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

MASTER SYLLABUS

ELEC 383– Power Transmission and Distributions

Created by: Stephen Frempong

Updated by : Stephen Frempong

CANINO SCHOOL OF ENGINEERING TECHNOLOGY
ELECTRICAL ENGINEERING TECHNOLOGY & ENGINEERING ECIENCE DEPRTMENT

February 2019

A. **TITLE :** Power Transmission and Distributions

B. **COURSE NUMBER:** ELEC 383

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

 # Credit Hours: 3
 # Lecture Hours: 3 one hour lecturers **per week**
 # Lab Hours: **per week**
Other: **per week**

Course Length: 15 **Weeks**

D. ! **WRITING INTENSIVE COURSE:** NO

E. ! **GER CATEGORY: NONE**

F. ! **SEMESTER OFFERED:** FALL/SPRING

G. ! **CATALOG DESCRIPTION:** This course in electrical power generation and transmission will emphasize on those aspects that concern engineers and technologists in the performance of their tasks. Topics covered include: Hydropower, Thermal, Nuclear, and Wind Power Generating Stations, Transmission and Distribution of Electrical Energy, Direct Current Transmission, HVDC Light Transmission System, Power Stability, and Cost of Electricity.

H. ! **PRE-REQUISITES :** ELEC 215 [Electrical Energy Conversion], or permission of instructor.

CO-REQUISITES: NONE

I. ! **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. Perform power-flow analysis	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.
b. Analyze transmission line voltages	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.
c. Apply critical thinking to solving electrical power problems	2. Critical Thinking	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.
d. Perform transmission line calculations	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.
e. Nuclear, Hydroelectric, and Wind Power generation	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.
f. Perform transmission line simulation	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.

J. **APPLIED LEARNING COMPONENT:**

Classroom/Lab

K. **TEXTS:**

1. Theodore Wildi, Electrical Machines, Drives, and Power Systems, 6th Edition, Upper Saddle River, New Jersey 07458: Prentice Hall, 2006. OR, as determined by instructor.

L. !**REFERENCES:**

Arthur R. Bergen and Vijay Vittal, Power Systems Analysis, 2nd Edition, Upper Saddle River, New Jersey 07458: Prentice Hall, 2000.

M. **EQUIPMENT:** Power laboratory equipment plus simulation software will be used for the lab exercises.

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

O. **SUGGESTED MEASUREMENT CRITERIA/METHODS:**

Exams
Quizzes
Papers
Participation
Presentation

P. **DETAILED TOPICAL OUTLINE:**

I. ! Special Purpose Transformers

II. ! Three-Phase Transformers

a. Delta-delta connection
b. Delta-wye connection
c. Wye-delta connection
d. Wye-wye connection
e. Open delta connection
f. Three phase transformer
g. Step-up and step-down autotransformer
h. Calculations involving 3-phase transformer

III. Synchronous Machines

a. Constant Speed Operation
b. Excitation
c. Power Factor Rating
d. Starting Torque
e. Power Factor Control
f. Construction
g. Stator Similar to an Alternator
h. Rotor Design

i. Exciters
j. Phasor Analysis
k. Lagging and Leading Current
l. Maximum Load
m. Pull Out Torque
n. Control Through D-C Field Excitation
o. Normal Excitation - Unity Power Factor
p. Under Excited - Lagging Power Factor
q. Over Excited - Leading Power Factor
r. Calculation of CEMF
s. Load Characteristics
t. V and A Curves
u. Analysis of Current Components

V. The Synchronous Capacitor
a. Control of Field Excitation
b. Control of Line Current
c. Correction of Power Factor
d. Calculation of KVA Rating
e. Dual Purpose Motor
f. Action as Synchronous Condenser and Motor
g. Calculation of KVA Rating

VI. Hunting
a. Sensitivity to Changes in Load
b. Shift to a New Torque Angle
c. Oscillations About Synchronous Position
d. Rotor Pulling Out of Step

IV. Alternate Power Generation Methods
a. Wind Energy
b. Solar Energy
c. Hydro-electric
d. Fuel cells

V. Hydropower Generating Station
a. Available hydro power
b. Types of hydropower stations
c. Makeup of a hydropower plant
d. Pumped-storage installations

VI. Thermal Generating Stations
a. Makeup of a thermal generating station
b. Turbines
c. Condenser
d. Cooling towers
e. Boiler-feed pump
f. Energy flow diagram for a steam plant
g. Thermal stations and the environment

VII. Nuclear Generating Stations
a. Composition of an atomic nucleus isotopes

b. The source of uranium
c. Energy released by atomic fission
d. Chain reaction
e. Types of nuclear reactors
f. Example of a light-water reactor
g. Example of heavy water reactor
h. Principles of the fast breeder reactor
i. Nuclear fusion

VIII. Transmission of Electrical Energy
a. Principal components of a power distribution system
b. Types of power lines
c. Standard voltages
d. Components of a HV transmission line
e. Construction of a line
f. Galloping lines
g. Corona effect – radio interference
h. Pollution
i. Lighting
j. Impulse insulation
k. Ground wires
l. Tower grounding
m. Equivalent circuit of a line
n. Typical impedance values
o. Voltage regulation and power transmission capability of transmission lines
p. Resistive/inductive lines
q. Choosing the line voltage
r. Methods of increasing power capacity
s. Extra-high power lines

IX. Distribution of Electrical Energy
a. Substation equipment
b. Circuit Breakers
c. Air-break switches
d. Grounding switches
e. Surge arresters
f. Current-limiting reactors
g. Grounding Transformer
h. Medium/Low voltage distribution

X. HVDC Light Transmission System

XI. The Cost of Electricity

Q. LABORATORY OUTLINE:

I. Safety & Power Supply
II. Phase Sequence
III. Real Power, Reactive Power, and Apparent power transfer

IV. Power Flow & Voltage Regulation of a Simple Transmission Line
V. Phase Angle & Voltage Drop between Sender & Receiver
VI. Parameters which Affect Real & Reactive Power Flow
VII. Parallel Lines, Transformers & Power-Handling Capacity
VIII. The Alternator
IX. The Synchronous machines
X. The Synchronous Capacitor & Long High Voltage Lines
XI. Transmission Line Networks & the Three-Phase Regulating Autotransformer
XII. The Synchronous Motor Under Load
XIII. Hunting & System Oscillation
XIV. Power System Transients