SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE: Industrial Networking

CODE NO. : ELR312   SEMESTER: FIVE

PROGRAM: Electrical Engineering Technology
– Process Automation

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DATE: September 2011   **PREVIOUS OUTLINE DATED:** September 2010

APPROVED: *" Corey Meunier "*

                                       CHAIR   **DATE**

TOTAL CREDITS: SEVEN

PREREQUISITE(S): ELR223 and ELN 230

HOURS/WEEK: 4 hours per week

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I. COURSE DESCRIPTION:

The Fundamentals of Industrial Networks is presented in this course is for those who need a basic working knowledge and an overview of today's data communications 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 is becoming an integral part of Industries daily activities. Students learn about the core TCP/IP protocols and how connections are made on Industrial Networks. This course answers the questions of: How do basic Industrial TCP/IP applications operate? What are TCP/IP clients and servers? What are the configuration requirements for TCP/IP in a window's operating systems

In fast-paced Industrial business environment, Technologists need to know how to choose among a multitude of network technologies and know how they are used in LANs. **Ethernet, Fast Ethernet, Switched Ethernet, Token Ring, FDDI**—which one of these key technologies is right for Industrial LAN? This course teaches the basic concepts to intelligently compare the advantages and disadvantages of these technologies in order to make effective, informed decisions when installing and maintaining Industrial Automation Networks.

Ethernet is fast becoming the new standard for industrial control networking worldwide. This course explains both Ethernet and TCP/IP as they apply to the Automation Technologies areas of job responsibilities. Included are topics such as the various types of copper and fibre based Ethernet cabling systems. We also look at the differences between repeaters, bridges, switches and routers.

This course also introductions common Allen Bradely automation networks such as Data Hwy. Ethernet I/P Controlnet, Devicenet and other common industrial networks such as Profibus, Modbus ,industrial ethernet and other networks 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 networked computing relative to standalone computing
- Identify the elements of a network
- Explain Basic Network Terminology and Concepts
- Describe several specific uses for a network
- 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
- Distinguish between a peer-to-peer and server-based network
- Explain the difference between LAN, MAN, WAN and Enterprise Networks
- Describe the terms Server and Client
- State the characteristics of a server-based network
- State the network operating systems (NOS) available to support a PC server-based network

2.   Understand the characteristics of Peer to Peer,sever based

networks and the OSI model

Potential Elements of the Performance:

- List the type of servers that can be used with a server-based network

- State the characteristics of a peer-to-peer network

- Describe the conditions under which a server-based network is recommended over a peer-to-peer network

- Describe the conditions under which a peer-to-peer based network is recommended over a server-based network

- Compare wired to wireless networking

- State the seven layers of the OSI model

- Describe what happens at the Application layer

- Describe what happens at the Presentation layer

- Describe what happens at the Session layer

- Describe what happens at the Transport layer

- Describe what happens at the Network layer

- Describe what happens at the Data Link layer

- Describe what happens at the Physical layer

- Describe how the Data Link Layer is divided up into the LLC and MAC layers in the IEEE 802 model

- Identify the layer in the OSI model where a particular hardware device operates

- Identify the key networking standards organizations that set standards for networking

- Explain why networking standards are needed

- Describe the types of networking standards

3.   *Analyze OSI Model commutation and addressing*

Potential Elements of the Performance:

- Explain Communication between stacks

- Describe how the OSI Model is applied

- Describe specific networking services within each layer of the OSI Model

- Explain how two systems communicate through the OSI Model

- Discuss the structure and purpose of data frames

- Describe the two types of addressing contained in the OSI Model

- Identify the characteristics of TCP/IP

- Understand the position of network protocols in the OSI Model

- Identify the core protocols of each protocol suite and its functions

- Understand TCP/IP protocol's addressing scheme.

- Define Network Topology

- Explain the Bus, Ring, and Star Networking Topologies and describe the Advantages and disadvantages of each. networks

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

    Potential Elements of the Performance:

    - Define term Network Transport System

    - Explain Circuit Switching and describe the Advantages and disadvantages
    .
    - Explain Packet Switching and describe the Advantages and disadvantages.

    - Describe how packet-switching is different from circuit-

switching

- Describe why data networks use packet-switching

- State how packets are routed to their destination

- Compare the different types of switching used in data transmission

- Understand the transmission methods, or logical topologies, underlying Ethernet, Token Ring, LocalTalk, and FDDI networks

- Define the term NIC.

- Identify the functions of LAN connectivity hardware

- Install and configure a network adapter (network interface card)

- Identify problems associated with connectivity hardware

- Describe the factors involved in choosing a network adapter, hub, switch, or router

- Understand the functions of repeaters, hubs, bridges, switches, and gateways

- Describe the uses and types of routing protocols

- Explain MAC Addressing and what they do

- Explain how a NIC connects to a cable and to a computer.

5.   *Analyze the operation of various types Network components.*

Potential Elements of the Performance:

- Identify (3) different types of cabling for Ethernet networks.

- State their functions in LAN connectivity

- Discuss the network purpose of a hub and types?

- Discuss the network purpose of a switch and benefits?

- Discuss the network purpose of a bridges and benefits?

- Discuss the network purpose of a router and benefits?

- Discuss the network purpose of a repeaters and benefits?

- Discuss the network purpose of a gateway and benefits?

- State how does a bridge create a routing table?

- Describe 3 most common types of cabling media used in LANs and their characteristics.

- Define the term NOS

- Identify the functions of NOS

- Understanding how client computers communicate with a server

6. ***Understand the basics of common Industrial Networks.***

   Potential Elements of the Performance:

   - Identify different Industrial Networks such as Controlnet etc.

   - Identify basic Industrial Networks addressing methods

   - Understanding the differences between industrial network types

   - Describe basic steps in troubleshooting basic industrial network problems

   - Understand the basic concepts of network troubleshooting

- Understand the basic concepts of installing devices on a particular industrial network .

- Demonstrate the ability to communicate peer to peer information from two or more industrial computerized equipment over several AB industrial netwoks such as Ethernet I/P, controlnet, devicenet, Data Hwy. etc

III. TOPICS:

1. Induction to Computer Networks
2. Overview of Networking Standards and the OSI Model
3. Overview of Network Protocols
4. Overview of Topologies
5. Overview of Network Transport Systems
6. Overview of Networking Hardware.
7 Overview of AB Industrial Networks.
8 Introduction to of AB Industrial Networks Installation
9 Introduction to of AB Industrial Networks communication and Troubleshooting

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:
Network+ Guide to Networks by Tamara Dean
AB manuals and documentation information on the internet

V. EVALUATION PROCESS/GRADING SYSTEM:

Test 1	15 marks	15% overall
Test 2	15 marks	15% overall
Test 3	20 marks	25% overall
Assigned Questions	8 marks	8% overall
from Text or /and handouts		
Lab Demonstration/W	20 marks	20% overall
Lab Write-ups	15 marks	15% overall
Class Participation/attendance 7 marks		7% overall
Total 100 marks		100 %

The following semester grades will be assigned to students:

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Grade	Definition	Grade Point Equivalent
A+	90 – 100%	4.00
A	80 – 89%	
B	70 - 79%	3.00
C	60 - 69%	2.00
D	50 – 59%	1.00
F (Fail)	49% and below	0.00

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 <u>immediately</u> 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 to contact the instructor before working on any live equipment that they are not familiar with or have not been instructed in the safety procedures 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 312 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.

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STUDENT   COURSE   AGREEMENT

I,_____**student ID #** _____
(please print)

**with regards to the course known as <u>Networking (ELR 312), have read and
understand the course content, outline and expectations which clearly
states the following:</u>**

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.

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.**

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 which was your first Lab class.

_____
(Signature)   (Date)

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Student Lab Evaluation Sheet ELR312

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 ELR312.

Lab #	Description NOTE: All labs are compulsory unless state other wise	Demo Mark	Instructor's Signature	Write-up Mark
0	Safety in the labs and related equipment.	No mark		No mark
1	**Chapter 1 From Text Project 1-1, Project 1-2, Project 1-3**			
2	**Chapter 2 From Text Project 2-1, Project 2-2, Project 2-3**			
3	**Chapter 4 From Text Project 4-1, Project 4-2, Project 4-3**			
4	**Chapter 5 From Text Project 5-4**			
5	**Chapter 3 From Text Project 3-1, Project 3-2**			
6	Install and Set up DH+ communication NIC Card in the AB 5000 Also Test using RSLinx software			
7	PEER TO PEER COMMUNICATION USING MESSAGE BLOCKS FOR AB-5 WITH HMI DH+			
8	PEER TO PEER COMMUNICATION USING MESSAGE BLOCKS FOR AB-5 to 500 WITH HMI DH+			
9	PEER TO PEER COMMUNICATION USING MESSAGE BLOCKS FOR AB-5 to 5000 WITH HMI DH+			
10	Install and Set up Ethernet communication NIC Card in the AB 5000 Also Test using RSLinx software			
11	PEER TO PEER COMMUNICATION USING MESSAGE BLOCKS FOR AB-5000 to 5000 WITH HMI Ethernet IP			
12	Install and Set up Controlnet communication NIC Card in the AB 5000 Also Test using RSLinx software			
13	PEER TO PEER COMMUNICATION USING MESSAGE BLOCKS FOR AB-5000 to 5000 WITH HMI Controlnet			

Assignments:

From Text Network+ Guide To networking
Chapter 1-- 20 Review Questions
Chapter 2-- 20 Review Questions
Chapter 4-- 25 Review Questions
Chapter 5-- 20 Review Questions
Chapter 3-- 25 Review Questions
Chapter 6-- 25 Review Questions

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 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.

- ✓ 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 were they may obtain necessary equipment/manuals e.g. internet for manuals and info.

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