TELE9755

Microwave Circuits, Theory and Techniques

Term 2, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Rodica Ramer	ror@unsw.edu.au		EE&T room 308	93854759

Lecturers

Name	Email	Availability	Location	Phone
King Yuk Chan	kyc@unsw.edu.au		EE&T room 328	

School Contact Information

Consultations: Lecturer consultation times will be advised during the first lecture. You are welcome to email the tutor or laboratory demonstrator, who can answer your questions on this course and can also provide you with consultation times. ALL email enquiries should be made from your student email address with ELEC/TELExxxx in the subject line; otherwise, they will not be answered.

Keeping Informed: Announcements may be made during classes, via email (to your student email address) and/or via online learning and teaching platforms – in this course, we will use Moodle https://moodle.telt.unsw.edu.au/login/index.php. Please note that you will be deemed to have received this information, so you should take careful note of all announcements.

Student Support Enquiries

For enrolment and progression enquiries please contact Student Services

Web

Electrical Engineering Homepage

Engineering Student Support Services

Engineering Industrial Training

UNSW Study Abroad and Exchange (for inbound students)

UNSW Future Students

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

Email

Engineering Student Support Services – current student enquiries

- e.g. enrolment, progression, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries

- e.g. admissions, fees, programs, credit transfer

Course Details

Units of Credit 6

Summary of the Course

The general flow of the course is Applications, Systems, Components. Applications of microwaves: (terrestrial and satellite communications, radar, remote sensing, wireless). System requirements for elements are to be analysed. Propagation modes (TEM, TE, TM, quasi-TEM), attenuation, dispersion, S-parameters are parts of general fundamentals. Analysis of circuit components and MIC are to be introduced.

Course Aims

Wireless communication is one of the fasted growing technology areas and is found in wireless systems like Global Positions Satellite (GPS) systems, Wireless Local Area Networks (WLANs), paging systems, Direct Broadcast Satellite (DBS) television, Radio Frequency Identification (RFID) systems, mobile phones, automobile industry, and IoT. These systems have the capability of providing global connectivity for voice, video, and data communications. Hence, there is enormous commercial interest in this technology and never enough supply of competent microwave engineers.

This course will look at the hardware aspects of wireless systems from a telecommunications engineer perspective covering both basic passive and active microwave components as parts of the microwave building blocks in telecommunication transceiver system. The theoretical background comprises a brief recapitulation of models and high-frequency transmission principles and Smith charts, followed by mathematical representation of microwave circuits, analysis of multiport microwave networks, introduction to modern planar technologies, lumped vs. distributed planar circuits, and analysis of planar circuits. Passive and active components will be discussed.

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Explain the limitations of conventional low frequency lumped-element circuits versus distributed circuits.	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE1.6
2. Explain the advantages and disadvantages of current microwave technologies.	PE1.1, PE1.2, PE1.3, PE1.4
3. Review concepts and principles of microwave and millimetre-wave devices and evaluate their characteristic performance.	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE1.6
4. Design and construct microwave components and systems.	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE2.1, PE2.2, PE2.3, PE3.2, PE3.3, PE3.5, PE3.6

Teaching Strategies

Please refer to the information in Moodle

Additional Course Information

Contact Hours

The course consists of 3 hours: 2 hours of lectures, and 1-hour tutorial.

	Day	Time	Location
Lectures	Wednesday	13 – 15 (wk 1-10)	Microsoft Teams Meeting
Tutorials		15 - 16 (wk 1-10)	Microsoft Teams Meeting

Credits

This is a 6 UoC course and the expected workload is 15 hours per week throughout the 10-week term.

Relationship to Other Courses

This is a postgraduate course in the School of Electrical Engineering and Telecommunications. The course is offered to students enrolled in the postgraduate level in the School of EE&T at the University of New South Wales. The course gives the foundation for microwave engineering design principles. The course should be taken by students that plan to design overall communications systems.

Assumed Knowledge

It is essential that the students are familiar with circuit theory, basic analogue electronics and communication principles before this course is attempted. Electromagnetic theory and circuit theory techniques are assumed background knowledge for this subject. It is further assumed that the students are familiar with circuit simulators, have good computer literacy and that they are able to operate electronics equipment.

Following Courses

The course will provide an essential basic understanding to attempt the postgraduate courses TELE 9344 Cellular and Mobile and Communications and TELE 4652 Mobile and Satellite Communications, which are core courses in the Telecommunications and Master of Engineering Science post-graduate specialization coursework program, offered by the School.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Final Examination	60%		1, 2, 3, 4
2. Assignment	20%	27/07/2022 11:59 PM	1, 2, 3, 4
3. Mid-Semester Exam	20%	29/06/2022 04:00 PM	1, 2, 3

Assessment 1: Final Examination

Assessment length: 2 hour

The exam in this course is a standard 2-hour written examination, comprising three to five compulsory questions. The examination tests analytical and critical thinking and general understanding of the course material in a controlled fashion. Questions may be drawn from any aspect of the course, unless specifically indicated otherwise by the lecturer.

Assessment criteria

Marks will be assigned according to the correctness of the responses.

Assessment 2: Assignment

Start date: 29/06/2022 04:00 PM
Due date: 27/07/2022 11:59 PM

The assignment allows self-directed study leading to the solution of partly structured problems. Marks will be assigned according to how completely and correctly the problems have been addressed, the quality of the written assignment and the understanding of the course material demonstrated by the report.

Assessment 3: Mid-Semester Exam

Start date: 29/06/2022 03:00 PM
Due date: 29/06/2022 04:00 PM

The mid-session examination tests your general understanding of the course material and is designed to give you feedback on your progress through the analytical components of the course. Questions may be drawn from any course material already covered in the course schedule. It may contain numerical and analytical questions. Marks will be assigned according to the correctness of the responses.

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

Lectures

Students should read relevant sections of the recommended text. Reading additional texts will further enhance the learning experience. UNSW *assumes* that self-directed study of this kind is undertaken in addition to attending formal classes throughout the course.

Tutorial classes

Students should attempt all your problem sheet questions. The importance of adequate preparation prior to each class cannot be overemphasized, as the effectiveness and usefulness of the tutorial depend to a large extent on this preparation. Answers to these questions will be discussed during the tutorial class and the tutor will cover the more complex questions in the tutorial class. In addition, during the tutorial class, 1-2 new questions that are not in your notes may be provided by the tutor, for Students to try in class. These questions and solutions may not be made available, so it is worthwhile for you to attend the tutorial classes to gain maximum benefit from this course.

View class timetable

Timetable

Date	Type	Content
Week 1: 30 May - 3 June	Lecture	Introduction and recapitulation
Week 2: 6 June - 10 June	Lecture	Recapitulation of fundamental concepts cont.
Week 3: 13 June - 17 June	Lecture	Theory background
Week 4: 20 June - 24 June	Lecture	Theory background cont.
Week 5: 27 June - 1 July	Blended	Microwave technologies and components
	Assessment	Mid-Semester Exam
Week 6: 4 July - 8 July	Lecture	Microwave passive devices
Week 7: 11 July - 15 July	Lecture	Microwave passive devices cont.
Week 8: 18 July - 22 July	Lecture	Microwave passive devices cont.
Week 9: 25 July - 29	Lecture	Microwave active devices

July	Assessment	Assignment
Week 10: 1 August - 5 August	Lecture	Microwave active devices

Resources

Prescribed Resources

Textbooks

Prescribed textbook

- D. Pozar – Microwave Engineering, John Wiley, 4th Ed. 2012.
- R. Collin – Foundations of Microwave Engineering, Mc Graw Hill, 2nd Ed 2006.

Recommended Resources

Reference books

- D. Pozar, Microwave an RF Design of Wireless Systems, John Wiley, 4rd Ed. 2013.
- R.S. Elliott, Guided Waves and Microwave Circuits, Prentice Hall, 1999.
- D. K. Cheng, Field and Wave Electromagnetics, Addison Wesley, 2nd Ed., 1992.
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On-line resources

- Moodle

  As a part of the teaching component, Moodle will be used to disseminate teaching materials, host forums and occasionally quizzes. Assessment marks will also be made available via Moodle: https://moodle.telt.unsw.edu.au/login/index.php.

  A.S. Sedra and K.C. Smith, Microelectronic Circuits, Oxford University Press, 7th Ed., 2010.

Course Evaluation and Development

Continual Course Improvement

This course is under constant revision in order to improve the learning outcomes for all students. Please forward any feedback (positive or negative) on the course to the course convener or via the online student survey myExperience. You can also provide feedback to ELSOC who will raise your concerns at student focus group meetings. As a result of previous feedback obtained for this course and in our efforts to provide a rich and meaningful learning experience, we have continued to evaluate and modify our delivery and assessment methods.

In 2018, a few students expressed interest in visiting the antenna range testing facilities and the Giga-Hertz laboratory from CSIRO. In response to this request, two visits to these facilities at CSIRO were organized to.in 2019.

Laboratory Workshop Information

TBA

Academic Honesty and Plagiarism

Academic Honesty and Plagiarism

Plagiarism is the unacknowledged use of other people's work, including the copying of assignment works and laboratory results from other students. Plagiarism is considered a form of academic misconduct, and the University has very strict rules that include some severe penalties. For UNSW policies, penalties and information to help you avoid plagiarism, see https://student.unsw.edu.au/plagiarism. To find out if you understand plagiarism correctly, try this short quiz: https://student.unsw.edu.au/plagiarism-quiz.

General Conduct and Behaviour

Consideration and respect for the needs of your fellow students and teaching staff is an expectation. Conduct which unduly disrupts or interferes with a class is not acceptable and students may be asked to leave the class.

Academic Information

COVID19 - Important Health Related Notice

Your health and the health of those in your class is critically important. You must stay at home if you are sick or have been advised to self-isolate by NSW health or government authorities. Current alerts and a list of hotspots can be found here. **You will not be penalised for missing a face-to-face activity due to illness or a requirement to self-isolate**. We will work with you to ensure continuity of learning during your isolation and have plans in place for you to catch up on any content or learning activities you may miss. Where this might not be possible, an application for fee remission may be discussed.

If you are required to self-isolate and/or need emotional or financial support, please contact the Nucleus: Student Hub. If you are unable to complete an assessment, or attend a class with an attendance or participation requirement, please let your teacher know and apply for special consideration through the Special Consideration portal. To advise the University of a positive COVID-19 test result or if you suspect you have COVID-19 and are being tested, please fill in this form.

UNSW requires all staff and students to follow NSW Health advice. Any failure to act in accordance with that advice may amount to a breach of the Student Code of Conduct. Please refer to the Safe Return to Campus guide for students for more information on safe practices.

Dates to note

Important Dates available at: https://student.unsw.edu.au/dates

Student Responsibilities and Conduct

Students are expected to be familiar with and adhere to all UNSW policies (see https://student.unsw.edu.au/policy), and particular attention is drawn to the following:

Workload

It is expected that you will spend at least **15 hours per week** studying a 6 UoC course, from Week 1 until the final assessment, including both formal classes and *independent, self-directed study*. In periods where you need to complete assignments or prepare for examinations, the workload may be greater. Over-commitment has been a common source of failure for many students. You should take the required workload into account when planning how to balance study with employment and other activities.

Attendance

Regular and punctual attendance at all classes is expected. UNSW regulations state that if students attend less than 80% of scheduled classes they may be refused final assessment.

Work Health and Safety

UNSW policy requires each person to work safely and responsibly, in order to avoid personal injury and to protect the safety of others.

Special Consideration and Supplementary Examinations

You must submit all assignments and attend all examinations scheduled for your course. You can apply for special consideration when illness or other circumstances beyond your control interfere with an assessment performance. If you need to submit an application for special consideration for an exam or assessment, you must submit the application **prior to the start** of the exam or before the assessment is submitted, except where illness or misadventure prevent you from doing so. Be aware of the "fit to sit/submit" rule which means that if you sit an exam or submit an assignment, you are declaring yourself well enough to do so and cannot later apply for Special Consideration. For more information and how to apply, see https://student.unsw.edu.au/special-consideration.

Administrative Matters

On issues and procedures regarding such matters as special needs, equity and diversity, occupational health and safety, enrolment, rights, and general expectations of students, please refer to the School and UNSW policies:

https://student.unsw.edu.au/guide

https://www.engineering.unsw.edu.au/electrical-engineering/resources

Disclaimer

This Course Outline sets out description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline (as updated in Moodle), the description in the Course Outline/Moodle applies:

Image Credit

Synergies in Sound 2016

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	✓
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	✓
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	✓
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	✓
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	✓
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	✓
PE2.2 Fluent application of engineering techniques, tools and resources	✓
PE2.3 Application of systematic engineering synthesis and design processes	✓
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	
PE3.2 Effective oral and written communication in professional and lay domains	✓
PE3.3 Creative, innovative and pro-active demeanour	✓
PE3.4 Professional use and management of information	
PE3.5 Orderly management of self, and professional conduct	✓
PE3.6 Effective team membership and team leadership	✓