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

MASTER SYLLABUS

ELEC 488 – ELECTRICAL POWER SYSTEMS

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

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A. **TITLE**: ELECTRICAL POWER SYSTEMS

B. **COURSE NUMBER:** ELEC 488

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

 # Credit Hours: 3
 # Lecture Hours: 2 **per week**
 # Lab Hours: 2 **per week**
Other: **per week**

Course Length: 15 **Weeks**

D. **WRITING INTENSIVE COURSE**: No

E. **GER CATEGORY: NONE**

F. **SEMESTER(S) OFFERED:** Spring

H. **CATALOG DESCRIPTION:** This course covers advanced topics in AC and DC transmission such as the per unit concept of transformer and generator analysis, transient stability of power systems etc. Students learn power-flow and economic power dispatch by using both analytical techniques and power system simulators. Basic knowledge of power system control is provided by covering the topics of supervisory control and data acquisition (SCADA), protective relaying etc. The course address the energy economics, efficiency and ethics of dynamic pricing and smart meters. The course also delivers topics on smart grid supply that integrate renewable and distributed generation (i.e. photovoltaic and wind).

I. **PRE-REQUISITES:**
ELEC 215, ELEC 383 or Permission of the instructor

CO-REQUISITES: None

J. **STUDENT LEARNING OUTCOMES**

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

Course Objective	*Institutional SLO*	*ABET- Student Outcomes*
a. Evaluate advance transformer and generator model using per unit system.	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. Evaluate economic/optimal power dispatch, and analyze the synchronous machine transient characteristics.	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.
c. Apply the principle of DC/AC converter/inverter; protective relays and data acquisition for power system control application.	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.
d. Analyze the concept of SCADA and demonstrate the concept of smart grid.	2. Critical Thinking	

J. APPLIED LEARNING COMPONENT:

Classroom/Lab

K. TEXTS:

Power System Analysis, Hadi Saadat, WCB McGraw Hill, ISBN0-07-561634-3

L. ! REFERENCES:

1. Power Systems Analysis, 2nd Edition, Arthur R. Bergen and Vijay Vittal, Upper Saddle River, New Jersey 07458: Prentice Hall, 2000.
2. Power System Analysis and Design, Glover, Sarma and Overbye; Cengage Learning, ISBN-10: 1-111-42577-9

M. ! EQUIPMENT: Available laboratory equipment will be used.

N. ! GRADING METHOD: A-F

O. ! SUGGESTED MEASUREMENT CRITERIA/METHODS

- Exams
- Quizzes
- Lab Reports and Practical Exams
- Participation
- Presentation

P. DETAILED COURSE OUTLINE:

I. Advanced topics on performance of AC and DC transmission lines

   A. Advanced analysis of power handling capacity of transmission line
   B. Lumped circuit equivalent model
   C. Complex power transmission in short, medium and long lines

II. Basic transformer and generator models used per unit system
   A. Per unit normalization in single and three phase transformers
   B. Regulating transformer for voltage and phase angle control
   C. Auto transformer in large power system
   D. Circuit model for synchronous generator
   E. Instantaneous power output

III. Power-flow in electrical networks
   A. Power flow equation and problem
   B. Numerical method of solving power flow problem (Newton-Rapson, Gaus-siedal etc.)
   C. Introduction to power flow simulators
   D. Regulating transformer in power flow analysis

IV. Economic/optimal power dispatch and smart metering
   A. Simplified analysis of power control system
   B. Formulation of economic dispatch problem
   C. Division of power in control areas
   D. Synchronous machine transient analysis

V. Balance and unbalance fault in transmission line and symmetric component
   A. Use of symmetric component in fault analysis
   B. More general fault circuit analysis
   C. Transformer model for sequence networks

VI. Principle of DC/AC converter/inverter

VII. Protective relays and data acquisition for power system control application.
   A. Protection of radial system
   B. Differential protection
   C. Impedance relay
   D. Overlapping zones and protection

VIII. Concepts of supervisory control and data acquisition (SCADA)

IX. Concepts of smart grid with distributed generation

Q. LABORATORY OUTLINE:

I. Grid connected System
II. Contingency Analysis
III. Power Flow Program – Case Study (loading effect)
IV. Characteristics of digital voltage relay REU 523
V. Measuring and displaying 3 phase load with data acquisition module
VI. Harmonic analysis and power quality measurement industrial 3 phase load
VII. Over current and earth fault relay testing using relay tester
VIII. Characteristics of current transformers
IX. Current transformer circuits to determine the power flow direction
X. Power factor correction in dynamic loads
XI. Digital relays and differential relays