COLLEGE OF ENGINEERING
MECHANICAL AND ELECTRICAL DEPARTMENT

Course Name: ELECTRICAL MACHINES II
Course ID:
Faculty Curse ID: 5675
University Course ID: **CACEI ID:** IA
Study plan level: VII **Credits:** 12
Normal hours per week: 5 **Total hours course:** 80
Lab hours per week: 2
Complementary Practices:
Extra-class Work Hours / Week: 5
Course type: IEA, IME/ Mandatory, own area
Approved credits needed:
Curricular last revision date: 2013

Prerequisite course Electrical Machines I (5574)

COURSE JUSTIFICATION

Electric motor which, a little more than one hundred years of its invention, is more efficient driving machine by the man, making it clear to teaching in engineering programs associated with electrical engineering.
The induction motor is currently the main driving force in industrial, commercial applications I residential. Its robustness, low maintenance and cost has taken him to position itself as the engine of greater utility in modern life. On the other hand direct current motor, despite the fact that their applications have decreased significantly in the industry, no longer a motor to study for their applications in low-power and as actuators.

COURSE OBJECTIVE

Identify constructive forms, as well as models of induction motor and the direct current motor operating in permanent state. Develop the basic theory of both electric machines and their potential applications.

COURSE TOPICS

1. Basic principles of induction motor **4 hrs.**

Objective: Apply and develop basic concepts of electromagnetism induction motor.
1.1. Three requirements for the operation of the induction motor.
1.2 Frequency and speed.
1.3 Sliding.
1.4. Principle of the torque induced in induction motor.

2. Construction and classification of induction motor **3 hrs.**

Objective: To identify the elements that constitutes the construction of induction motor, as well as its classification.

2.1 Estatorrotor: parts that make it up.
2.2. Classification of insulation.
2.3 Classification of the type of rotor engine.
2.4 Classification of the rotor by its construction.
2.5. Types of housing in induction motor.

3. Phase induction motor circuit. **10 hrs.**

Objective: Develop and analyze the equivalent circuit of induction motor phase, to interpret their behavior in steady state.

3.1 Equivalent circuit per phase real and modified.
3.2. Phase diagram.
3.3 Power flow diagram.
3.4 Curve induction motor speed.
3.5 Power and torque.

4. Efficiency and performance parameters. **5 hrs.**

Objective: To identify the necessary tests that allow to obtain the characteristic parameters, as well as their efficiency.

4.1 Induction motor losses.
4.2 Proof of direct current in stator.
4.3. Test in vacuum.
4.4. Test with blocked rotor.
4.5. Test with load.

5. Variation of speed torque curve by rotor design. **4 hrs.**

Objective: To identify the influence of design of rotor three-phase induction motor speed torque curve.

5.1. Variation of inductance and resistance in the circuit of the cage.
5.2. Classes of NEMA squirrel cage induction motor design.
5.3 Winding rotor induction motor.

6. Selection, control and protection of induction motor

5 hrs.

Objective: Acquire the basic criteria for the implementation, control and protection of induction motor.

6.1 Induction motor nameplate.
6.2 Selection criteria: charging, cycle operation and environment.
6.3 Letters code of induction motor.
6.4. Electromechanical control.
6.5 Control of solid state.

7. Single phase induction motor

9 hrs.

Objective: To develop the basic theory, as well as the methods of booting in single phase induction motor.

7.1. The double rotating magnetic field theory.
7.2 The single-phase motor equivalent circuit.
7.3 Speed torque curve.
7.4. Methods for single-phase motor start.

8. The direct current machine **4 hrs.**

Objective: Apply and develop the basic concepts of electromagnetism to the direct current motor.

8.1 Linear machine operation.
8.2 Rotating loop: operating as generator.
8.3 Swivel loop: operating as a motor.
8.4 Process switching in a simple direct current machine.

9. Construction and classification of direct current machine

6 hrs.

Objective: To identify the elements that constitutes the construction of direct current machine, as well as its classification.

9.1.-Stator: field winding.
9.2.-Rotor: armature winding.
9.3 Types of armature winding.
9.4. Auxiliary poles and interpolos.
9.5. Materials in the construction of the machine of direct current.
9.6. Classification of the machine of direct current operation.

10. Direct-current motor **8 hrs.**

Objective: Develop and analyze the equivalent circuit of direct current permanent state machines.

10.1. The armature reaction.
10.2 Equivalent circuit and magnetization curve.
10.3 Counter electromotive force.
10.4 Power and torque induced
10.5 Characteristic torque speed.
10.6. Regulation of speed.

11. Types of direct-current motors

6 hrs.

Objective: Interpret the equivalent circuits, curve speed, speed regulation and application of direct current motor.

11.1 Motor shunt.
11.2 Engine series.
11.3 Compound engine.
11.4 Permanent magnet motor.
11.5 Universal motor.
11.6 Efficiency and losses in direct current motor.

12. Direct current motors speed control **5 hrs.**

Objective: To identify the conditions necessary for the control of DC motor speed.

12.1. Control by armor.
12.2 Control field.
12.3 Areas of operation of the motor: torque speed.
12.4 Solid-state control

13. Nominal values and start the engine of direct current

3 hrs.

Objective: To identify on the motor name plate data and this data, select the type of boot and protection.

13.1. A direct current motor plate data.
13.2 Selection of direct current motor.
13.3 Circuits start to a direct current motor.
13.4. Protection for an engine of direct current circuits.

14. Special purpose motors.

8 hrs.

Objective: To know the general theory of special purpose motors

14.1 Servomotors.
14.2 Stepper motor.
14.3 Variable reluctance motor.
14.4 Brushless direct-current motor.
14.5 Hysteresis motor.

METHODOLOGY

Exposition of the topics: analysis and synthesis of the concepts presented in the course program. Exercises in digital computer programs about modeling and simulation to support meaningful learning, using tools such as digital platforms online, discussion of tasks or projects that encourage collaborative work among students, application of exams, and lab practices.

EVALUATION CRITERIA

The grade obtained in the course is the average of four midterms and one final exam. Each test is weighted with the guidelines and requirements of the professor who teaches the course. To approve the course is necessary to pass the corresponding laboratory.

BIBLIOGRAPHY

TEXT BOOK:

Guru Bhag S., Hiziroglu Hüseyin R., "Máquinas Eléctricas y Transformadores", 3ª Ed, Oxford University Press, 2005

Chapman Stephen J., "Máquinas Eléctricas", 4ª. Ed, McGraw-Hill, 2005

Richardson Donald V, Caisse Arthur J, "Máquinas Eléctricas Rotativas y Transformadores", 4ª Ed, Prentice-Hall, 1997

Wildi Theodore, "Máquinas Eléctricas y Sistemas de Potencia", 6a Ed., Pearson, 2007

Cathey Jimmie J. "Máquinas Eléctricas: Análisis y Diseño Aplicando Matlab" 1ª Ed. McGraw-Hill, 2002

Enríquez Harper Gilberto "Experimentos con Máquinas Eléctricas: Máquinas Rotatorias y Transformadores" Limusa, 2005

Paresh C. Sen, Principles of Electric Machines and Power Electronics, John Wiley & Sons.

ELECTRONIC LINKS:

http://www.abb.com.mx/
http://www.baldordistribuidora.com/
http://www.siemens.com.mx/
http://www.cfe.gob.mx
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