	**Variable-Reluctance Machines and Stepping Motors** • Basics of VRM Analysis • Practical VRM Configurations	CH-08	

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	• Current Waveforms for Torque Production • Nonlinear Analysis • Stepping Motors		
14	**Single-and Two-Phase Motors** • Single-Phase Induction Motors: Qualitative Examination • Starting and Running Performance of Single-Phase Induction and Synchronous motors • Revolving-Field Theory of Single-Phase Induction Motors • Two-Phase Induction Motors	CH-09	
15	**Speed and Torque Control** • Control of DC Motors • Control of Synchronous Motors • Control of Induction Motors • Control of Variable-Reluctance Motors	CH-11	
16	**Final Exam**		

7. Book Reference:

- **Main Text Book:**

  "*Electric Machinery*. 6th ed", Authors: Fitzgerald, A. E., Charles Kingsley, Jr., and Stephen D. Umans, **Publisher**: McGraw-Hill, 2007, **ISBN**: 9780071230100

- **Supplement / Textbook / Manual**

  "Fundamental of Electric Circuit-6Ed,", Authors: Christopher K. Alexander and Matthew N.O. Sadiku, **Publisher**: McGraw-Hill, 2007, **ISBN**: 978-1-259-25132-0

  "Principle and Applications of Electrical Engineering, 6Ed", Authors: Giorgio Rizzoni, **Publisher**: McGraw-Hill, 2016, **ISBN**: 978-981-4577-41-0

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