

I. COURSE DESCRIPTION:

The theory and hardware of the active and passive components employed in microwave systems are considered. Topics include electromagnetic theory, transmission lines, waveguide components, antennas, microwave semiconductor devices and microwave tubes.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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

1) Analyze a transmission line.

Potential Elements of the Performance:

- Use Circuit theory and Electromagnetic Theory to analyze a transmission line.
- Use the Smith chart to analyze a transmission line.

2) Analyze a rectangular and circular waveguides.

Potential Elements of the Performance:

- Identify the transverse electric and transverse magnetic modes of operation of a rectangular and circular waveguide.
- Calculate various parameters such as cutoff frequency, guide wavelength, phase constant, group velocity and phase velocity and guide impedance.
- Calculate the resonant frequency of waveguide resonators.
- Perform measurements in the lab on microwave waveguide equipment.

3) Analyze various waveguide components using scattering parameters.

Potential Elements of the Performance:

- Use scattering parameters to calculate the reflection coefficient and attenuation or isolation for various waveguide components such as: terminators, attenuators, waveguide tees, magic tee, directional coupler, isolator and circulator.

4) Analyze microwave antenna properties.

Potential Elements of the Performance:

- Use antenna formulas to analyze the properties of various microwave antennas including the: Dipole Antenna, Small Loop Antenna, Horn Antenna, Parabolic Reflector Antenna, Lens Antenna, Slot Antenna, Polyrod Antenna, Frequency-Independent Antenna and Antenna arrays.

5) Describe the operation of microwave tubes.

Potential Elements of the Performance:

- Describe the operation of Linear Beam Devices such as the Klystron Amplifier, Reflex Klystron Oscillator, Traveling Wave Tube Amplifier, Backward Wave Amplifier and Backward Wave Oscillator.
- Describe the operation of Crossed-Field devices such as the Magnetron.

6) Design and build a microwave amplifier.

Potential elements of the performance:

- Use the Smith Chart to design a microwave amplifier using microstrip technology.
- Build and test the amplifier in the lab.

III. TOPICS:

- 1) Introduction to Microwaves
- 2) Circuits and Electromagnetic Fields
- 3) Transmission Lines
- 4) Waveguides and Resonators
- 5) Smith Chart
- 6) Microwave Network Parameters
- 7) Microwave Components
- 8) Antennas
- 9) Microwave Tubes
- 10) Solid-State Microwave Devices

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Microwave Theory, Components, and Devices
by John A. Seeger

V. EVALUATION PROCESS/GRADING SYSTEM:

The grading weight will be:

Theory 75%

Lab 25%

The following semester grades will be assigned to students in postsecondary courses:

<u>Grade</u>	<u>Definition</u>	<u>Grade Point Equivalent</u>
A+	90 - 100%	4.00
A	80 - 89%	3.75
B	70 - 79%	3.00
C	60 - 69%	2.00
R (Repeat)	59% or below	0.00
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field placement or non-graded subject areas.	
U	Unsatisfactory achievement in field placement or non-graded subject areas.	
X	A temporary grade. This is used in limited situations with extenuating circumstances giving a student additional time to complete the requirements for a course (see <i>Policies & Procedures Manual – Deferred Grades and Make-up</i>).	
NR	Grade not reported to Registrar's office. This is used to facilitate transcript preparation when, for extenuating circumstances, it has not been possible for the faculty member to report grades.	

VI. SPECIAL NOTES:Special Needs:

If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your instructor and/or the Special Needs office. Visit Room E1204 or call Extension 493, 717, or 491 so that support services can be arranged for you.

Retention of course outlines:

It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other postsecondary institutions.

Plagiarism:

Students should refer to the definition of “academic dishonesty” in *Student Rights and Responsibilities*. Students who engage in “academic dishonesty” will receive an automatic failure for that submission and/or such other penalty, up to and including expulsion from the course/program, as may be decided by the professor/dean. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

Course outline amendments:

The Professor reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources.

Substitute course information is available in the Registrar's office.

VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the professor. Credit for prior learning will be given upon successful completion of a challenge exam or portfolio.

VIII. DIRECT CREDIT TRANSFERS:

Students who wish to apply for direct credit transfer (advanced standing) should obtain a direct credit transfer form from the Dean's secretary. Students will be required to provide a transcript and course outline related to the course in question.