THE UNIVERSITY OF WESTERN ONTARIO
FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

ECE9401A – COMPUTER-BASED POWER SYSTEM PROTECTION
COURSE OUTLINE – Fall 2014
(M.E.Sc. & Ph.D. ONLY)

OBJECTIVES:

To allow the student to: a) gain an understanding of the hardware, firmware, software and algorithms used in   computer-based relay systems.
b) become familiar with the upcoming technologies associated with the computer-based relaying and protection systems.

CONTACT HOURS: 3 lecture hours/week, half course
COURSE SCHEDULE: Mondays 1:30 - 4:30pm, WL 259

ANTIREQUISITE: None

PREREQUISITES: Bachelor's degree in electrical engineering

TOPICS:

1. Introduction
2. Relay hardware
3. Introduction to relay algorithms & phasor estimation
4. Frequency estimation techniques
5. Protection algorithms
6. Monitoring, alarms, events and diagnostics
7. Control functions and programmable logic
8. Communication in µP-based relays
9. Relay Testing, Modeling and Simulation
10. Wide area synchrophasor measurement system
11. Recent advances and new topics

SPECIFIC LEARNING OBJECTIVES:
Section 1-2   Demonstrate an understanding of relay hardware, firmware and software.

Sections 3-5   Demonstrate knowledge of phasor and frequency estimation and algorithms for protecting various power system elements including lines, transformers, busbars, generators and motors.

Sections 6   Demonstrate an understanding of monitoring and diagnostic functions.

Section 7   Demonstrate an understanding of control and logic functions

Section 8   Demonstrate an understanding of Communication in µP-based relays and substations

Section 9   Demonstrate knowledge of recent practices for relay testing, modeling and simulation

Section 10-11   Demonstrate familiarity with the recent advances in the area of computer-based relaying, substation automation and wide area protection.

TEXTBOOK:

A.G. Phadke and J.S. Thorp, "Computer Relaying for Power Systems", John Wiley and Sons, second edition, 2009.

REFERENCES:

"Microprocessor Relays and Protection Systems", IEEE Tutorial Course (88EH0269-1-PWR), *IEEE Power Engineering Society*, NJ, 1988.

Gerhard Ziegler, "Numerical Distance Protection: Principles and Applications", Siemens, Second Edition 2006.

"Computer Relaying", IEEE Tutorial Course (79EH0148-7-PWR), *IEEE Power Engineering Society*, NJ, 1979.

"Power System Protection", Vol. 4, Electricity Training Association, Institution of Electrical Engineers, 1995.

A.T. Johns and S.K. Salman, "Digital Protection for Power Systems", P. Peregrinus on behalf of the Institution of Electrical Engineers, London, 1995

ESSAY AND ORAL PRESENTATION:

The students in the course will be required to prepare an essay on an assigned topic and make an oral presentation to colleagues and faculty.

EVALUATION:

The final course grade will be based on the results of an essay, an oral presentation, and a final examination. The examination shall be semi-open book, calculators and formula sheets will be allowed.

For the purpose of evaluation, the course is divided into two components, namely
   a) Examination and
   b) Project

In order to pass the course, a student must obtain a passing grade in each component. A student who fails either component shall receive a final grade not greater than 48%. The approximate weights for the components are shown below.
Maximum Penalties*

Component	Weight	English	Presentation
a) Examination	65	10%	10%
b) Project	35	10%	10%

*In accordance with the policy of the University, the grade assigned to all written and oral work presented in English shall take into account syntax, diction, grammar and spelling. In addition, in the professional life
of an engineer, the manner in which oral and written communications are presented is extremely important. An engineering student must develop these skills as an integral part of the undergraduate program. To encourage the student to do so, the grades assigned to written and oral work will take into account all aspects of presentation including conciseness, organization, neatness, use of headings, and the preparation and use of tables and figures.

All work will be marked first for content after which a penalty not to exceed the maximum shown above may be applied for lack of proficiency in English and/or presentation.

With regard to the written assignments, students should be aware of the University regulations with regard to plagiarism.

ATTENDANCE:

Any student who, in the opinion of the instructor, is absent too frequently from class in this course, will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular examination in the course.

CHEATING:

University policy states that cheating is a scholastic offense. The commission of a scholastic offense is attended by academic penalties which might include expulsion from the program. If you are caught cheating, there will be no second warning.

PLAGIARISM:

Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage of text from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar). The following web site provides some clear examples that will help avoid plagiarism:
http://www.hamilton.edu/academics/resource/wc/usingsources.html

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 X 82147 for any specific question regarding an accommodation. Students that are in emotional/mental distress should refer to Mental Health@Western, http://www.uwo.ca/uwocom/mentalhealth/, for a complete list of options about how to obtain help.

COURSE INSTRUCTOR:

Professor M. Dadash Zadeh
mdadash@uwo.ca
Thompson Engineering Building, Room 245