

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: DATA COMMUNICATIONS

Code No.: CET222-5 Semester: 4

Program: COMPUTER ENGINEERING TECHNOLOGY

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APPROVED:

L.P. Prognath
Dean

93-04-30
Date



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TOTAL CREDIT HOURS: 75

PREREQUISITES: CET228

I. PHILOSOPHY/GOALS:

This course addresses the needs of the Computer Engineering Technician to be well versed in both the practical and theoretical aspects of Data Communications and Networks. Asynchronous and synchronous communications, interface standards, protocols, modems, communications software, telephone system fundamentals, local area networks and wide area network concepts and the OSI 7-layer model for computer networks are studied with many areas reenforced with practical lab activities.

II. STUDENT PERFORMANCE OBJECTIVES:

Upon successful completion of this course the student will:

1. Be able to describe the data communications environment using appropriate terminology.
2. Describe the characteristics of various media, data codes, modems and modulation techniques and signal impairments.
3. Describe the operation of various data link protocols such as Bisync, SDLC and DDCMP.
4. Describe various devices used to enhance transmission such as Concentrators and Multiplexers and techniques for error correction, data compression and encryption.
5. Describe the nature of Local Area Networks and the important IEEE 802 standards used to describe them.

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6. Describe the layers of the OSI 7-layer model of computer networks and various protocol suites used by major vendors.
7. Use communications software, modems and test equipment effectively.
8. Understand Novell Netware organization and maintenance to the point where network management functions can be done.

III. TOPICS TO BE COVERED:

1. Data Communications terminology.
2. Media and transmission techniques.
3. Data Link Protocols
4. Modems, Modulation and Multiplexers
5. Data compression, error detection, and encryption.
6. Local Area Networks: topologies and standards
7. OSI 7-layer network model
8. ISDN and Packet Switched networks

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IV. LEARNING ACTIVITIES

REQUIRED RESOURCES

BLOCK 1: INTRODUCTION TO DATA COMMUNICATIONS

1. State the basic components of a Data Communications system.
2. Describe the nature of Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE).
3. Discuss the differences between Serial and parallel communications; simplex, half duplex and full duplex communication; point-to-point and multipoint circuits; and dedicated vs. dial-up lines.
4. Describe asynchronous and synchronous transmission characteristics.
5. Describe the Intel 8250 UART (Universal Asynchronous Receiver/ Transmitter), its registers and operation and be able to program it as used in a PC COM port. (This topic is covered in depth in a practical lab exercise.)

TEXT:
"DATA
COMMUNICATIONS:
A USER'S GUIDE"
by KEN SHERMAN

CHAP. 1,2

CHAP. 6

CHAP. 8

INSTRUCTOR'S
NOTES

BLOCK 2: THE DATA COMMUNICATIONS ENVIRONMENT

1. Identify the Common carriers in Canada and data communications Standards Organizations.
2. Describe communications media and their characteristics: twisted-wire pairs, coaxial cable, microwave, satellite links and fibre-optics and others as discussed.
3. Describe fully the nature of the EIA-232-C serial interface standard: its interchange circuits, electrical and functional characteristics.
4. Describe other physical layer interface standards such as RS-423, RS-422, RS-449, X-series interfaces.

CHAP. 3

CHAP. 4

CHAP. 5

CHAP. 5

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5. Describe the 20 mA current loop and its uses.

CHAP. 5

BLOCK 3: THE TELEPHONE SYSTEM, IMPAIRMENTS, MULTIPLEXING AND DATA COMPRESSION, ERROR DETECTION AND MODEMS

1. Define signal bandwidth and describe the nature of a "voice" channel.
2. Describe the telephone system, the standard telephone and the nature of telephone lines.
3. Be able to use frequency domain descriptions of signals.
4. Digital communications: advantages, sampling theorem, digital coding schemes (NRZ, RZ, Manchester, AMI), and Pulse Code Modulation (PCM).
5. Modulation techniques: Amplitude modulation, frequency modulation, phase modulation, multilevel modulation techniques such as QAM.
6. Modem operation and the specific characteristics of the following Bell modem types: Bell 103, Bell 212, Bell 202, Bell 209 and the CCITT V-series Modems.
7. Describe common multiplexing techniques: frequency-division multiplexing (FDM) and time-division multiplexing (TDM) and in particular, the basic FDM group of voice channels and T1 1.544 Mbps TDM systems for voice and data.
8. Describe the characteristics of statistical multiplexers, concentrators and message switches.
9. Discuss the nature of noise and transmission impairments, their measurement using decibels, and some cures.

CHAP. 21

CHAP. 2

INSTRUCTOR'S
NOTES

CHAP. 10

CHAP. 10

CHAP. 10

CHAP. 11

CHAP. 12

CHAP. 21

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| 10. Describe error detection and correction techniques: Echoplex, Horizontal and vertical redundancy checking (HRC and VRC or parity), Cyclic Redundancy Checking (CRC), Forward Error Correction techniques and TCM. | CHAP. 13 |
| 11. Describe techniques of Data Compression and encryption. | CHAP. 13 |

BLOCK 4 NETWORK ARCHITECTURES AND LAYERED PROTOCOLS

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| 1. Describe the ISO OSI (Open System Interconnect) 7-layer Model for networks and the use of interfaces and protocols to enable orderly communication in a network. | CHAP. 15 |
| 2. Describe Data Link layer Functions. | CHAP. 15 |
| 3. Describe various flow control, error control and sequencing techniques in data links. | CHAP. 9 |
| 4. Describe the following three examples of data link protocols:

a) <u>Bisync</u> : a half-duplex character-oriented IBM protocol. This will include a study of the use of ASCII control codes. | CHAP. 9 |
| b) <u>SDLC</u> (Synchronous Data Link Control) IBM's bit-oriented protocol. | CHAP. 9 |
| c) <u>DDCMP</u> (Digital Data Communications Message Protocol) DEC's byte-count oriented protocol. | INSTRUCTOR'S NOTES |

BLOCK 5: LOCAL AREA NETWORKS:LANs

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| 1. Describe the nature of Local Area Networks and their common topologies. | CHAP. 15 |
| 2. Describe network access control methods for LANs and their protocols: CSMA/CD, Token Ring, Token Bus and be able to describe the IEEE 802 standards applicable to LANs. | CHAP. 15 |

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| 3. Describe the characteristics of Ethernet LANs. | CHAP. 15 |
| 4. Describe the IBM Token Ring LAN. | CHAP. 15 |
| 5. Describe the FDDI (Fiber Distributed Data Interface) LAN as used in high speed fiber optic networks. | CHAP. 15 |
| 6. Describe the nature of Bridges, Routers and Gateways. | CHAP. 15 |
| 7. Be able to describe the nature of Novell Netware Networks, their capabilities, basic utilities and management. | INSTRUCTOR'S NOTES |

BLOCK 6: RELATED TECHNOLOGIES

[Time limitations may require this block to be deferred until CET314 in 6th semester.]

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| 1. ISDN: An overview of Integrated Services Digital Network services. | CHAP. 16 |
| 2. PBX's: Private Branch Exchanges and their role in data communications. | CHAP. 14 |
| 3. Packet switching and the X.25 standard. | CHAP. 17 |

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V. METHOD OF EVALUATION:

3 WRITTEN TESTS (20% each) [at approx. 5 week intervals]	60%
LAB PROJECTS/ASSIGNMENTS	30%
QUIZZES	5%
ATTENDANCE	5%

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

GRADING SCHEME

A+	90	-	100%
A	80	-	89%
B	70	-	79%
C	55	-	69%
I	Incomplete		
R	Repeat		

UPGRADING OF INCOMPLETES

When a student's course work is incomplete or final grade is below 55%, there is the possibility of upgrading to a pass when a student meets the following criteria:

1. The students attendance has been satisfactory.
2. An overall average of at least 40% has been achieved.
3. The student has not had a failing grade in all of the theory tests taken.
4. The student has made reasonable efforts to participate in class and complete assignments.

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.

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LAB REPORTS

The due date for assigned lab reports is one week after the date of completion of the lab. Lab reports not completed by the assigned due-date will be penalized by 10% for each week late. All lab reports must be individually submitted by each member of lab groups. A minimum of 5 lab reports must be satisfactorily completed.

ATTENDANCE:

Absenteeism will affect a student's ability to succeed in this course. In addition, five percent of the final grade will be based on attendance. Absences due to medical or other unavoidable circumstances should be discussed with the instructor, so that remedial activities can be scheduled.

VI. REQUIRED STUDENT RESOURCES:

TEXT BOOKS: "DATA COMMUNICATION: A USER'S GUIDE"
by KEN SHERMAN (PRENTICE-HALL)

VII. ADDITIONAL RESOURCE MATERIALS AVAILABLE:

Lab references to be used during the semester"

1. Procomm Plus Users Manual
2. Telix Users Manual
3. GVC Modem Users Manual
4. Novell Netware Manuals
5. Data Communications Test Equipment Manuals (as assigned)

VIII. SPECIAL NOTES:

Students with special needs (eg. physical limitations, visual or hearing impairments, or learning disabilities) are encouraged to discuss any required accommodations confidentially with the instructor.

Your instructor reserves the right to modify the course as deemed necessary to meet the needs of students or take advantage of new or different learning opportunities.

The Blocks of objectives will not necessarily be covered in the order shown in this course outline.