**LETOURNEAU UNIVERSITY**

**EETC 3433 ELECTRICAL MACHINERY AND CONTROLS for JLNU**

**Fall Semester 2024**

2021-22 CATALOG DATA: A study of instrumentation and control systems including analog, digital, and programmable controllers used in both open- and closed-loop control systems. Topics include system modeling and dynamic analysis, controller design, and applications of the different types of control systems along with sensors, transducers, and final correcting devices.

CREDIT: 3 credit hours.

# Suggested Readings:

1. Introduction to Control Systems Technology, 7th edition, 2002 by Bateson
2. Electrical Power and controls, 2nd edition, 2004 by Skvarenina
3. Electrical Machines, Drives, and Power Systems, 6th edition, 2006, by Wildi

INSTRUCTOR: Ms. Judy WS Wong

REFERENCES:

* MATLAB online documentation
* Do more Designer (PLC) online documentation.

GOALS AND/OR OBJECTIVES:

1. To give the students the ability to choose electrical machinery best suited to a specific design application.
2. To establish the student in the fundamentals of electronic control systems and related instrumentation for use in various real-world applications.
3. To give the students the basic PLC knowledge

COREQUISITE: None

COMPUTER USAGE: Students will be required to use computers for PLC simulation and MATLAB for control systems.

DESIGN CONTENT: Students shall be required to demonstrate ability to solve various design problems related to the application and control of motors, generators, and transformers.

SCHEDULE:

20 x 100min spread within 6 weeks

# TOPICAL OUTLINE OF THE COURSE CONTENT

* **Chapter 1: Introduction to Electrical Machinery and Control**
  + Course Overview and Learning Objectives
  + Evolution of Electrical Machinery
  + Role in Modern Engineering and Industry 4.0
* **Chapter 2: Advanced Applications of AC and DC Machines**
  + Overview of AC and DC Machines: Key Differences and Similarities
  + Advanced Control Techniques for Both Machine Types
  + Applications in Robotics, Electric Vehicles, and Industrial Automation
* **Chapter 3: Synchronous Machines**
  + Synchronous Generators in Renewable Energy Systems
  + Advanced Control Techniques for Synchronous Motors
  + Applications in Smart Grids and Energy Management Systems
* **Chapter 4: Induction Motors**
  + High-Efficiency Induction Motors and Their Design
  + Variable Frequency Drives (VFDs) and Advanced Control
  + Integration of Smart Sensors and IoT for Performance Monitoring
* **Chapter 5: Programmable Logic Controllers (PLCs)**
  + Advanced PLC Architecture and Programming Techniques
  + Integration of PLCs with SCADA Systems
  + Applications in Industrial Automation and Process Control
* **Chapter 6: PID Control Systems**
  + Advanced PID Control Strategies and Tuning Methods
  + Implementation of PID in Complex Control Systems
  + Case Studies: PID Applications in Machinery Control
* **Chapter 7: Transformers and Smart Technologies**
  + Smart Transformers: Design and Functionality
  + Health Monitoring and Condition-Based Maintenance
  + Integration with Renewable Energy Sources
* **Chapter 8: Power Electronics and Electric Drives**
  + Latest Developments in Power Electronics for Machine Control
  + Applications in Electric and Hybrid Vehicles
  + Control Strategies for Advanced Electric Drives
* **Chapter 9: Advanced Control Techniques**
  + Real-Time Control Systems and Algorithms
  + Model Predictive Control and Fuzzy Logic Applications
  + Integration of AI and Machine Learning in Control Systems
* **Chapter 10: Maintenance and Condition Monitoring**
  + Predictive Maintenance Technologies Using AI
  + Advanced Diagnostic Tools for Electrical Machines
  + Real-World Case Studies in Condition Monitoring
* **Chapter 11: Innovations in Electrical Machinery**
  + Impact of 5G and Edge Computing on Machinery Control
  + Sustainable Practices and Innovations in Electrical Engineering
  + Future Trends: Electrification and Smart Cities
* **Chapter 12: Capstone Project and Future Trends**
  + Student Presentations on Emerging Technologies
  + Discussion on Ethical Considerations and Sustainability
  + Trends Shaping the Future of Electrical Machinery and Control

POLICIES:

1. TESTS: Advance notice of a necessary absence must be given to the instructor by voice mail or email or else a zero will be given for the test.
2. HOMEWORK: It is assumed that the student will work all of the assigned problems. Problems will be collected by due date announced by instructor; late homework will not be accepted.
3. Regular attendance and class participation are important. Tardiness or absences may affect grade.
4. Individual homework exercises must be individual work. It often helpful to work in study groups when doing homework problems to discuss the material. If this is done, then the assignment should list the names of the other students in the study group. The final problem or assignment should still be worked through by the individual. All work must be shown in your solution.
5. Group assignments in the form of homework, special projects, and laboratory reports may be assigned. In this case, it is expected that all students in the group participate equally in the exercise and contribute to the submitted copy of the material.
6. The instructor reserves the right to modify the course outline and policies mentioned in this syllabus at any time during the semester.

GRADING:

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| Grade Basis:  Homework / classwork…………………………...……….40%  Quiz /presentation ……...………………………………..20%  Laboratory Exercises /project..……………………………20%  Comprehensive Final Exam……………………………….20%  Grade Scale:  A = 90-100  B = 80-89.9  C = 70-79.9  D = 60-69.9  F = 0-59.9 | |  | |
| PROJECTS, LABORATORY, AND OTHER:   1. System Components – Sensors, Actuators 2. Basics & Types of Control 3. LaPlace Transforms and Transfer Functions 4. Bode plot 5. Programmable Logic Controllers (PLC) 6. Transformer 7. Electric Motors 8. 3-phase power   Prepared by: Judy Wong October 18, 2024 |  | |