COURSE DESCRIPTION

ECE 671: Microwave and RF Engineering

Winter 2019

Instructor: Dr Slim Boumaiza {sboumaiz@uwaterloo.ca, ███████, ext. 37017}

DESCRIPTION: The course focuses on the fundamental methods for the analysis and design of microwave/RF passive and active circuits. The essentials of computer-aided design of microwave/RF circuits as well as major aspects of hardware implementations will be covered. Important RF applications for wireless communication systems will also be discussed. The course will include:

- Transmission line theories and generalized matrix representation of RF circuits
- Analysis of multi-port RF networks
- Introduction to modern microwave planar technologies
- Lumped and distributed microstrip circuits
- Analysis of microstrip circuits
- Microstrip couplers, hybrids and impedance matching networks
- Microwave resonators and filters
- Design of RF low noise amplifiers (LNAs)
- Design of RF oscillators and mixers
- Use of existing commercial CAD design tools for RF circuits
- Hybrid and Monolithic RF circuits

OBJECTIVES: Students are expected to be able to design and analyze various microwave passive (filters, couplers, combiners/dividers) and active circuits (linear amplifiers and oscillators) after successful completion of the course work. For that, this course introduces transmission line theory, impedance matching techniques, and microwave circuit network analysis. It discusses the design of practical microwave circuits such as filters, couplers, low-noise, amplifiers, and oscillators.

PREREQUISITES:

- Basic knowledge in Electromagnetic and analog Electronic
- Electrical and Computer Engineering course "Electromagnetic Fields"(ECE 370) or equivalent, or permission of the instructor

DESIGN PROJECT: Each student will have a design project dealing with the design of a particular nonlinear RF active or passive circuit with realistic specifications. The design project requires that the student use RF CAD software Agilent's Advanced Design System.

SOFTWARE TOOLS: The design project and the homework assignments require that the student use Keysight's Advanced Design System software which models microwave elements with second-order effects.

USE OF CALCULATORS IN EXAMINATIONS: Programmable and/or scientific calculators without formulae storage and /or text display features may be used during examinations. Personnel computers may not be used in examinations

GRADING BASIS

- Assignments 15%
- Project 15%
- Midterm 20%
- Final Examination 50%

TEXTBOOK

Required Textbook:

- D. Pozar: "Microwave Engineering", 3rd Edition, John Wiley & Sons, Inc.

Recommended books:

- Guillermo Gonzalez, Microwave Transistor Amplifiers: Analysis and Design, Second Edition, Prentice Hall, ISBN: 0-13-254335-4

- R. Ludwig, P. Bretchko, RF Circuit Design: Theory and Applications, Upper Saddle River, NJ: Prentice Hall, 2000

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check www.uwaterloo.ca/academicintegrity/ for more information.]

Plagiarism: For all assignments, students are welcome to consult with others. Nevertheless, each student is expected to add value beyond that of the work developed in conjunction with others and the submitted material must be in the student's own words.

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, www.adm.uwaterloo.ca/ infosec/Policies/policy70.htm. When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity [check www.uwaterloo.ca/academicintegrity/] to avoid committing an academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline, www.adm.uwaterloo.ca/infosec/Policies/policy71.htm. For typical penalties check Guidelines for the Assessment of Penalties, www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm.

Appeals: A decision made or penalty imposed under Policy 70 (Student Petitions and Grievances) (other than a petition) or Policy 71 (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals) www.adm.uwaterloo.ca/infosec/Policies/policy72.htm.

Note for Students with Disabilities: The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate

accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.