SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ON

COURSE OUTLINE

COURSE TITLE: MICROWAVE and SATELLITE COMMUNICATIONS

CODE NO.: ELN 316-5 SEMESTER: FIFTH

PROGRAM: ELECTRONIC ENGINEERING TECHNOLOGY (4023)

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APPROVED: L P Chaput 95-08-29
DEAN DATE

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TOTAL CREDIT HOURS: 5

PREREQUISITE(S): ELN245, ELR309

PHILOSOPHY/GOALS:

THIS COURSE WILL GIVE THE STUDENT A THOROUGH KNOWLEDGE OF THEORY AND OPERATION OF PASSIVE AND ACTIVE COMPONENTS EMPLOYED IN MICROWAVE EQUIPMENT. LABORATORY WORK INCLUDES THE EXPERIMENTAL GENERATION OF MICROWAVE SIGNALS AND THEIR TESTING WITH WAVEGUIDE HARDWARE. ALSO INCLUDED ARE MICROWAVE CIRCUIT CONSTRUCTION PROJECTS.

STUDENT PERFORMANCE OBJECTIVES:

UPON SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENT WILL:

1. HAVE A FUNDAMENTAL KNOWLEDGE OF ELECTROMAGNETIC FIELD THEORY AND BE ABLE TO APPLY IT TO THE SOLUTION OF TRANSMISSION LINE PROBLEMS.
2. UNDERSTAND THE OPERATION OF WAVEGUIDES AND APPLY FORMULAS TO THE SOLUTION OF PROBLEMS.
3. BE ABLE TO USE THE SMITH CHART IN THE SOLUTION OF TRANSMISSION LINE PROBLEMS.
4. HAVE OF FUNDAMENTAL KNOWLEDGE OF MICROWAVE NETWORK PARAMETERS AND APPLY IT TO THE SOLUTION OF PROBLEMS.
5. BE FAMILIAR WITH VARIOUS TYPES OF MICROWAVE COMPONENTS AND HOW THEY OPERATE.
6. BE FAMILIAR WITH VARIOUS TYPE OF MICROWAVE TUBES AND HOW THEY OPERATE.
7. BE FAMILIAR WITH VARIOUS TYPES OF MICROWAVE ANTENNAS AND HOW THEY OPERATE.

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TOPICS TO BE COVERED:

1. INTRODUCTION TO MICROWAVES
2. CIRCUITS AND FIELDS
3. TRANSMISSION LINES
4. WAVEGUIDES AND RESONATORS
5. SMITH CHART
6. MICROWAVE NETWORK PARAMETERS
7. SOLID-STATE MICROWAVE DEVICES
8. MICROWAVE COMPONENTS
9. MICROWAVE TUBES
10. ANTENNAS
11. SATELLITE COMMUNICATIONS

REQUIRED TEXTBOOK:

MICROWAVE THEORY COMPONENTS AND DEVICES
BY- JOHN A. SEEGER
(PRENTICE HALL 1986)

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LEARNING ACTIVITIES	REQUIRED RESOURCES
1 INTRODUCTION 1.1 MICROWAVE FREQUENCIES 1.2 HISTORY 1.3 APPLICATION OF MICROWAVES 1.4 UNITS 1.5 CO-ORDINATE SYSTEMS	TEXT: CHAPTER 1
2 CIRCUITS AND FIELDS 2.1 CIRCUIT THEORY 2.2 ELECTROMAGNETIC FIELDS 2.3 HIGH FREQUENCY EFFECTS	TEXT: CHAPTER 2
3 TRANSMISSION LINES 3.1 STEP INPUT TO A TRANSMISSION LINE 3.2 AC SOLUTION FOR A TRANSMISSION LINE	TEXT: CHAPTER 3
4 WAVEGUIDES AND RESONATORS 4.1 TRANSVERSE ELECTRIC MODES IN A RECTANGULAR WAVEGUIDE 4.2 POWER IN A RECTANGULAR WAVEGUIDE 4.3 TRANSVERSE MAGNETIC MODES IN A RECTANGULAR WAVEGUIDE 4.4 CIRCULAR WAVEGUIDES 4.5 WAVEGUIDE CAVITIES	TEXT: CHAPTER 4

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LEARNING ACTIVITIES	REQUIRED RESOURCES
5 SMITH CHART	TEXT: CHAPTER 6
5.1 DETERMINATION OF INPUT IMPEDANCE	
5.2 USE OF THE SMITH CHART WITH ADMITTANCE	
5.3 SINGLE STUB MATCHING USING THE SMITH CHART	
5.4 DOUBLE STUB MATCHING	
5.5 DETERMINING IMPEDANCE USING THE SMITH CHART AND THE SLOTTED LINE	
5.6 SMITH CHART AND POWER	
5.7 LOSSY LINES	
5.8 FREQUENCY AND THE SMITH CHART	
6 MICROWAVE NETWORK PARAMETERS	TEXT: CHAPTER 7
6.1 TWO PORT PARAMETERS	
6.2 ABCD PARAMETERS	
6.3 SCATTERING PARAMETERS	
6.4 PROPERTIES OF S-PARAMETERS	
6.5 CHANGE OF PORT POSITION	
6.6 SCATTERING TRANSFER PARAMETERS	
6.7 SIGNAL FLOW GRAPHS	
7 MICROWAVE COMPONENTS	TEXT: CHAPTER 8
7.1 COAXIAL LINES	
7.2 WAVEGUIDE SECTIONS	
7.3 WAVEGUIDE REACTIVE ELEMENTS	
7.4 TERMINATIONS	
7.5 ATTENUATORS	
7.6 PHASE SHIFTER	
7.7 WAVEGUIDE TEES	
7.8 MAGIC TEES	
7.9 DIRECTIONAL COUPLER	
7.10 ISOLATOR	
7.11 CIRCULATOR	

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LEARNING ACTIVITIES	REQUIRED RESOURCES
8 SOLID-STATE MICROWAVE DEVICES 8.1 SEMICONDUCTOR CONCEPTS 8.2 MICROWAVE APPLICATIONS OF SEMI-CONDUCTOR DIODES 8.3 PASSIVE DIODE DEVICES 8.4 MICROWAVE TRANSISTORS	TEXT: CHAPTER 11
9 MICROWAVE TUBES 9.1 LINEAR BEAM MICROWAVE TUBES 9.2 CROSSED-FIELD TUBES 9.3 MILLIMETER-WAVE TUBES	TEXT: CHAPTER 10
10 ANTENNAS 10.2 PROPERTIES OF ANTENNAS 10.2 DIPOLE ANTENNA 10.3 HORN ANTENNA 10.4 PARABOLIC REFLECTOR ANTENNAS 10.5 LENS ANTENNA 10.6 SLOT ANTENNA 10.7 POLYROD ANTENNA 10.8 HELICAL ANTENNA 10.9 FREQUENCY-INDEPENDENT ANTENNA 10.10 ANTENNA ARRAYS	TEXT: CHAPTER 9
11 SATELLITE COMMUNICATIONS	

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V. EVALUATION METHODS:

Testing:

a) Written tests based upon theory objectives will occur following the completion of each theory block and with about a week of advance notice. Short written quizzes may occur at any time without advance notice.

b) Testing of laboratory objectives will occur concurrent with the specific laboratory activity.

Grading:

a) Grading is done using the following definitions:

- Consistently outstanding performance.....A+ (90-100)
- Outstanding performance.....A (80- 90)%
- Above average performance.....B (70- 80)%
- Satisfactory performance.....C (55- 70)%
- Unsatisfactory performance.....R (< 55)%

b) The grading of laboratory type objectives will be in two parts: The demonstrated ability to perform a skill function, e.g. use an instrument in a specified role or trouble shoot a circuit, will be graded "C". Failure to demonstrate the skill function will be graded "R". Subjective evaluation of lab reports, supporting theory, deportment, housekeeping etc., will be used to modify the skill function grade upward, where applicable.

c) Laboratory reports are due one week after the scheduled date of completion for a given laboratory experiment. Late reports are penalized 5% per day.

d) The grading weight will be 30% for the laboratory and 70% for the theory.

e) A final overall accumulated mark of 55% is the minimum requirement for course credit with the added restriction that neither the theory or the lab part of the course can be less then 55%.

f) A failing grade on more then half the classroom theory tests during the semester leads directly to an "R" grade.

g) Failing one third of the semesters theory tests excludes a final "A" grade, regardless the theory average.

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Upgrading:

a) If a test is missed for reasons whatsoever, the grade for that test is 0 unless a very good and credible reason can be given for the absence.

b) The method of upgrading is at the teachers discretion. It may consist of the rewriting of block tests, the writing of comprehensive examination, repeating laboratory experiments or repeating the course.

c) No upgrading tests will take place during the semester. All rewrites will be scheduled during the last week of the semester.

d) In the case of final marks less than 55% and greater than 50%, provided an 80% or better attendance record, consideration will be given to a supplemental examination covering the whole course. The grades that can be obtained on the supplemental are either a "C" grade or an "R" grade.

Attendance:

a) Attendance for laboratory classes is compulsory. Laboratory activities missed for reasons whatsoever must be completed during the students own time.

b) Attendance for all theory classes is highly recommended and recorded, but not mandatory.

c) Anyone with an accumulated attendance record of less then 80% at the end of the semester, and who is also in a failing condition, can expect to have to repeat the course, with no rights to write a make-up test.