

## **MECH 3630 Electrical Technology**

Spring semester 2023

### **Course Description:**

Theoretical and practical treatment of key elements in electrical technology with industrial applications. Main topics include magnetic circuits, transformers, electrical machines, and applications for industrial automation.

**Prerequisites:** None

**Textbook:** P.C. Sen,  
Principles of Electric Machines and Power Electronics, third edition,  
Wiley, 2013.

**Instructor:** Prof. Yongsheng Gao  
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### **Grading Policy:**

Assignment (15%)  
Laboratory (15%)  
Midterm Exam (30%)  
Final Exam (40%)

### **Supplementary Texts:**

Edward Hughes, Electrical Technology, 7th edition, rev. by Ian M. Smith,  
Addison Wesley Longman Ltd., 1995.

Brian Scaddan, Electrical Installation Work, third edition,  
Newnes, Butterworth-Heinemann, 1998.

Geoffrey Stokes, A Practical Guide to the Wiring Regulations,  
Blackwell Science, 1994.

### **Laboratory Work:**

2 experiments and 1 demonstration

### **Lecture Content:**

1. Magnetic Circuits (1.5 weeks)  
Hysteresis  
Sinusoidal excitation  
Permanent magnet
2. Transformers (2 weeks)  
Construction and working principle

Equivalent circuit analysis  
Autotransformers and three-phase transformers

3. Electromechanical Energy Conversion (0.5 weeks)  
Energy conversion process  
Field energy  
Mechanical force in the electromagnetic system  
Rotating machines
4. DC Machines (3 weeks)  
Motor and generator principles  
Speed-torque characteristics of series, shunt, and compound wound motors
5. Induction (Asynchronous) Machines (3.5 weeks)  
Construction and principle of action of squirrel cage motors  
Speed control and starting method  
Equivalent circuit analysis  
Speed-torque characteristics
6. Synchronous Machines (0.5 weeks)  
Construction and principle of action  
Equivalent circuit analysis  
Speed-torque characteristics
7. Single-Phase Motors (0.5 weeks)  
Double revolving field theory  
Equivalent circuit analysis  
Speed-torque characteristics
8. Special Machines (0.5wks)  
Servomotors  
Synchros  
Stepper motors
9. Transients and Dynamics (0.5wks)  
DC machines  
Synchronous machines  
Induction machines  
Transformer
10. Power Semiconductor Converters (0.5 wks)  
Power semiconductor devices  
Controlled rectifiers  
AC voltage controllers  
Choppers  
Inverters and cycloconverters