

ELR 310  
CODE NO.

ELECTRICAL SYSTEM ANALYSIS & DESIGN  
COURSE NAME

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE OUTLINE: ELECTRICAL SYSTEM ANALYSIS AND DESIGN

CODE NO.: ELR 310 - 7

PROGRAM: ELECTRICAL TECHNOLOGY

SEMESTER: SIX

DATE: DECEMBER, 1991

PREVIOUS  
OUTLINE DATED: JANUARY, 1986

AUTHOR: R. MCTAGGART

NEW: \_\_\_\_\_ REV.: X

APPROVED:

W. Filipowich  
COORDINATOR

Jan 6, 1992  
DATE

L. P. O'Connell  
DEAN

9-21-06  
DATE

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TOTAL CREDIT HOURS: 112

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PREREQUISITE(S): ELR 215, ELR 317

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**PHILOSOPHY/GOALS:**

COMPUTER AIDED DESIGN METHODS WILL BE UTILIZED TO ASSIST DESIGN AND ANALYSIS OF LARGE AND SMALL SCALE ELECTRICAL SYSTEMS. TOPICS WILL INCLUDE LOAD FLOW, SCADA SYSTEMS, SYSTEM PROTECTION, AND ADVANCED POWER ELECTRONICS. EXTENSIVE LAB AND PROJECT WORK WILL BE USED TO SUPPORT THE THEORY.

**STUDENT PERFORMANCE OBJECTIVES:**

UPON SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENT WILL BE ABLE TO:

1. USE VARIOUS CAD SOFTWARE PACKAGES;
2. DESIGN AND BUILD A SIMPLE PRINTED CIRCUIT BOARD;
3. DESIGN, BUILD, AND TROUBLESHOOT BASIC SCR FIRING AND POWER CIRCUITS;
4. DESCRIBE THE COMPONENTS OF A DC TRANSMISSION SYSTEM AND PERFORM BASIC CALCULATIONS TO DETERMINE SYSTEM CHARACTERISTICS;
5. MODEL AN AC POWER SYSTEM IN THE STEADY STATE AND PERFORM A LOAD FLOW ANALYSIS OF A THREE BUS SYSTEM;
6. ANALYZE SYMMETRICAL AND UNBALANCED FAULTS ON AN THREE PHASE POWER SYSTEM;
7. UNDERSTAND PROTECTIVE RELAYS AND PERFORM BASIC RELAY COORDINATION STUDIES.

**TOPICS TO BE COVERED:**

1. CAD SOFTWARE PACKAGES;
2. DIRECT CURRENT POWER TRANSMISSION;
3. THE POWER SYSTEM IN STEADY STATE;
4. POWER SYSTEM FAULT ANALYSIS;
5. POWER SYSTEM PROTECTION.

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LEARNING ACTIVITIES

REQUIRED RESOURCES

1. CAD SOFTWARE PACKAGES
  - PRINTED CIRCUIT BOARD DESIGN AND CONSTRUCTION
  - SCR CIRCUITS
2. DC POWER TRANSMISSION
  - SOLID STATE CONVERTERS
  - POWER FLOW AND CONTROL
  - FAULTS AND HARMONICS
3. THE POWER SYSTEM IN STEADY STATE
  - SYSTEM MODELLING
  - LOAD FLOW ANALYSIS
  - SYSTEM CONTROL
  - SCADA SYSTEMS
  - COMPUTER ANALYSIS OF THE LOAD FLOW PROBLEM
4. POWER SYSTEM FAULT ANALYSIS
  - SYMMETRICAL SHORT CIRCUITS
  - UNBALANCED FAULTS
  - SYMMETRICAL COMPONENT ANALYSIS
  - SEQUENCE IMPEDANCES OF NETWORK COMPONENTS
5. POWER SYSTEM PROTECTION
  - EQUIPMENT PROTECTION
  - POWER LINE PROTECTION
  - RELAY COORDINATION
  - GROUNDING

TESTS  
PROJECTS  
TOTAL

ELECTRICAL DISTRIBUTION ENGINEERING, A. J. PANSINI  
ELECTRIC POWER DISTRIBUTION SYSTEM ENGINEERING, T. GOWEN  
ELECTRIC POWER: CHALLENGES AND CHOICES, A. WYATT  
ELECTRIC POWER SYSTEMS, S. H. WEDDY  
ELECTRICAL POWER TECHNOLOGY, T. WILDI  
ELECTRICAL TRANSMISSION AND DISTRIBUTION, WESTINGHOUSE  
ELECTRIC UTILITY SYSTEMS AND PRACTICES, H. M. RUSTENAKS  
HANDBOOK OF ELECTRIC POWER CALC., SEIDMAN & MAHROUS  
IEEE GUIDE FOR SAFETY IN AC SUBSTATION GROUNDING (STD 88)  
POWER SYSTEM OPERATION, R. H. MILLER  
PROTECTIVE RELAYS: THEIR THEORY AND PRACTICE, WARRINGTON  
STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS, FINE & BEATT  
SWITCHGEAR AND CONTROL HANDBOOK, R. W. SHEATON

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METHOD(S) OF EVALUATION

|          |      |
|----------|------|
| TESTS    | 60%  |
| PROJECTS | 40%  |
| TOTAL    | 100% |

THE GRADING SYSTEM USED WILL BE AS FOLLOWS:

A+ = 90 - 100%    A = 80 - 89%    B = 70 - 79%    C = 55 - 69%  
R REPEAT

NOTES: IN ORDER TO OBTAIN A PASSING GRADE THE STUDENT MUST MAINTAIN A MINIMUM 55% AVERAGE IN BOTH TEST SCORES AND PROJECT EXERCISES.

IF A STUDENT MISSES A TEST HE/SHE MUST HAVE A VALID REASON (ie. MEDICAL OR FAMILY EMERGENCY). IN ADDITION THE SCHOOL MUST BE NOTIFIED BEFORE THE SCHEDULED TEST SITTING. THE STUDENT SHOULD CONTACT THE INSTRUCTOR INVOLVED. IF THE INSTRUCTOR CANNOT BE REACHED LEAVE A MESSAGE WITH THE DEAN'S OFFICE OR THE COLLEGE SWITCHBOARD. IF THIS PROCEDURE IS NOT FOLLOWED THE STUDENT WILL RECEIVE A MARK OF ZERO ON THE TEST WITH NO REWRITE OPTION.

REQUIRED STUDENT RESOURCES:

TEXT BOOKS: THE INSTRUCTOR WILL PROVIDE RESOURCES IN ADDITION TO THOSE IN THE COLLEGE LIBRARY.

ADDITIONAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE LIBRARY BOOK SECTION:

E.H.V. SUBSTATION AND EQUIPMENT, BHOUMICK & BHATTACHARYYA  
ELECTRICAL DISTRIBUTION ENGINEERING, A. J. PANSINI.  
ELECTRIC POWER DISTRIBUTION SYSTEM ENGINEERING, T. GONEN.  
ELECTRIC POWER: CHALLENGES AND CHOICES, A. WYATT.  
ELECTRIC POWER SYSTEMS, B. M. WEEDY.  
ELECTRICAL POWER TECHNOLOGY, T. WILDI.  
ELECTRICAL TRANSMISSION AND DISTRIBUTION, WESTINGHOUSE.  
ELECTRIC UTILITY SYSTEMS AND PRACTICES, H. M. RUSTEBAKKE.  
HANDBOOK OF ELECTRIC POWER CALC., SEIDMAN & MAHROUS.  
IEEE GUIDE FOR SAFETY IN AC SUBSTATION GROUNDING (STD 80)  
POWER SYSTEM OPERATION, R. H. MILLER.  
PROTECTIVE RELAYS: THEIR THEORY AND PRACTICE, WARRINGTON.  
STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS, FINK & BEATY.  
SWITCHGEAR AND CONTROL HANDBOOK, R. W. SMEATON.