STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

MASTER SYLLABUS

ELEC 215 – ELECTRICAL ENERGY CONVERSION

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CANINO SCHOOL OF ENGINEERING TECHNOLOGY
ELECTRICAL ENGINEERING TECHNOLOGY & ENGINEERING SCIENCE DEPARTMENT - 2019

A. TITLE : ELECTRICAL ENERGY CONVERSION

B. COURSE NUMBER: ELEC 215

C. CREDIT HOURS: (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)

 # Credit Hours: 4
 # Lecture Hours: 3 **per week #**
Lab Hours: 3 **per week**
Other: per week

Course Length: 15 **Weeks**

C. WRITING INTENSIVE COURSE: NO

D. GER CATEGORY: None

E. SEMESTER OFFERED: Fall/Spring

F. CATALOG DESCRIPTION: Fundamentals of Electricity, Magnetism, and Circuits related to generation of electrical power are discussed. The study of construction and operation of direct current generators and motors. The principles of operation of three phase induction motors and alternating current generators are presented. Topics also include linear motor and single phase motor principles and operation. Single phase transformer theory, and three phase circuits are also covered. Laboratory experiments are performed to reinforce the theory for each of the covered topics.

G. PRE-REQUISITES: Electric Circuits 2 (ELEC 102/129), or Electricity (ELEC 261) or permission of instructor.

CO-REQUISITES: None

H. STUDENT LEARNING OUTCOMES:

- Institutional Student Learning Outcomes (ISLO)
- Accreditation Board for Engineering and Technology (ABET) – Student Outcomes

Course Objectives	Institutional SLO	ABET- Student Outcomes
a. Describe how electrical power is generated and distributed	2. Critical Thinking 5. Industry, Professional, Discipline-Specific Knowledge and Skills	1. An ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly defined engineering problems appropriate to the discipline.

3. Demonstrate hands-on experience in DC/AC Motors, and analyze transformer design	1. Critical Thinking 5. Industry, Professional, Discipline-Specific Knowledge and Skills	1. An ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly defined engineering problems appropriate to the discipline.
4. Troubleshoot transformers and motors	2. Critical Thinking 5. Industry, Professional, Discipline-Specific Knowledge and Skills	4. An ability to conduct standard tests, measurements, and experiments and to analyze and interpret the result to improve processes. 5. An ability to function effectively as a member as well as a leader on technical teams.
3. Prepare and deliver a technical presentation	1. Communication	3.An ability to apply written, oral, and graphical communication in broadly-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature.
4. Perform test on electrical generators/motors, and analyze the result	2. Critical Thinking 5. Industry, Professional, Discipline-Specific Knowledge and Skills	4. An ability to conduct standard tests, measurements, and experiments and to analyze and interpret the result to improve processes. 5. An ability to function effectively as a member as well as a leader on technical teams.

I. APPLIED LEARNING COMPONENT:

Classroom/Lab

K. TEXTS:

Wildi Theodore, *Electrical Machines, Drives, and Power Systems*, 6th Edition. Upper Saddle River, New Jersey: Prentice-Hall, 2006. OR, as determine by instructor.

L. %REFERENCES:

Donald V. Richardson, and Arthur J. Caisse, Jr., *Rotating Electric*) *Machinery and Transformer Technology,* 4th Edition. Upper Saddle River, New Jersey: Prentice-Hall, 1997.

M. **EQUIPMENT:** All necessary Equipment is available.

N. **GRADING SYSTEM:** A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

Quizzes
Tests
Laboratory projects
Paper / Presentation.

P. DETAILED TOPICAL OUTLINE:

I. Energy in an Inductor/Capacitor, and Electromagnetism
II. Fundamentals of Mechanics and Heat
   A. Force
   B. Torque
   C. Power
   D. Power of Motor
   E. Transformation of Energy
   F. Efficiency of a Machine
   G. Speed of a Motor/Load system
III. Direct Current Generators
   A. Generating an ac voltage
   B. Converting ac to dc by commutation
   C. Difference between ac and dc generators
   D. Induced voltage relationships
   E. Characteristics of the generator under load
   F. Shifting the brushes to improve commutation
   G. Separately excited generator
   H. Shunt generator
   I. Load characteristics
IV. Direct Current Motors
   A. Counter-electromotive force (cemf)
   B. Mechanical Power and Torque
   C. Speed Rotation
   D. Armature speed control
   E. Field speed control
   F. Series motor
   G. Shunt motor
   H. Compound motor
   I. Reversing the direction of rotation
   J. Stopping a motor
   K. Armature reaction
   L. Flux distribution
V. Efficiency and Heating of Electrical Machines
VI. Active, Reactive, and Apparent Power

A. Instantaneous power
B. Active power
C. Reactive power
D. The capacitor and reactive power
E. Apparent power
F. Power factor
G. Power triangle

VII. Three-Phase Circuits

A. Delta & Wye connection
B. Balanced & Unbalanced Three-Phase loads
C. Three-Phase Power Calculation

VIII. The Ideal Transformers

IX. Practical Transformers

X. Equivalent Circuit of a Practical Transformer

XI. Autotransformers

XII. Three-Phase Induction Machines

A. Principle components
B. Principles of operation
C. The rotational field
D. Direction of rotation
E. Number of poles-synchronous speed
F. Starting characteristic of induction motors
G. Voltage and frequency induced in the rotor
H. Effect of rotor resistance on motor operation
I. Motor under load
J. Active power flow
K. Torque versus speed curve
L. Wound rotor & squirrel cage type induction machines
M. Properties of linear induction motors
N. Starting & plugging an induction motor
O. Doubly-Fed induction machines
P. Abnormal conditions
Q. Variable speed drives
R. Equivalent circuit of the induction machines

Q. <u>LABORATORY OUTLINE</u>

1. High voltage AC circuit measurements & calculations
2. Transformer Polarities
3. Step-down & step-up transformers
4. The Autotransformer
5. Direct Current Machine Characteristics
6. Direct Current Series Generators
7. Separately Excited Direct Current Shunt Generators
8. Self-Excited Direct Current Shunt Generators
9. Cumulative Compound Direct Current Generators

10. Differential Compound Direct Current Generators
11. The Direct Current Shunt Motor
12. The Direct Current Series Motor
13. The Direct Current compound Motor
14. Prime-Mover & torque measurements
15. Three-Phase circuits
16. The Wound Rotor Induction Motor
17. Split-Phase Induction Motor I & II
18. Characteristics of Squirrel cage type Induction Motor
19. Power Factor Correction for Induction Motors