SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

SAULT COLLEGE

COURSE OUTLINE

COURSE TITLE: TELECOMMUNICATION SYSTEMS I

CODE NO. :   ELR251   **SEMESTER:**   FOUR

PROGRAM: ELECTRICAL ENGINEERING TECHNICIAN
- Process Automation
- Process Automation & Trades
- Power Generation

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APPROVED: *"Corey Meunier"*   _____

                        CHAIR   **DATE**

TOTAL CREDITS: FOUR

PREREQUISITE(S):   ELN109   ELN115   ELR109

HOURS/WEEK: FOUR

I.   COURSE DESCRIPTION
The student will study the technology and protocols that comprise data and voice telecommunication networks of today. The OSI 7 Layer Model will form the basis of the course with focus on the bottom 3 layers. The theory will be strengthened with hands-on labs in cable making, protocol analysis (RS232, TCP/IP) as well as building a simple client/server network.   Wireless networks and secure communications will also be investigated.

II.   LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:
Upon successful completion of this course, the student will demonstrate the ability to:

1.   *Describe telecommunication networks in general and begin building a telecommunications vocabulary.*

      Potential Elements of the Performance:
      - list and describe the elements common to all telecommunication networks.
      - define a network
      - define and distinguish LAN, WAN, CAN, MAN
      - compare and contrast various types of networks including client/server, peer to peer.
      - describe the term NOS network operating systems
      - describe physical topologies (bus,ring,star), and associated media access control methods (logical topology)
      - compare circuit switching and packet switching
      - differentiate simplex, full/half duplex

      This learning outcome will constitute approximately 5% of the course.

2.   *Identify the various telecommunication standards organizations and their associated standards*

      Potential Elements of the Performance:
      - List and describe the 7 layers of the OSI model and
      - Compare them to the 4 layers of the TCP/IP model
      - Identify various protocols at each layer and describe their purpose
      - Identify the method of addressing at various layers and the associated protocol data units
      - List the following standards organizations and identify the important telecommunication standards from each: ANSI, EIA/TIA, IEEE, ISO, ITU, ISOC, IANA AND ICANN

      This learning outcome will constitute approximately 10% of the course.

3   *Analyze the various methods of transmitting data at the Physical Layer*

Potential Elements of the Performance:
- describe the EIA/TIA RS232C standard and capture and analyze a data transmitted using this standard
- describe how parity can be used as a method for error detection
- Identify fiber optic media types, capabilities and describe the various potential impairments
- list and describe various methods for encoding data into electrical signals and identify potential electrical impairments
- list and describe various modulation methods & telephone channel capacity including a statement of Shanons law
- list and describe various devices that operate at the physical layer including repeaters, hubs, transceivers.
- Describe the components of structured network cabling.
- Identify the various standards that apply to structured cabling
- Describe the purpose of, identify and construct network patch cables including straight through, crossover and rollover

This learning outcome will constitute approximately 20% of the course.

4   *Describe the operation of protocols and devices at the OSI Data link layer and explain how they support communications*
Potential Elements of the Performance:
- Explain the role of Data Link layer protocols in data transmission.
- Describe how the Data Link layer prepares data for transmission on network media.
- Describe the different types of media access control methods.
- Identify the common logical network topologies and describe how the logical topology determines the media access control method for that network.
- Explain the purpose of encapsulating packets into frames
- Describe the Layer 2 frame structure and identify generic fields.
- Explain the role of the frame header and trailer fields, including addressing, QoS, type of protocol, and Frame Check Sequence.
- Describe the devices that operate at the data link layer including bridges, switches and the NIC.

This learning outcome will constitute approximately 10% of the course.

5   ***Describe the features of the Network layer protocols and services and explain the fundamental concepts of routing***
Potential Elements of the Performance:

- Identify the role of the Network layer as it describes communication from one end device to another end device.
- Examine the most common Network layer protocol the Internet Protocol (IP), and its features for providing connectionless and best-effort service
- Understand the principles used to guide the division, or grouping, of devices into networks.
- Understand the hierarchical addressing of devices and how this allows communication between networks.
- Understand the fundamentals of routes, next-hop addresses, and packet forwarding to a destination network.

This learning outcome will constitute approximately 10% of the course.

6   ***Calculate, and apply subnet masks and IP addresses to fulfill givenrequirements***
Potential Elements of the Performance:

- Explain the structure IP addressing and demonstrate the ability to convert between 8-bit binary and decimal numbers.
- Given an IPv4 address, classify by type and describe how it is used in the network.
- Explain how addresses are assigned to networks by ISPs and within networks by administrators.
- Determine the network portion of the host address and explain the role of the subnet mask in dividing networks.
- Given IPv4 addressing information and design criteria, calculate the appropriate addressing components.
- Use common testing utilities to verify and test connectivity and operational status of the IP protocol stack on a device.

This learning outcome will constitute approximately 10% of the course.

7   ***Describe the features of the Transport layer protocols and services***

Potential Elements of the Performance:
- Explain the need for the Transport layer.
- Identify the role of the Transport layer as it provides the end-to-end transfer of data between applications.
- Describe the role of two TCP/IP Transport layer protocols: TCP and UDP.
- Explain the key functions of the Transport layer, including reliability, port addressing, and segmentation.
- Identify when it is appropriate to use TCP or UDP and provide examples of applications that use each protocol.

This learning outcome will constitute approximately 10% of the course.

8   ***Describe & utilize the Application Layer & its protocols.***

Potential Elements of the Performance:
- Describe how the functions of the three upper OSI model layers provide network services to end user applications.
- Define how people use the Application Layer to communicate across the telecommunication network.
- Describe the function of well-known TCP/IP applications, such as the World Wide Web and email, and their related services (HTTP, DNS, SMB, DHCP, SMTP, SNMP, and Telnet).
- Explain how protocols ensure services running on one kind of device can send to and receive data from many different network devices.

This learning outcome will constitute approximately 10% of the course.

9   Describe the nature of Encryption/Decryption and implement secure communications

Potential Elements of the Performance:
- describe the nature of cryptography
- describe a hash and where it is used in cryptography
- distinguish between secret key vs public/private key encryption
- send a secure message across a communications channel

This learning outcome will constitute approximately 10% of the course

10.   Describe how wireless communication can be used within an industrial setting.

Potential Elements of the Performance:
- Identify the components of a wireless telecommunication system
- suggest how wireless (unbounded) media can be used to solve an access problem in industrial telecommunications
- review the standards used in wireless networking

This learning outcome will constitute approximately 5 % of the course.

III.   TOPICS:

1. Introduction to Telecommunications and Networks
2. Standards, protocols and models
3. The Physical Layer, Signals, Protocols and devices
4. The Data Link Layer, protocols and devices
5. The Network Layer, protocols and devices
6. IP Addressing
7. The Transport Layer Protocols
8. The Application Layer
9. Introduction to IP Version 6 (time permitting).
10. Secure communication and Wireless

IV.   REQUIRED RESOURCES/TEXTS/MATERIALS:

All material is provided for the student via LMS and or Internet references.

V.   EVALUATION PROCESS/GRADING SYSTEM:

WRITTEN TESTS	60%
LAB PROJECTS/ASSIGNMENTS	30%
QUIZZES	5%
LAB ATTENDANCE	5%

(The percentages shown above may vary slightly if circumstances warrant.)

NOTE: To pass the course, the student must achieve a passing grade (50%) in both the theory and the lab part of this course.   For example, it is not possible to pass the course if a student has a failing average in the three written tests but is passing the lab portion, (or vice versa).

The following semester grades will be assigned to students:

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.	

UPGRADING OF INCOMPLETES

When a student's course work is incomplete or final grade is below 50%, there is the possibility of upgrading to a pass when a student meets all of the following criteria:

1. The student's attendance has been satisfactory.
2. An overall average of at least 45% has been achieved.
3. The student has passed at least 1 of the 3 theory tests.
4. The student has made reasonable efforts to participate in class and complete assignments.

The nature of the upgrading requirements will be determined by the instructor and may involve one or more of the following: completion of existing labs and assignments, completion of additional assignments, re-testing on individual parts of the course or a comprehensive test on the entire course.

LABS:

Lab activities represent a very important component of this course. Because of this, attendance is mandatory and the satisfactory completion of all lab activities is required. It is the student's responsibility to discuss absences from regularly scheduled labs with the instructor so that alternate arrangements (where possible) can be made to complete the lab requirements.

It is acceptable that students consult with each other in relation to their assigned problems. However, it is unacceptable to copy programs written by someone else and submit them as your own work. Where plagiarism or copying is found and it is impossible to determine whose original work it is, a mark of zero will be assigned to all assignments involved.

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.

VII.   COURSE OUTLINE ADDENDUM:

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