

I. COURSE DESCRIPTION:

The Fundamentals of Industrial Networks as presented in this course is for those who need a basic working knowledge and an overview of today's data communications industrial networking and device control networking technologies. Data communications is commonly used in the world of Industrial Automation Control. Whether it is transmission of manufacturing control information from a central computer to automated machines or processes or the selection of a data and collection of information. Data communications has become an integral part of Industries daily activities.

The objective of this course is to outline the best practice in designing, installing, commissioning and troubleshooting industrial Networks. In any given plant, factory or installation, there are a number of different industrial networks and communications standards use and the key to successful implementation is the degree to which the entire system integrates and works together. With so many different standards on the market today, the debate is not about what is best, be it Foundation Fieldbus, Profibus, Devicenet or Industrial Ethernet, but rather about selecting the most appropriate technologies and standards for a given application and then ensuring that the best practice is followed in designing, installing and commissioning the data communications links to ensure they run fault-free.

The industrial networking communications system in a plant has become the foundation of the entire operation. It is critical that the best practice be used in designing, installing, and fixing any problem that may occur. The important point to make is that with today's wide range of protocols available to an industry, the student will develop an understanding of how to select, install and maintain industrial network protocols in the most cost-effective manner for an industrial plant environment and therefore this course will concentrate on a systems approach.

This course will focus on introducing common Allen Bradley automation networks such as Data Hwy. Ethernet I/P ControlNet, Devicenet and other commonly used industrial networks such as Profibus, Modbus, and industrial EtherNet ect.as time permits.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course, the student will demonstrate the ability to:

1. ***Understand various Basic Terminology, Concepts of a Computer Network and related networking certifications.***

Potential Elements of the Performance:

- List the advantages of industrial networked computing relative to islands of automation
- Identify the elements of an industrial network
- Explain Basic Industrial Network Terminology and Concepts
- Describe several specific uses for Industrial networks
- Identify some of the certifications available to networking professionals
- Identify the kinds of non-technical, or "soft," skills that will help you succeed as a networking professional
- Identify and Distinguish between different Data communications standards such as, RS-232 interface standard, RS-485 interface standard
- Explain the difference between LAN, WAN and Enterprise Networks
- Describe the terms Server and Client
- State the characteristics of a Topologies, Protocols, CSMA/CD (Ethernet), Token Ring, Token Bus as it applies to Industrial Networks
- Understand the importance of the ISO OSI model and how it applies to the Industrial Networks discussed in this course
- Identify and Lists the Layers of the ISO OSI model

2. *Understand the characteristics of Peer to Peer, sever based networks and the OSI model*

Potential Elements of the Performance:

- Understand the basics of Industrial EtherNet
- State the application advantages and limitations of Industrial Ethernet in today's modern industries
- Understand the role of TCP/IP and its associate protocols have in the Industrial Ethernet plant application
- Describe the conditions under which a peer-to-peer based network is recommended over a server-based network
- Compare wired to wireless industrial networking
- List the Advantages and Disadvantages of Wireless technology
- State the seven layers of the OSI model
- List and Describe Communication medias used in Industrial Networking systems discussed in this course
- Identify Industrial Networking cable types and uses
- Identify Industrial Networking Fiber Optics and uses
- Describe the terms Electrical Coupling Grounding and Shielding as they applies to Industrial

3. Analyze OSI Model commutation and addressing

Potential Elements of the Performance:

- Understand and Identify ControlNet Applications and place in in a typical plant **Hierarchy**
- Identify Frame Format and Network Characteristics
- Understand ControlNet Configuration and Network Components
- Explain ControlNet Addressing and Topology
- Discuss Installation ,commissioning and troubleshooting
- Identify the Types & Media characteristics
- Identify the core protocols of each protocol suite and its functions

4. Analyze the operation of various types Network transport systems.

Potential Elements of the Performance:

- Understand and Identify Devicenet Applications and place in in a typical plant Hierarchy
- Identify Frame Format and Network Characteristics
- Understand Devicenet Configuration and Network Components
- Explain Devicenet Addressing and Topology
- Discuss Installation ,commissioning and troubleshooting
- Identify the Types & Media characteristics

5. Analyze the operation of various types Network components.**Potential Elements of the Performance:**

- Understand and Identify different types of Profibus networks and their Applications and place in in a typical plant Hierarchy
- Identify Frame Format and Network Characteristics
- Understand Profibus networks Configuration and Network Components
- Explain Profibus Networks Addressing and Topology
- Discuss Installation ,commissioning and troubleshooting
- Identify the Types & Media characteristics

6. Understand the basics of common Industrial Networks.**Potential Elements of the Performance:**

- Identify different Industrial Networks such as Modbus, ASI, and Hart etc.
- Identify basic Industrial Networks addressing methods
- Understanding the differences between industrial network types
- Discuss Installation ,commissioning and troubleshooting
- Identify the Types & Media characteristics
- Demonstrate the ability to communicate peer to peer information from two or more industrial computerized lab equipment over several AB industrial networks such as Ethernet I/P, ControlNet, Devicenet, Data Hwy. etc

III. TOPICS:

1. Induction to Industrial Networks
2. Overview of Serial Communication Standards and the OSI Model
3. Overview of Industrial Ethernet
4. Overview of Ethernet IP Installation, Commissioning, and Troubleshooting
5. Overview of ControlNet
6. Overview of ControlNet Installation, Commissioning, and Troubleshooting
7. Overview of Devicenet.
8. Overview of Devicenet Installation, Commissioning, and Troubleshooting
9. Introduction to Profibus, Modbus, Hart Fieldbus, ASI., and others

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

To be announced

AB and other Company manuals and documentation information on the internet

V. EVALUATION PROCESS/GRADING SYSTEM:

Test 1	10 marks	10% overall
Test 2	20 marks	20% overall
Test 3	20 marks	20% overall
Assigned	10 marks	10% overall
from Text or /and handouts		
Lab Demonstration	20 marks	20% overall
Lab Write-ups	15marks	15% overall
Class Participation/attendance	5 marks	5% overall
Total 100 marks		100 %

The following semester grades will be assigned to students:

Grade	<u>Definition</u>	<i>Grade Point Equivalent</i>
A+	90 – 100%	4.00
A	80 – 89%	3.00
B	70 - 79%	2.00
C	60 - 69%	1.00
D	50 – 59%	0.00
F (Fail)	49% and below	
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field /clinical placement or non-graded subject area.	
U	Unsatisfactory achievement in field/clinical placement or non-graded subject area.	
X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.	
NR	Grade not reported to Registrar's office.	
W	Student has withdrawn from the course without academic penalty.	

VI. SPECIAL NOTES:

Attendance:

Sault College is committed to student success. There is a direct correlation between academic performance and class attendance; therefore, for the benefit of all its constituents, all students are encouraged to attend all of their scheduled learning and evaluation sessions. This implies arriving on time and remaining for the duration of the scheduled session.

It is the departmental policy that once the classroom door has been closed, the learning process has begun. Late arrivers will not be granted admission to the room.

VII. COURSE OUTLINE ADDENDUM:

The provisions contained in the addendum located on the portal form part of this course outline.

General Information:

Special Accommodations:

If you have a special learning need or issue, it works to your advantage to notify your instructor immediately if special devices or assistance will help you in this class.

Classroom Etiquette:

Pagers and cell phones should be either turned off or set to vibrate mode during class. Please show courtesy to the class by restricting conversation to in-class topics, and raise your hand to gain attention when asking a question or raising a point of discussion.

Class Room Safety:

Safety is the most important aspect in this course and any compromise in student safety by any other student will not be tolerated. Students that observe any unsafe lab condition and/or act must report it to the instructor immediately. Student safety in the Labs is the number one priority. Students are not to work any on energized equipment without first informing the instructor. The Student is not to work on any live equipment that they are not familiar with or have not been instructed in the safety procedures and operation of that particular equipment.

Turning in Work :

Be sure to include your name and the course name and section on all work to be turned in.

Late Coursework :

All assignments are to be turned in on the due date. Students may be allowed to make up any late work at the instructor's discretion.

Term tests/quizzes

With the expectation that the student will attend all classes, there will be no make up tests for missed tests. There will be no rewrites for low-test scores.

Attendance

Students' attendance and participation are required in all activities. If a student is absent from class, it is her/his responsibility to find out what was missed prior to the next class and complete any assigned work before the next class. Absence does not constitute a reason for missed work or late assignments.

ADDITIONAL:

Since all work must be performed on a special network server located at the college, there will be little opportunity to work on the projects at home. The reading, review questions, and planning must be done outside of class time.

All student assignment materials that are not picked up by the student will be held for a maximum of two weeks after grading. After this time materials may be discarded or used at the professor's discretion. Attendance may be monitored. Regular absentia may be reported to OSAP at the college's discretion.

Assignments:

Any Chapter review questions (written in a Text) are designed to help the student review and consolidate the theory presented in each of the chapters. The chapters in an assigned text, computer programs demos, computer text files and the hand out material that the instructor may provide to the student, are designed as walk-through learning tools and must be read for understanding **ahead of class**. The hands-on projects are designed to allow the student to apply and practice the concepts introduced in ELR 325 while providing an opportunity to reinforce skills learned previously.

All assignments including Student Assignments, Lab Exercises, and Lab demonstrations are due on or before the due date specified in class. Assignments handed in on the due date must be in the instructor's hands **before** the specified time. **Late assignments will not be graded or checked.** Students **must** complete all assignment in the required time, no extensions will be permitted, therefore, the due date will be strictly enforced to provide time for the instructor to mark the lab write-up material and return it to the student. No photocopies or mass produced documents will be accepted.

Homework Policy:

Homework includes all written Lab work, assignments, assigned questions, and any other work that the instructor may assign through out the duration of the course.

All homework should have either a cover sheet or a header with the course number and name, the assignment number, the due date, and the submitter clearly written.

All homework is to be turned in at the start of class. They are to be legible and neat, with all relevant work shown.

While you are encouraged to discuss this class and problem-solving methods with each other, you are not to share your actual homework papers with one another.

Cell phones/PDAs etc.

Use of cell phones/PDAs for any form of communication (voice, text...) during class or lab time is strictly prohibited. Cell phones/PDAs must be silenced during regular class and lab times and must be turned off and kept out of sight during test sittings. Failure to follow the latter requirement during a test sitting will result in a grade of 0 being assigned.

Students may not wear earphones of any kind (i.e. for play back of recorded music/voice) during lab activities or test sittings. This does not include hearing aids required for hearing impaired.

STUDENT COURSE AGREEMENTI, _____ **student ID #** _____

(Please print)

with regards to the course known as Networking (ELR 325), have read and understand the course content, outline and expectations which clearly states the following:

- 1- Absolutely no make up tests or exams will be administered with the exceptions of personal illness or death of an immediate family member both requiring written verification.
- 2- All Assignments / labs must be complete and handed in by the due date or a grade of 0 will be awarded. All Labs assigned must be completed by the last lab class and signed off by the instructor to or the student will receive an F grade for the lab portion of this course.
- 3- Attendance for all class activities is compulsory. Any lecture notes, lab assignments etc. missed will become the student's responsibility to retrieve from another student.
- 4- Quizzes can be presented at anytime without prior notification.
- 5- Students must be able to demonstrate labs that are assigned by the instructor after the due date if requested by the instructor. Each student must be sure that he / she can duplicate the lab that they turned in. If the student cannot duplicate the lab to the satisfaction of the instructor, a grade of 0% will be assessed to that particular lab. Demonstration request will be at the discretion of the instructor.
- 6- **In order to maintain a passing grade the student must obtain a minimum 50% average in ALL subject sections that the course may have, such as, the theory Tests section, / Lab section etc.**
- 7- **If the student is not clear with any requirement state in the course outline, or in additional handouts, or stated by the instructor during class room activities, it is the responsibility of the student to see the instructor immediately or as soon as possible during the class.**
- 8- Most important you understand all safety requirements that are required of you to function safely at all times in the automation networking labs, B1050. These requirements were explained to you by the instructor as outlined below in Lab 0 during your first Lab class.

Print Name _____

(Signature)_____
(Date)

Student Lab Evaluation Sheet ELR325

Student's Name _____ Mark _____

NOTE: Each student must turn in his/her own sheet with each lab demonstration verified by the instructor signature. If the student does not turn the sheet with all labs signed by the instructor the write-up will not be accepted and the student will be assessed a mark of 0% resulting in an overall F (fail) grade for ELR325.

Lab #	Description NOTE: All labs are compulsory unless state other wise	Demo Mark	Instructor's Signature	Write-up Mark
0	<u>Safety in the labs and related equipment.</u>	No mark		No mark
1A	<u>Demonstrate</u> the use of and Map out B1050 Ethernet IP Network using RsNetworks for Ethernet-IP	5%		10%
1B	<u>Install And Set Up Ethernet IP</u> Communication Nic Card In The Ab 5000 Also Test and Verify Using Rslinx& RsNetworks Software.	10%		10%
1C	<u>Peer To Peer Communication</u> Using Message Blocks For Ab 5000 To 5000 Ethernet Ip	10%		5%
2A	<u>Install And Set Up DH+</u> Communication NIC Card In The AB 5000 Also Test Using RSLinx Software	5%		5%
2B	<u>Peer To Peer Communication</u> Using Message Blocks For Ab 5 To 5 Dh+	5%		5%
2C	<u>Peer To Peer Communication</u> Using Message Blocks For Ab 5 To 500 Dh+	5%		5%
2D	<u>Peer To Peer Communication</u> Using Message Blocks For Ab 5 To 5000 Dh+	5%		5%
3A	<u>Master/Slave Communications</u> Plc-5 Scanner To Plc. 5 Adapter Communications Using Block Transfers With Simple Start / Stop Send & Receive 1 word	10%		10%
4A	<u>Demonstrate</u> the use of and Map out B1050 ControlNet Network using RsNetworks for Controlnet	10%		10%
4B	<u>Install And Set Up ControlNet</u> Communication Nic Card In The Ab 5000 Also Test Using Rslinx & RsNetworks Software	10%		10%
4C	<u>Peer To Peer Communication</u> Using Message Blocks For Ab 5000 To 5000 ControlNet	10%		5%
5A	<u>Demonstrate</u> the use of and Map out B1050 Devicenet Network using RsNetworks for Devicenet	10%		10%
5B	<u>Install And Set Up Devicenet</u> Communication Nic Card In The Ab 5000 Also Test Using Rslinx Software	5%		10%
6A	Ab-5 Scanner To Slc. 504 Remote Plc. extra	5% bonus		5% bonus
		100%		100%

Assignments:

Homework/ Assignment Requirements/Policy

- ✓ All homework/assignments should have either a cover sheet or a header with the course number and name, the assignment number, the due date, and the submitter clearly written.
- ✓ All homework/assignments are to be turned in at the start of class. They are to be legible and neat, with all relevant work shown.
- ✓ While you are encouraged to discuss this class and problem-solving methods with each other, you are not to share your actual homework papers with one another.
- ✓ They must be typed in word and any diagram will be done in AutoCAD.
- ✓ When they are turned in, they will be in a hard copy.
- ✓ Any material or equipment required for the completion of these projects is the responsibility of the student. The student must obtain the necessary equipment/manuals and or supplies to complete the projects. The instructor will advise students where they may obtain necessary equipment/manuals e.g. internet for manuals and info.

Demonstration requirements of Lab Projects will be outlined in class and in a student handout located online that the student can download.

Write-Up requirements of Lab Projects will be outlined in class and in a student handout located online that the student can download.

All projects/ assignments/homework must be submitted by the deadline outlined in the course weekly schedule.