



EE371-Electric Drives (Required Course)

Code and Name: EE 371 Electric Drives

Credit Hours: 3 (Lecture: 3, Tutorial: 1)

Textbook:

- Electromechanical Energy Devices and Power Systems, Z. A. Yamayee and J. L. Bala. Jr, John Wiley & Sons Inc., 1994.

Other References:

- Electric Machines and Electromechanics, Syed Nasar, second edition, Schaum's Outlines, McGraw Hill, 1988.

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.

Pre-requisites: EE222 and EE 271

Co-requisites: None

Course Learning Outcomes:

With relation to ABET Student Outcomes (SOs: 1-7)

1. Solve electrical engineering problems related to electrical machines. (1)
2. 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. (2)
3. Calculate the efficiency of electric machines and design a three-phase machine and evaluate its performance. (1)
4. Evaluate the performance of an electrical machine. (1)
5. Apply information related to the new aspects of electric machines and calculate the performance specs of a given electric machine. (1)
6. Criticize the use of a given electric machine in an inappropriate application. (1)

Topics to be covered:

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

Grading Policy:

The grading for the course are 60% coursework and 40% Final Exam. The coursework consists of two Midterm Exams, where each midterm exam is worth 20%. It also includes quizzes, homework, and projects for the remaining 20% that is modified by the course instructor.

