Course Outline

**Instructor**
- Prof. Athula Rajapakse, P.Eng.
  SPC-307 Stanley Pauley Centre
  (204) 480-1403
  Athula.Rajapakse@umanitoba.ca

**Office Hours**
- Tuesday and Thursday
  10:30am–12:00pm
  1:00pm–2:30pm
  or by appointment

**Teaching Assistant**
- Rajesh Vaid
  E3-574 EITC
  umvaid@myumanitoba.ca
- Aklo Rapasinghe
  SPC-307 Stanley Pauley Centre
  rupabwha@myumanitoba.ca

**Contact Hours**
- 5 credit hours
- Lectures
  3 hours × 13 weeks = 39 hours
- Laboratories
  3 hours × 8 weeks = 24 hours
- Tutorials
  3 hours × 2 weeks = 6 hours
- Field Trip
  6 hours

**Prerequisites:**
- ECE 3720 Electric Power and Machines

**Course Website:**
http://ece.eng.umanitoba.ca/undergraduate/ECE3650

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**Important Dates**

- **Term Tests**
  February 11th, 2015, 6:30–8:30pm
  March 11th, 2015, 6:30-8:30pm

- **Voluntary Withdrawal Deadline**
  March 19th, 2015

- **Mid-Term Break**
  February 16–20, 2015
  No classes or examinations

- **Good Friday**
  April 3rd, 2015
  No classes or examinations

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**Course Outline**

**ECE 3650 – Electric Machines**

**Winter 2015**

**Course Objectives**

Constructional features, analysis, modeling, and applications of three phase transformers, synchronous machines, and single phase induction motors; Principle of operation of special motors.

**Course Content**

The following topics will be covered:

- Sinusoidal excitation of magnetic circuits:
  - Hysteresis loss; Eddy current loss; Saturation and exciting currents; Voltage and frequency ratings of electrical machines
- Three phase transformers:
  - Three phase transformer connections; Special transformer connections (Open Delta, Scott, and Zigzag); Three-phase transformer analysis; Per unit system; Harmonics and inrush currents
- Synchronous machines
  - Constructional features; Stator windings; Voltage generation and armature reaction; Equivalent circuit; Open circuit and short circuit tests; Analysis of a synchronous machine connected to an infinity bus; Steady state stability; Synchronous machine capability curve
- Salient pole synchronous machines
  - d-q currents and reactances; Phasor diagram; Power transfer; Determination of d-q reactances
- Single phase induction motors
  - Operating principle and starting methods; Double revolving field theory; Equivalent circuit
- Special motors
  - Principle of operation of reluctance, hysteresis, and brushless dc motors; Universal motor.

**Textbook**


**Other References**


**Requirements/Regulations**

- Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a final grade.
- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should also familiarize themselves with the University’s General Academic Regulations, as well as Section 3 of the Faculty of Engineering Academic Regulations dealing with incomplete term work, deferred examinations, attendance and withdrawal.
- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.
Learning Outcomes

1. Estimate eddy current and hysteresis losses in magnetic circuits.
2. Analyze phase relationships of three-phase transformers and circuits with three-phase transformers.
3. Analyze performance and operating limits of a grid connected synchronous machine using equivalent circuits.
4. Analyze the performance of salient pole synchronous machines using d-q theory.
5. Explain different starting methods and analyze the operating performance of single phase induction motors using equivalent circuits.

Expected Competency Levels

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Evaluation

The final course grade is determined by the student's performance in laboratories, in quizzes, and on examinations. Students must complete all the laboratories in order to be eligible to receive a passing grade. Attendance to a daylong field trip to McArthur Falls generating station is compulsory. The trip will be scheduled on a Saturday. The exact date will be announced well in advance.

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<tr>
<th>Component</th>
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<th>Method of Feedback</th>
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<td>Laboratories + Field Trip</td>
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* Method of Feedback: F - Formative (written comments and/or oral discussion), S - summative (numerical grade)

Academic Integrity

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations on Academic Integrity, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.