UNSW Course Outline

TELE9755 Microwave Circuits, Theory and Techniques - 2024

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General Course Information

Course Code : TELE9755
Year : 2024
Term : Term 3
Teaching Period : T3
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Electrical Engineering & Telecommunications
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Postgraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

Wireless communication is one of the fast-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 systems. 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 Aims

The completion of the course should provide students:

- A step forward from the general electrical engineering and electromagnetics principles to the high-frequency electronic components for communications applications
- Understanding elementary and specific concepts of microwave components and their analysis, which will lead to an understanding of the world of high-frequency circuits
- Critical concepts in microwave engineering background essential to modern wireless communication system operation
- Necessary skills and training applicable in the wireless industry

Relationship to Other Courses

Electromagentic theory is the backgournd for this course. Wireless communications relay on the harware presented in his course. The next more advanced knowledge is presented in RF Integraged circuits course.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Recognise the limitations of conventional low frequency lumped-element circuits versus distributed circuits.
CLO2 : Explain the advantages and disadvantages of current microwave technologies.
CLO3 : Review concepts and principles of microwave and millimetre-wave devices and evaluate their characteristic performance.
CLO4 : Design and construct microwave components and systems.

Course Learning Outcomes	Assessment Item
CLO1 : Recognise the limitations of conventional low frequency lumped-element circuits versus distributed circuits.	• Mid-Term Exam • Assignment • Final Examination
CLO2 : Explain the advantages and disadvantages of current microwave technologies.	• Mid-Term Exam • Assignment • Final Examination
CLO3 : Review concepts and principles of microwave and millimetre-wave devices and evaluate their characteristic performance.	• Mid-Term Exam • Assignment • Final Examination
CLO4 : Design and construct microwave components and systems.	• Mid-Term Exam • Assignment • Final Examination

Learning and Teaching Technologies

Moodle - Learning Management System

Learning and Teaching in this course

Lectures notes and tutorial questions appear on Moodle afer the class presentations including the solutions to problems.

Problems are discussed in class and the students are encouraged to activly participate during the tutorials wither communicating with the lecurer and /or their colleagues.

Other Professional Outcomes

Relationship to Engineers Australia Stage 1 competencies:

The Course Learning Outcomes (LOs) contribute to the Engineers Australia (National Accreditation Body) Stage I competencies as outlined below

Engineers Australia (EA), Professional Engineer Stage 1 Competencies

PE1: Knowledge and Skill Base:

PE1.1 Comprehensive, theory-based **understanding of underpinning fundamentals**: LO 1, 2, 3, 4

PE1.2 Conceptual understanding of underpinning maths, **analysis**, statistics, **computing**: LO 1, 2, 3, 4

PE1.3 In-depth understanding of specialist bodies of **knowledge**: LO 1, 2, 3, 4

PE1.4 Discernment of knowledge development and research directions: NA
PE1.5 Knowledge of **engineering design** practice: LO 1, 2, 3, 4, 5
PE1.6 Understanding of the scope, principles, norms, and accountabilities of sustainable engineering practice: NA

PE2: Engineering Application Ability:
PE2.1 Application of established engineering methods to **complex problem solving**: LO 2, 3, 4
PE2.2 Fluent **application of engineering techniques**, tools and resources: LO 1, 2, 3, 4
PE2.3 Application of systematic engineering synthesis and design processes: NA
PE2.4 Application of systematic approaches to the conduct and management of engineering projects: NA

PE3: Professional and Personal Attributes:
PE3.1 Ethical conduct and professional accountability: LO 4
PE3.2 Effective **oral and written communication** (professional and lay domains): LO 4
PE3.3 **Creative, innovative** and pro-active demeanour: LO 3, 4
PE3.4 Professional use and management of information: NA
PE3.5 Orderly management of **self, and professional conduct**: LO 4
PE3.6 Effective team membership and team leadership: NA

This course is also designed to provide the course learning outcomes which arise from targeted graduate capabilities. The targeted graduate capabilities broadly support the UNSW and Faculty of Engineering graduate capabilities (also listed below).

Targeted Graduate Capabilities

Electrical Engineering and Telecommunications programs are designed to address the following targeted capabilities which were developed by the school in conjunction with the requirements of professional and industry bodies:

- The ability to apply knowledge of basic science and fundamental technologies;
- The skills to communicate effectively, not only with engineers but also with the wider community;
- The capability to undertake challenging analysis and design problems and find optimal solutions;
- Expertise in decomposing a problem into its constituent parts, and in defining the scope of each part;
- A working knowledge of how to locate required information and use information resources to their maximum advantage;

- Proficiency in developing and implementing project plans, investigating alternative solutions, and critically evaluating differing strategies;
- An understanding of the social, cultural and global responsibilities of the professional engineer;
- The ability to work effectively as an individual or in a team;
- An understanding of professional and ethical responsibilities;
- The ability to engage in lifelong independent and reflective learning

UNSW Graduate Capabilities

The course delivery methods and course content directly or indirectly addresses a number of core UNSW graduate capabilities, as follows:

- Developing scholars who have a deep understanding of their discipline, through lectures and solution of analytical problems in tutorials and assessed by assignments and written examinations.
- Developing rigorous analysis, critique, and reflection, and ability to apply knowledge and skills to solving problems. These will be achieved by the laboratory experiments and interactive checkpoint assessments and lab exams during the labs.
- Developing capable independent and collaborative enquiry, through a series of tutorials spanning the duration of the course.
- Developing independent, self-directed professionals who are enterprising, innovative, creative and responsive to change, through challenging design and project tasks.
- Developing citizens who can apply their discipline in other contexts, are culturally aware and environmentally responsible, through interdisciplinary tasks, seminars and group activities

Additional Course Information

Electromatic engineering and circuit analysis year 2 and 3 core subjects are pre-requisite

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Mid-Term Exam Assessment Format: Individual	20%	Start Date: 09/10/2024 01:05 PM Due Date: Not Applicable
Assignment Assessment Format: Individual	20%	Start Date: 30/10/2024 01:05 PM Due Date: 30/10/2024 02:00 PM
Final Examination Assessment Format: Individual	60%	Start Date: not known yet

Assessment Details

Mid-Term Exam

Assessment Overview

The one-hour mid-term examination tests your general understanding of the course material up to week 5. It is designed to give you feedback on your progress through the analytical components of the course. Questions may be drawn from any material already covered in the course schedule. Marks will be assigned according to the correctness of the responses. Feedback will be provided via an exam review session and the exam will be solved and discussed in detail in a tutorial session.

Course Learning Outcomes

- CLO1 : Recognise the limitations of conventional low frequency lumped-element circuits versus distributed circuits.
- CLO2 : Explain the advantages and disadvantages of current microwave technologies.
- CLO3 : Review concepts and principles of microwave and millimetre-wave devices and evaluate their characteristic performance.
- CLO4 : Design and construct microwave components and systems.

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

Not Applicable

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.
For more information on Generative AI and permitted use please see here.

Assignment

Assessment Overview

The assignment is a self-directed study targeting a technology that has an impact on microwave engineering and is useful for professionals in the field. It is anticipated that students will need to commit about 12 hours of their time to this assessment and deliver a written report summarising their findings Marking will be based on a rubric with feedback provided within two weeks after the submission due date.

Course Learning Outcomes

- CLO1 : Recognise the limitations of conventional low frequency lumped-element circuits

versus distributed circuits.
- CLO2 : Explain the advantages and disadvantages of current microwave technologies.
- CLO3 : Review concepts and principles of microwave and millimetre-wave devices and evaluate their characteristic performance.
- CLO4 : Design and construct microwave components and systems.

Detailed Assessment Description

The students must deliver their findings in an in-class test on a topic selected from a few relevant pre-announced topics.

Assessment Length

1 hour

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

Not Applicable

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.
For more information on Generative AI and permitted use please see here.

Final Examination

Assessment Overview

The two-hour final examination tests analytical and critical thinking and general understanding of the course material. Questions may be drawn from any aspect of the course that has been presented in lectures, workshops and/or laboratories, unless specifically indicated otherwise by the lecturer. Marks will be assigned according to the correctness of the responses.

Course Learning Outcomes

- CLO1 : Recognise the limitations of conventional low frequency lumped-element circuits versus distributed circuits.
- CLO2 : Explain the advantages and disadvantages of current microwave technologies.
- CLO3 : Review concepts and principles of microwave and millimetre-wave devices and evaluate their characteristic performance.
- CLO4 : Design and construct microwave components and systems.

Assessment Length

2 hours

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

Not Applicable

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.
For more information on Generative AI and permitted use please see here.

General Assessment Information

The results in the students assessments will be discused with each student who wishes to see their work.

Grading Basis

Standard

Requirements to pass course

The students must achieve a total 50 marksin all activities to pass this course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 0 : 2 September - 8 September	Reading	
Week 1 : 9 September - 15 September	Lecture	Class administration issues. Introduction and recapitulations of fundamental concepts.
Week 2 : 16 September - 22 September	Lecture	Theoretical background of microwave networks.
Week 3 : 23 September - 29 September	Lecture	Theoretical background of microwave networks.
Week 4 : 30 September - 6 October	Lecture	Theoretical backgound. Current microwave technologies.
Week 5 : 7 October - 13 October	Blended	Midterm test. Microwave components.
Week 6 : 14 October - 20 October	Presentation	Flexibility week. Optional experiement.
Week 7 : 21 October - 27 October	Lecture	Microwave passive and active devices.
Week 8 : 28 October - 3 November	Lecture	Microwave passive and active devices.
Week 9 : 4 November - 10 November	Lecture	Microwave passive and active devices.
Week 10 : 11 November - 17 November	Lecture	Microwave passive and active devices.

Attendance Requirements

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

General Schedule Information

The course will run for ten weeks and will consist of lecture presentations and interleaved tutorials.

Course Resources

Prescribed Resources

Textbook: "Microwave Engineering" , David Pozar, John Wiley G. 4th Ed 2014.

Recommended Resources

- “Foundation of Microwave Engineering”, Robert E. Collins, 2nd Ed., Mc Graw Hill 2000,
- “Microwave Transistor Amplifiers”, G. Gonzalez, 3rd Ed., Prentice Hall 2007,
- “RF Design Guide: Systems, Circuits and Equations”, Peter Vitzmuller, 1995,
- “Computer-Aided Design of Microwave Circuits”, K.C. Gupta, R. Garg, R. Chadha, Artech House 1981,
- “RF Circuit Design”, C. Bowick, C. Ajluni, J. Blyler –, 2nd Ed. 2007,

Additional Costs

There are no additional costs for this class.

Course Evaluation and Development

Stuents in this class expressed thier wish to have access to facilities that provide research activities in microwave communications.

To increase the students interest in the class topic and improve their learning experience, we organised visits to CSIRO, ANFF and MMM laboratoires.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Rodica Ramer		EE&T lv 3 room 308	0293854759	Wednesday 4:00pm - 5:00 pm	Yes	Yes

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: https://www.unsw.edu.au/engineering/student-life/student-resources/program-design.

Note: This course outline sets out the 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 or your primary learning management system (LMS) 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/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, 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

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)

School-specific Information

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.

Use of AI for assessments

Your work must be your own. If you use AI in the writing of your assessment, you must acknowledge this and your submission must be substantially your own work. More information can be found on this website.

Workplace Health & Safety (WHS)

WHS for students and staff is of utmost priority. Most courses involve laboratory work. You must follow the rules about conduct in the laboratory. About COVID-19, advice can be found on this website.

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