UNIVERSITY OF HOUSTON
Engineering Technology

ELET 3307: ELECTRICAL MACHINES and CONTROLS

CLASS and GRADING PROCEDURE

There will be three tests during the semester, two regular tests and a comprehensive final. Test two will be a take home test. Each test will count 100 points and the final grade will be calculated from the equation

\[ FG = \frac{T_1 + T_2 + T_F}{3} + HWB \]

where

- \( FG \) is the final grade
- \( T_1, T_2, \) and \( T_F \) are the first, second, and final tests respectively
- \( HWB \) is the homework bonus which will be worth between one and three points depending upon the amount of graded homework and will be prorated according to the amount and quality of the homework turned in.

Make up tests will be given only if the student has a very good reason for missing a test and the teacher is notified ahead of time (in the case of an accident or emergency as close to test time as possible) that the student must miss the test.

Unless otherwise stated homework is due the next regular class meeting in which it is assigned. The homework is covered then so late homework in not normally accepted.

While attendance is not calculated into the grade, a student who accumulates six hours of unexcused absences is subject to instructor drop without notification.

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Useful web site: [http://www.uh.edu/provost/stu/stu_syllabsuppl.html](http://www.uh.edu/provost/stu/stu_syllabsuppl.html)  
This website has information about academic honesty, the academic calendar, and other matters of interest.

Please note:

“The American with Disabilities Act of 1990 requires that the university make reasonable accommodation to persons with disabilities as defined in the act. Students who feel they need assistance under the ADA guidelines should approach the instructor to discuss such consideration.”
COURSE OUTLINE

COURSE: ELET 3307  Electrical Machines and Controls
PREREQUISITE(S): ELET 2301, MATH 1431
COREQUISITE(S): ELET 3107
CREDIT HOURS: 3 (3-0)
COURSE COORDINATOR: Luke Faulkenberry

COURSE DESCRIPTION:

Characteristics and applications of DC and AC motors, generators, and controls.

AUTHORIZED TEXT: Electric Machinery Fundamentals, 4th Ed.
Chapman
McGraw Hill 0-07-246523-9

STATEMENT OF COURSE OBJECTIVES:

To introduce the student to:
1. The theory of operation, and characteristics of rotating electrical machines.
2. The applications of rotating electrical machines and basic electromechanical controls.

COURSE OUTLINE:

UNIT I. FUNDAMENTAL CONCEPTS (2 wks)

A. Basic Magnetic Concepts
   1. Basic field concepts
   2. Magnetic induction
      a. Voltage induction
      b. Counter force
   3. Magnetic force generation
      a. Current generation of force
      c. Counter emf
B. Basic motor - generator concepts
UNIT II. MACHINE PRINCIPLES (4 wks)

A. DC Machine Principles
   1. Construction and windings
   2. Production of voltages and torques
   3. Ideal commutation
   4. Problems with commutation
      a. Armature reaction
      b. Inductive kick
   5. Generated voltage equations

B. General AC Machine Concepts
   1. Construction and windings
   2. Equivalent circuit
   3. AC voltage and torque equations

UNIT III. DIRECT CURRENT MACHINES (3 wks)

A. Direct Current Generators
   1. Types of DC Generators
      a. Separately excited shunt
      b. Self excited shunt
      c. Compound
   2. Magnetization Curves
   3. Terminal Characteristics (V vs. I) of Generators
   4. Potential Instability Problems
      a. Flux weakening due to armature reaction
      b. Differential compound connection

B. Direct Current Motors
   1. Types of DC Motors
      a. Shunt
      b. Series
      c. Compound
   2. Starting and Controlling DC Motors
   3. Applications of DC Motors

UNIT IV. POLYPHASE INDUCTION MOTORS (3 wks)

A. Basic Principles
B. Slip, Slip Speed, and Rotor Speed
C. Terminal Characteristics of Induction Motors
D. Special Features of Wound-Rotor Induction Motors
E. Application of Induction Motors
F. Control of Induction Motors

UNIT V. ALTERNATING CURRENT SYNCHRONOUS MACHINES (3 wks)

A. Synchronous Generators
   1. The phasor diagram
2. Response to changes in real and reactive load
3. Paralleling AC synchronous generators
4. Control of real and reactive power

B. Synchronous Motors
1. The phasor diagram
2. Response to changes in shaft load (torque vs. speed)
3. Control or reactive power (power factor correction)
4. Starting synchronous motors
5. Synchronous motor applications
6. Synchronous motor starting

UNIT VI. SINGLE-PHASE MOTORS (.5 wks)
A. Basic Theory
B. Single-Phase Induction Motors
   1. Torque-speed characteristics
   2. Types of single phase induction motors
      a. Split-phase
      b. Capacitor-start
      c. Capacitor-run
      d. Shaded-pole
C. Universal Motors
D. Hysteresis Motors

UNIT VII. STEPPING MOTORS (.5 wks)
A. Description
B. Operation
   1. Single stepping
   2. Half stepping
   3. Micro stepping
C. Application Considerations
   1. Resonance
   2. Damping
   3. Torque considerations

COMPUTER USAGE: Word Processing, Spread Sheet for graphics and a math solver such as Mathcad.

LIBRARY USAGE: Normally two one or two page written library assignments on motor testing are assigned each semester.