



### ELEC 404 – Microwaves and Fiber Optics Term – SUMMER 2017 (201705)

#### Instructor

Dr. Thomas Darcie  
Phone: (250) 721-8686  
E-mail: tdarcie@uvic.ca

#### Office Hours

Days: By appointment  
Time:  
Location: EOW 443

#### Course Objectives

To introduce students to microwave and fiber optic engineering, including transmission line theory, microwave network analysis, optical fiber, and related components and measurement principles.

#### Learning Outcomes

Upon completion of this course students should be able to:

- describe basic properties of transmission lines in terms of characteristic impedance, complex propagation constants, transmission and reflection coefficients,
- understand electromagnetic wave propagation in waveguides, including wave impedance, spatial structure of electric and magnetic fields, and mode cutoff condition,
- describe the basic operation of coupled lines in terms of even and odd mode impedances and coupling coefficient,
- describe networks of inter-connected microwave components and ports in terms of network analysis tools and in particular the scattering matrix,
- calculate power flow in transmission lines and waveguides,
- use a variety of techniques to optimize power flow or minimize reflections in transmission line systems and in particular become comfortable with the applications of the Smith Chart,
- calculate basic antenna parameters such as beam width, directivity, gain, radiation loss and resistance and calculate power link budget for a variety of wireless links,
- describe the noise temperature, noise figure, gain, and power available from a microwave amplifier,
- understand basic design and fabrication techniques and mode propagation properties for optical fiber,
- calculate propagation limitations in optical fiber resulting from attenuation and chromatic dispersion, and
- describe basic use of various optical waveguide devices including couplers, circulators, and fiber Bragg gratings in constructing a basic optical communication link.

#### Syllabus

**Introduction and Fundamentals** ..... 3

#### **Microwave Engineering:**

Transmission Line Theory ..... 4.5

Waveguide theory .....	4.5
Couplers and Coupled Lines.....	1.5
Network Analysis .....	3
Smith Chart and Load Matching .....	3
Antennas .....	1.5
Impedance Matching and Tuning.....	3
Amplifier Fundamentals .....	1.5
<b>Optical Fiber Engineering:</b>	
Optical Fiber Communications.....	1.5
Modes and Propagation in Optical Fiber.....	3
Impairments in Optical Fiber .....	1.5
Optical Waveguide Devices .....	1.5
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Sub Total	33
Test	1.5
Review	1.5
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Total	36

**Laboratory Experiments** (Each experiment is of 3 hours duration)

Experiment 1	Standing Waves and Impedance Measurements Using Slotted Line
Experiment 2	Microwave Couplers and Network Analysis
Experiment 3	Microwave Antennas
Experiment 4	Basic Fiber Optic Measurements and Transmission

**Lectures**

A-Section(s): A01 / CRN 30337  
Days: Mondays & Thursdays  
Time: 1:00 - 2:20  
Location: ECS 108

**Labs**

**Location: ELW A321**

B01 Tue. 14:00-17:00 (wk1)  
B02 Tue. 14:00-17:00 (wk2)  
B03 Fri. 14:00-17:00 (wk1)  
B04 Fri. 14:00-17:00 (wk2)  
B05 Wed. 14:30-17:30 (wk1)  
B06 Wed. 14:30-17:30 (wk2)

**Required Text**

Title: Microwave Engineering  
Author: D. M. Pozar  
Publisher: John Wiley & Sons

**Optional Text**

Title: Optical Fiber Communications  
Author: G. Keiser  
Publisher: McGraw-Hill

Year: 2012 (4th ed.)

Year: 2011 (4th ed.)

Title: Laboratory Manual for ELEC 404 - Microwave and Fiber Optics (posted online)

Author: T. Darcie, P. Fedrigo, R. Vahldieck, J. Bornemann

Publisher: University of Victoria

Year: April 2011

## References:

## Assessment:

Assignments	10 %	Due Dates: As posted
Labs	20 %	
Mid-term	20 %	Date: June 29, 2016 – regular lecture time and place
Classroom	10 %	
Final Exam	40 %	Date: TBD

**Note:** Failure to complete all laboratory requirements will result in a grade of N being awarded for the course.

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

**Assignment of E grade and supplemental examination for this course will be at the discretion of the Course Instructor. The rules for supplemental examinations can be found in the current Undergraduate Calendar.**

<http://web.uvic.ca/calendar2017-05/undergrad/info/regulations/grading.html>

## Note to Students:

Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

**Accommodation of Religious Observance:** <http://web.uvic.ca/calendar2017-05/general/policies.html>

**Policy on Inclusivity and Diversity:** <http://web.uvic.ca/calendar2017-05/general/policies.html>

**Standards of Professional Behaviour:** You are advised to read the Faculty of Engineering document Standards for Professional Behaviour, which contains important information regarding conduct in courses, labs, and in the general use of facilities. <https://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf>

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the entry in the current Undergraduate Calendar for the UVic policy on academic integrity.

<http://web.uvic.ca/calendar2017-05/undergrad/info/regulations/academic-integrity.html>

**Equality:** This course aims to provide equal opportunities and access for all students to enjoy the benefits and privileges of the class and its curriculum and to meet the syllabus requirements. Reasonable and appropriate

accommodation will be made available to students with documented disabilities (physical, mental, learning) in order to give them the opportunity to successfully meet the essential requirements of the course. The accommodation will not alter academic standards or learning outcomes, although the student may be allowed to demonstrate knowledge and skills in a different way. It is not necessary for you to reveal your disability and/or confidential medical information to the course instructor. If you believe that you may require accommodation, the course instructor can provide you with information about confidential resources on campus that can assist you in arranging for appropriate accommodation. Alternatively, you may want to contact the Resource Centre for Students with a Disability located in the Campus Services Building. The University of Victoria is committed to promoting, providing, and protecting a positive, and supportive and safe learning and working environment for all its members.

**Course Lecture Notes:** Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.