

ECE 524F MICROWAVE CIRCUITS

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<http://www.waves.utoronto.ca/prof/gelefth/courses/ece424.html>

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**Purpose: Learn the principles of designing modern microwave and RF circuits.
Signal-integrity issues in high-speed digital circuits are also introduced.**

SYLLABUS

1. EM THEORY REVIEW

Wave equation, plane-wave solutions, good dielectrics, good conductors, skin-depth.

2. IDEAL TRANSMISSION LINE (TL) THEORY

Circuit model for a TL, TL-equations, time-harmonic solutions, lossless line, low-loss line, terminated line, impedance-transformation, transients on a TL, Smith chart.

3. IMPEDANCE MATCHING

L-matching networks, single-stub tuning, double-stub tuning, multisection transformers.

4. PLANAR TRANSMISSION LINE SYSTEMS

Stripline, microstrip, coplanar waveguide CPW, microstrip discontinuities, introduction to Monolithic Microwave Integrated Circuits (MMIC's).

5. DESIGNING WITH SCATTERING PARAMETERS

Equivalent voltages & currents, impedance & admittance matrices, scattering matrix, ABCD matrix, 2-port networks.

6. PRACTICAL 3-PORT & 4-PORT DEVICES

Properties of 3-ports & 4-ports, even-odd mode analysis, Wilkinson power divider/combiner, branch line and ring couplers, coupled-lines, Lange coupler.

7. ACTIVE RF/MICROWAVE CIRCUITS

Transistor amplifier design, stability, noise, diode-mixers, RF receiver chains, oscillators.

8. MICROWAVE FILTERS

Insertion loss method for filter-design, Binomial filters, Chebyshev filters, filter transformations, filter implementation, Richard's transformation, Kuroda's identities, stepped-impedance filters.

LABORATORY FOR ECE524F

Experiment #1:

Construction and Characterization of a Microstrip Filter.

Experiment #2:

Construction and Characterization of a Microstrip Power-Divider.

Experiment #3:

A 1GHz Microstrip Solid-State Amplifier.

Demonstration: A 900 MHz Co-axial heterodyne receiver

Procedure:

Session I (BA 3114)

1. Design of the circuits using Puff, a special CAD tool running on PCs.

Session II (GB 450)

2. Construction of the circuits.
3. Testing of the circuits using state-of-the-art RF equipment such as a Network Analyzer.

TEXTBOOKS

Required:

Microwave Engineering, by David Pozar, 2nd Edition, Wiley.

Recommended:

RF Microwave Wireless Systems, K. Chang, Wiley (emphasis on systems).

RF Circuit Design, by R. Ludwig and P. Bretchko, Prentice Hall (emphasis

on active circuits).

SCHEDULE (check the ECE524 website for details)

- Two Lectures per week (Wed. 11-12am BA1240 , Thu. 9-10am RS310)
- One Tutorial every other week (Fri. 4-5pm BA2179; Mon 9-10am, BA2179)
- One Laboratory every other week (Thu. 4-7 pm; Mon. 9-12; BA3114 (Session I)/ GB450(Session II))

GRADING

Final Exam:	50%
Midterm Exam:	25%
Laboratory:	25%

Note: Practice problems and previous years midterm and final examinations are available on the ECE524 website