

ELG3311: Electric Machines and Power Systems

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Course Content:

- Machinery Principles
 - Magnetic Circuits
 - Electromechanical Energy Conversion
- Three Phase Power
 - Star Connection
 - Delta Connection
 - Balanced Three Phase Systems
- Transformers
 - Ideal Transformer
 - Real Single-Phase Transformer
 - The Equivalent Circuit of a Transformer
 - The Per-Unit System of Measurement
 - Voltage Regulation and Efficiency
 - Three Phase Transformers
- Introduction to Power Electronics
 - Power Electronics Components
 - Rectifier Circuits
 - Converters
- AC Machinery Fundamentals
 - Rotating Magnetic Field
 - Induced Voltage in AC Machines
 - Induced Torque in AC Machines
 - Power Flow and Losses
- Synchronous Generators
 - Construction of Synchronous Generators
 - The Equivalent Circuit
 - Power and Torque
 - The Synchronous Generator Operating Alone
 - Parallel Operation of Synchronous Generators
- Synchronous Motors
 - Construction of Synchronous Motors
 - The Equivalent Circuit
 - Power and Torque
- Induction Motors

- Induction Motor Construction
- The Equivalent Circuit of an Induction Motor
- Power and Torque
- Starting Induction Motors
- DC Machines
 - Principles of Operation
 - Commutation
 - Types of DC Motors
 - DC Generators
- Electric Power Utility Systems
 - Types of Generators
 - Power Grid
 - Power Transmission Lines
- Special-Purpose Electric Motors
 - The Universal Motor
 - Brushless DC Motor
 - Stepper Motor
 - Single Phase Induction Motor

Prerequisite: ELG2130, ELG2135, PHY2323 PHY1102

Assessment:

Each assessment part contributes to the total mark as described below:

Assignments and Quizzes (10%): There will be four assignments. They will be remitted in the proper box assigned to the course.

Quizzes: Four short quizzes will be given during both lecture and tutorial periods.

All due dates must be respected. Late assignments will NOT be marked and will receive a mark of 0.

Labs (15%): There will be five experiments and a small project. They will be performed by groups of two or three students.

The presence of all students in a team is obligatory and will be checked by the TAs. Each group must remit a report for each experiment.

Indicate clearly the name of the author(s).

The report must be submitted to your TA within 14 days of the date of the experiment. Late reports will not be marked.

An absence will get a zero (except for exceptional circumstances and where the work will be redone at a new date, with permission from the instructor).

Mid-term Test (25%): Closed book of 90-minute duration.

Final Exam (50%): Closed book three-hour exam.

Grading: The grading will be proportional to the number of correct answers. If a numerical number is required in the exam, try to always accomplish a value; do not just write equations down.

Final Mark: The final mark will be composed of the weighted sum of ALL elements of the course, as described above.

Assignments:

Please follow the following guidelines for submission of assignments:

- Use a cover sheet on which you completely print your full name, the date, the course number, and the homework assignment number.
- Write on only one side of the paper.
- Number each problem at a position on the page where a staple will not cover the number when you turn your paper in.
- At the start of each problem, or each part of a problem, draw the circuit diagram and write a short statement of what is to be solved for.
- Clearly label the circuit diagrams with all-pertinent voltages and currents.
- Work each problem and each part in order in a single column. Do not put more than one equation or answer on a line.
- Mark all answers, e.g. by putting a box around them.
- If you do not complete a problem or any part of a problem, write, “end” and underline the word at the point where you stopped.
- The assignment should be received at the ELG3311 box.

Laboratory:

- Each two or three student work as a group. Each group will submit one report. Each report must indicate the members of the group and the name of the writer.
- A good lab report does more than present data; it demonstrates the writer's comprehension of the concepts behind the data. Only recording the expected and observed results is not sufficient; you should also identify how and why differences occurred, explain how they affected your experiment, and shows your understanding of the principles the experiment was designed to examine. The format, although helpful, cannot replace clear thinking and organized writing. You still need to organize your ideas carefully and express them coherently.
- The Title Page needs to contain the name of the experiment, the names of lab partners, and the date.
- The Introduction states the objective of the experiment and provides the reader with background to the experiment.
- Equipment may be a simple list, but make sure it is precise and complete.
- Experimental procedure describes the process in chronological order. Explain all steps in the order they happened, not as they are supposed to happen.
- Results are generally dominated by calculations, tables and figures; but you still need to state all significant results explicitly in written form.
- Discussion is a significant part of your report, because you show that you understand the experiment beyond the simple level of completing it.
- Focus your discussion with the following procedures:
 - Compare expected results with those obtained.
 - Explain your results in terms of theoretical issues.
 - Relate results to your experimental objective(s).
 - Compare your results to similar investigations.
- It is legitimate to compare outcomes with classmates, not to change your answer, but to look for any anomalies between the groups and discuss those.

- Analyze the strengths and limitations of your experimental design. This is particularly useful if you designed the thing you are testing (e.g. a circuit).
- The Abstract summarizes four essential aspects of the report: the purpose of the experiment (sometimes expressed as the purpose of the report), key findings, significance, and major conclusions. The abstract often also includes a brief reference to theory or methodology. The information should clearly enable the reader to decide whether to read your whole report. The abstract should be one paragraph of 100-150 words.
- The References include your lab manual and any other literature resource you have used.
- The LAB Report should be submitted to the TA at the next lab session.