



The University of Southern Queensland

Course specification

The current and official versions of the course specifications are available on the web at <http://www.usq.edu.au/coursespecification/current>.
Please consult the web for updates that may occur during the year.

Description: Fields and Waves

Subject	Cat-nbr	Class	Term	Mode	Units	Campus
ELE	4605	86315	1, 2009	EXT	1.00	Toowoomba

Academic group:	FOENS
Academic org:	FOES04
Student contribution band:	2
ASCED code:	031307

STAFFING

Examiner: Andrew Maxwell
Moderator: Nigel Hancock

REQUISITES

Pre-requisite: (MAT1502 and ELE2103 and ELE2601) or Students must be enrolled in the following Program: MEPR

OTHER REQUISITES

Recommended prior or concurrent study: MAT2500

SYNOPSIS

It is a common requirement of an electrical engineer to convey electrical energy from one place to another, whether for the purpose of power or information transport. A pair of conductors used for this purpose constitute a transmission line, and for any appreciable distance a.c. voltages and currents on the line must be regarded as a travelling wave - whether from a power station, in a radio receiver, or across a digital circuit board. The electric and magnetic fields associated with voltage and currents may be similarly propagated as a travelling wave; such fields also constitute the basis of electrical machines and are the cause of much unwanted interference. Therefore, an understanding of both wave propagation and electro- magnetic fields is essential in all branches of electrical engineering.

OBJECTIVES

The course objectives define the student learning outcomes for a course. The assessment item(s) that may be used to assess student achievement of an objective are shown in parenthesis. On completion of this course, students should be able to:

1. identify situations in which it is appropriate to use transmission line theory; (exam)
2. solve problems in transmission line theory; (test, exam)
3. design simple transmission line matching networks; (test, exam)
4. solve static field problems numerically; (assignment, exam)

5. deduce the properties of guided electromagnetic waves from Maxwells equations; (exam)
6. solve simple electromagnetic field problems analytically. (exam)

TOPICS

	Description	Weighting (%)
1.	Transmission Lines	50.00
	1.1. Distributed circuit theory.	
	1.2. Travelling waves.	
	1.3. Characteristic impedance.	
	1.4. High frequency solutions.	
	1.5. Practical transmission lines.	
	1.6. Attenuation, phase delay and phase velocity.	
	1.7. Reflections and standing waves.	
	1.8. Stub lines.	
	1.9. Transmission line measurements.	
	1.10. Impedance matching.	
	1.11. Pulse and step response of transmission lines.	
	1.12. Lattice diagrams.	
	1.13. Initial and final responses.	
	1.14. Surge impedance.	
	1.15. Practical applications.	
	1.16. Transmission line analysis of printed circuit board tracks and logic circuits.	

2.	Electromagnetic Theory	25.00
2.1.	Overview of electromagnetism.	
2.2.	Fields and the visualisation of flux, div. and curl.	
2.3.	The Electrostatic Field.	
2.4.	Coulomb's Law.	
2.5.	Electric flux density and Gauss' Law.	
2.6.	Potential.	
2.7.	Laplace's Equation and two dimensional solution, numerical methods.	
2.8.	Capacitance.	
2.9.	Current.	
2.10.	Resistivity and resistance of materials.	
2.11.	The Magnetostatic Field; Ampere's Law.	
2.12.	Magnetic flux density.	
2.13.	Faraday's Law and electromagnetic induction.	
2.14.	Maxwell's Equations and displacement current.	

3. Electromagnetic Waves 25.00
- 3.1. Derivation from Maxwell's Equations.
 - 3.2. Velocity.
 - 3.3. Intrinsic impedance
 - 3.4. Visualisation.
 - 3.5. Energy density, power flow and the Poynting Vector.
 - 3.6. Electromagnetic waves in conducting media.
 - 3.7. Good conductors and the skin effect.
 - 3.8. Wave impedance.
 - 3.9. Guided electromagnetic waves.
 - 3.10. Boundary conditions.
 - 3.11. Waveguide propagation.
 - 3.12. Waveguide modes.
 - 3.13. The Waveguide Equation.
 - 3.14. Group and phase velocities.
 - 3.15. Guide wavelength.
 - 3.16. Impedances.
 - 3.17. Evanescent modes.

TEXT and MATERIALS required to be PURCHASED or ACCESSED

ALL textbooks and materials are available for purchase from USQ BOOKSHOP (unless otherwise stated). Orders may be placed via secure internet, free fax 1800642453, phone 07 46312742 (within Australia), or mail. Overseas students should fax +61 7 46311743, or phone +61 7 46312742. For costs, further details, and internet ordering, use the 'Textbook Search' facility at <http://bookshop.usq.edu.au> click 'Semester', then enter your 'Course Code' (no spaces).

Sadiku, MNO 2007, *Elements of electromagnetics*, 4th edn, Oxford University Press, New York.
(OR Krauss, JD & Fleisch, DA, 1999, *Electromagnetics with applications*, 5th edn., McGraw Hill, Boston (International Student Edition))

REFERENCE MATERIALS

Reference materials are materials that, if accessed by students, may improve their knowledge and understanding of the material in the course and enrich their learning experience.

Edminister, JA 1993, *Schaum's outline of electromagnetics*, 2nd edn, McGraw-Hill, New York.

Ramo, S et al 1994, *Fields and waves in communication electronics*, 3rd edn, Wiley, New York.

STUDENT WORKLOAD REQUIREMENTS

ACTIVITY	HOURS
Assessments	4.00
Directed Study	85.00
Examinations	2.00
Private Study	54.00
Report Writing	10.00

ASSESSMENT DETAILS

Description	Marks out of	Wtg (%)	Due date
ASSIGNMENT 1	200.00	20.00	28 Apr 2009
ASSIGNMENT 2	200.00	20.00	12 Jun 2009
2 HOUR CLOSED EXAMINATION	600.00	60.00	END S1 (see note 1)

NOTES

1. Student Administration will advise students of the dates of their examinations during the semester.

IMPORTANT ASSESSMENT INFORMATION

- 1 Attendance requirements:
There are no attendance requirements for this course. However, it is the students' responsibility to study all material provided to them or required to be accessed by them to maximise their chance of meeting the objectives of the course and to be informed of course-related activities and administration.
- 2 Requirements for students to complete each assessment item satisfactorily:
To satisfactorily complete an assessment item a student must achieve at least 50% of the marks or a grade of at least C-. Students do not have to satisfactorily complete each assessment item to be awarded a passing grade in this course. Refer to Statement 4 below for the requirements to receive a passing grade in this course.
- 3 Penalties for late submission of required work:
If students submit assignments after the due date without extenuating circumstances then a penalty of 5% of the assigned mark may apply for each working day late up to a maximum of ten working days at which time a mark of zero can be recorded for that assignment.
- 4 Requirements for student to be awarded a passing grade in the course:
To be assured of receiving a passing grade in a course a student must obtain at least 50% of the total weighted marks for the course.
- 5 Method used to combine assessment results to attain final grade:
The final grades for students will be assigned on the basis of the weighted aggregate of the marks (or grades) obtained for each of the summative assessment items in the course.
- 6 Examination information:

- In a Closed Examination, candidates are allowed to bring only writing and drawing instruments into the examination.
- 7 Examination period when Deferred/Supplementary examinations will be held:
Any Deferred or Supplementary examinations for this course will be held during the examination period at the end of the semester of the next offering of this course.
 - 8 University Regulations:
Students should read USQ Regulations 5.1 Definitions, 5.6. Assessment, and 5.10 Academic Misconduct for further information and to avoid actions which might contravene University Regulations. These regulations can be found at the URL <http://www.usq.edu.au/corporateservices/calendar/part5.htm> or in the current USQ Handbook.

ASSESSMENT NOTES

- 1 The due date for an assignment is the date by which a student must despatch the assignment to the USQ. The onus is on the student to provide proof of the despatch date, if requested by the Examiner.
- 2 Students must retain a copy of each item submitted for assessment. This must be produced within five days if required by the Examiner.
- 3 In accordance with University's Assignment Extension Policy (Regulation 5.6.1), the examiner of a course may grant an extension of the due date of an assignment in extenuating circumstances.
- 4 The Faculty will normally only accept assessments that have been written, typed or printed on paper-based media.
- 5 The Faculty will NOT accept submission of assignments by facsimile.
- 6 Students who do not have regular access to postal services or who are otherwise disadvantaged by these regulations may be given special consideration. They should contact the examiner of the course to negotiate such special arrangements.
- 7 In the event that a due date for an assignment falls on a local public holiday in their area, such as a Show holiday, the due date for the assignment will be the next day. Students are to note on the assignment cover the date of the public holiday for the Examiner's convenience.
- 8 Students who have undertaken all of the required assessments in a course but who have failed to meet some of the specified objectives of a course within the normally prescribed time may be awarded one of the temporary grades: IM (Incomplete - Make up), IS (Incomplete - Supplementary Examination) or ISM (Incomplete -Supplementary Examination and Make up). A temporary grade will only be awarded when, in the opinion of the examiner, a student will be able to achieve the remaining objectives of the course after a period of non directed personal study.
- 9 Students who, for medical, family/personal, or employment-related reasons, are unable to complete an assignment or to sit for an examination at the scheduled time may apply to defer an assessment in a course. Such a request must be accompanied by appropriate supporting documentation. One of the following temporary grades may be awarded IDS (Incomplete - Deferred Examination; IDM (Incomplete Deferred Make-up); IDB (Incomplete - Both Deferred Examination and Deferred Make-up).