ENGINEERING 7680: Supervisory Control and Data Acquisition

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Office Hours: Thu 8:30-10:00

Teaching Assistants: TBA  
E-mail: TBA  
Phone: TBA  
Office Location: TBA  
Office Hours: TBA

Communication: Preferred method of contact: MUN email, or in person.

CALENDAR ENTRY:  
7680 Supervisory Control and Data Acquisition examines data acquisition and intelligent field devices; distributed control systems and fieldbus technology; remote terminal units; programmable logic controllers and programming standards; operator control interface; communication system for supervisory control and data acquisition; and cyber security for industrial control systems.

PR: ENGI 5821  
LH: four 3-hour sessions per semester

LAB EXPERIENCE: Hands on.  
Ten mandatory lab experiments are completed by groups of two students under the watch of teaching assistants. Students perform analysis and design of data acquisition circuits, implement using hardware components, and debug and test the circuit. Written report is submitted by each group at the end of the lab.

CREDIT VALUE: 3 credit hours

COURSE TYPE: Elective

ACCREDITATION UNITS: 3/1/0

CONTENT CATEGORIES:  
<table>
<thead>
<tr>
<th>Math</th>
<th>Natural Science</th>
<th>Complementary Studies</th>
<th>Engineering Science</th>
<th>Engineering Design</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td>75%</td>
<td>25%</td>
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</tbody>
</table>

SCHEDULE:  
LECTURE: TTh 10:30 – 11:45am  
Room: EN-4034  
LABS: Wed 2:00-5:00pm  
Room: EN-2048
RESOURCES:

REFERENCE BOOKS
- Bolton, W., Programmable Logic Controllers, 4th Ed, 2006
- S. Mackay, E.Wright, J.Park, D.Reynders, Practical Industrial Data Networks, 2004

MAJOR TOPICS:
- Introduction to SCADA application in industrial control
- RTU, DCS and HMI architectures RS485, MODBUS, MODBUS+ communication standards
- IEC 1131-3 IL, SFC, and ST programming
- PLCs design and programming methods
- Communication systems for SCADA and industrial control systems
- SCADA security architecture and convergence
- Practical examples of typical SCADA systems

LEARNING OUTCOMES:

Course Level Graduate Attribute Focus: KB-D, Inv.-D, Des.-A

Upon successful completion of this course, the student will be able to:

<table>
<thead>
<tr>
<th></th>
<th>LEARNING OUTCOMES</th>
<th>GRADUATE ATTRIBUTES.</th>
<th>Methods of Assessment</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Demonstrate an understanding of SCADA systems</td>
<td>KB-A</td>
<td>Tests, Exam</td>
</tr>
<tr>
<td>2</td>
<td>Explain common SCADA architectures used in industry</td>
<td>KB-D</td>
<td>Tests, Exam</td>
</tr>
<tr>
<td>3</td>
<td>Select appropriate engineering tools for SCADA demonstration in lab</td>
<td>KB-A, Tools-A, Des.-A</td>
<td>Labs</td>
</tr>
<tr>
<td>4</td>
<td>Operate and program networked PLC’s</td>
<td>KB-D, PA-D, Inv.-D</td>
<td>Tests, Exam, Labs</td>
</tr>
<tr>
<td>5</td>
<td>Demonstrate knowledge of communication standards for SCADA</td>
<td>KB-A, Tools-A</td>
<td>Tests, Exam</td>
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<tr>
<td>6</td>
<td>Establish and demonstrate a low cost SCADA system in Lab</td>
<td>Prof-A, Team-A, Des.-A</td>
<td>Labs</td>
</tr>
<tr>
<td>7</td>
<td>Explain security issues of industrial control systems</td>
<td>KB-A</td>
<td>Tests, Labs</td>
</tr>
<tr>
<td>8</td>
<td>Demonstrate practical knowledge of SCADA and PLC programming</td>
<td>KB-D, PA.-D, Des.-A</td>
<td>Labs, Tests, Exam</td>
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</table>
Each Graduate Attribute for each learning outcome is rated at a Content Instructional Level of I=Introductory, D=Developed, or A=Applied). See http://www.mun.ca/engineering/undergrad/graduateattributes.pdf for more information on the 12 Graduate Attributes you are expected to be proficient in upon graduation.

ASSESSMENT:

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Midterm Test</td>
<td>10%</td>
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<tr>
<td>Lab work</td>
<td>40%</td>
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<tr>
<td>Final exam</td>
<td>50%</td>
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Dates

- Midterm Test: 10%
  - Mar
- Lab work: 40%
  - Jan 10, 17, 24, 31, Feb 7, 14, 28, Mar 7, 14, 21
  - (report due one week later)
- Final exam: 50%
  - TBA

LAB SAFETY:

Students are expected to demonstrate awareness of, and personal accountability for, safe laboratory conduct. Appropriate personal protective equipment (PPE) must be worn (e.g. steel-toed shoes, safety glasses, etc.) and safe work practices must be followed as indicated for individual laboratories, materials and equipment. Students will immediately report any concerns regarding safety to the teaching assistant, staff technologist, and professor.

ACADEMIC INTEGRITY AND PROFESSIONAL CONDUCT:

Students are expected to conduct themselves in all aspects of the course at the highest level of academic integrity. Any student found to commit academic misconduct will be dealt with according to the Faculty and University practices. More information is available at www.engr.mun.ca/undergrad/academicintegrity.


Individual work is expected of each student. Even if students work in groups, or discuss with others, assignments and reports should be independently prepared.

INCLUSION AND EQUITY:

Students who require physical or academic accommodations are encouraged to speak privately to the instructor so that appropriate arrangements can be made to ensure your full participation in the course. All conversations will remain confidential.

The university experience is enriched by the diversity of viewpoints, values, and backgrounds that each class participant possesses. In order for this course to encourage as much insightful and comprehensive discussion among class participants as possible, there is an expectation that dialogue
will be collegial and respectful across disciplinary, cultural, and personal boundaries.

**STUDENT ASSISTANCE:** Student Affairs and Services offers help and support in a variety of areas, both academic and personal. More information can be found at [www.mun.ca/student](http://www.mun.ca/student).

**ADDITIONAL INFORMATION:**

*Safety is of paramount importance in all our activities. Please note safety/fire exits on the first floor.*