COURSE OUTLINE

2301BPS
Electromagnetism & Optics

Semester 1 2009

Academic Organisation:	School of Biomolecular and Physical Sciences
Faculty:	Science, Environment, Engineering and Technology
Credit point value:	10
Student Contribution Band:	Band 2
Course level:	Undergraduate
Campus/Location/Learning Mode:	Nathan / On Campus / In Person
Convenor/s:	Dr Robert Sang (Nathan)
Enrolment Restrictions:	Nil
This document was last updated:	2 February 2009

BRIEF COURSE DESCRIPTION

This course is divided into two components. The first component is basic electromagnetism: the laws of electrostatics, magnetostatics and electromagnetism are generated from experimental observations leading to the derivation of Maxwell's equations in both vacuum and media. The propagation of electromagnetic waves in various media is studied. The second component of the course gives a general coverage of physical optics, introduction to light as an electromagnetic wave, the properties of such waves and their interaction with material media. This treatment is developed to cover the behaviour of light at interfaces (reflection and refraction, Fresnel equations), interference, coherence properties of light, diffraction, Fourier optics and image formation.

Prior-Assumed: 1301BPS Physics A or equivalent AND 1306BPS Physics B or equivalent, 1201BPS Mathematics IA or equivalent AND 1210BPS Mathematics IB or equivalent

Concurrent Assumed: 2203BPS Vector Calculus

SECTION A – TEACHING, LEARNING AND ASSESSMENT

COURSE AIMS

This course is divided into two components. The first component is basic electromagnetism: the laws of electrostatics, magnetostatics and electromagnetism are generated from experimental observations leading to the derivation of Maxwell's equations in both vacuum and media. The propagation of electromagnetic waves in various media is studied. The second component of the course gives a general coverage of physical optics comprising of an introduction to light as an electromagnetic wave, the properties of such waves and their interaction with material media. This section of the course covers; the behaviour of light at interfaces (reflection and refraction, Fresnel equations), interference, diffraction and coherence properties of light, Fourier optics and image formation.

LEARNING OUTCOMES

The content of the course will provide a fundamental understanding of concepts in electromagnetism and optics and a framework for the application of techniques for solving associated physical problems. These techniques will further enhance problem solving skills.

CONTENT, ORGANISATION AND TEACHING STRATEGIES

Lectures: 3 one hour lectures per week
Tutorials: 1 per week as required

CONTENT SUMMARY

The content of the course is as follows:

- Electrostatics: charge, force, electric field, equation of continuity, Gauss's Law, scalar potential, electric dipole, second Maxwell's Equation, equations of Poisson and Laplace, energy stored in the field, capacitance.
- Magnetostatics: force between two currents, Biot-Savart Law, magnetic flux, Ampère's Law, solenoid, vector potential, magnetic dipole.
- Electromagnetic Induction: e.m.f., Lenz's Law, Faraday's Law, self and mutual induction, energy stored in magnetic field, displacement current, Maxwell's Equations in vacuum.
- Electromagnetic Radiation: wave equation, plane wave solution, Poynting Vector.
- Properties of Matter: conduction, dielectric polarisation, displacement field, electric susceptibility, magnetisation, magnetic field intensity, magnetic susceptibility, Maxwell's Equations in matter, static boundary conditions.
- Laws of reflection and refraction: from Fermat's principle, from EM approach
- Fresnel equations - derivation
- Applications of Fresnel equations: normal incidence, total internal reflection, evanescent waves, Brewster's angle, reflection and refraction at the surface of a good conductor.
- Interference: vector superposition of fields, light wave interference (Young's double slit, Michelson interferometer), theory of partial coherence (visibility of fringes), coherence considerations (longitudinal coherence, spatial coherence)
- Diffraction: Kirchhoff scalar diffraction theory, Kirchhoff integral theorem (KIT), Babinet's principle, application of KIT to Fraunhofer diffraction (single slit, rectangular aperture, double slit, grating, resolving power of grating)

- Fourier optics: review of Fourier series and transforms, convolution, including graphical methods, relationship between Fourier transforms and diffraction patterns, Abbe's theory of image formation, spatial filtering

The course timetable[#] is as follows:

Week	Lecturer	Lecture Content	Tutorial
1	Dr Webb	Electrostatics	No tutorial
2	Dr Webb	Electrostatics	Electrostatics
3	Dr Webb	Electrostatics	Electrostatics
4	Assoc. Prof Sang	Magnetostatics	No tutorial
5	Assoc. Prof Sang	Magnetostatics/Time Varying EM	Magnetostatics
6	Assoc. Prof Sang	Time Varying EM	Time Varying EM
7		No Lectures	No Lectures
8	Dr Sun	Optical propagation	Optical propagation
9	Dr Sun	Optical propagation	Optical propagation
10	Dr Sun	Interference	Interference
11	Dr Weinhold	Diffraction	Diffraction
12	Dr Weinhold	Diffraction	Diffraction
13	All Lectuers	Revision	

Note that this timetable is indicative only and may change subject to the progression of the lectures.

ASSESSMENT

Item	Assessment Task	Weighting	Total Marks	Relevant Learning Outcomes	Due Day and Time
1.	4 x Assignments	40% (10% each)	40	1,2,3	Friday 5pm Weeks 4, 7, 10, 13
2	End-of-Semester exam (2 hour)	60%	60	1,2,3	Week 15 or 16

Assessment Details

Assessment is based on four assignments and an end-of-semester exam. This allows students time to assimilate more completely the conceptually and intellectually demanding material presented in this subject.

Return of Assessment Items

Assignment results will be available 2 weeks after the due date, final results will posted in the usual manner.

Notification of Availability of Feedback on Assessment

Feedback on assignments is available by directly contacting the teaching team member giving the assignment and feedback on the exam is available through the Convenor of the course.

GRADUATE SKILLS

Graduate Skills	Taught	Practised	Assessed
Effective communication (written)	☐	☒	☒
Effective communication (oral)	☐	☐	☐
Effective communication (interpersonal)	☐	☐	☐
Information literacy	☐	☒	☐
Problem solving	☒	☒	☒
Critical evaluation	☒	☒	☒
Work autonomously	☐	☒	☒
Work in teams	☐	☒	☐
Creativity and innovation	☐	☐	☐
Ethical behaviour in social / professional / work environments	☐	☐	☐
Responsible, effective citizenship	☐	☐	☐

TEACHING TEAM

Convenor Details	Nathan
Campus Convenor and Lecturer (Magnetostatics, Dynamical EM)	Associate Professor Robert Sang
Email	R.Sang@griffith.edu.au
Office Location	N34_0.29
Phone	(07) 373 53848
Fax	(07) 373 54426
Consultation times	Students may consult with the Convenor during normal office hours or by email

Additional teaching team members

Teaching Team Details	Nathan
Lecturer (Electrostatics)	Dr Jim Webb
Email	J.Webb@griffith.edu.au
Office Location	N25_ 2.14
Phone	(07) 373 55023
Fax	(07) 373 57656
Consultation times	Students may consult with the teaching team during normal office hours or by email

Teaching Team Details	Nathan
Lecturer (Optics & Interference)	Dr He-Bi Sun
Email	H.Sun@griffith.edu.au
Office Location	N34_ 0.15
Phone	(07) 373 55048
Fax	(07) 373 57656
Consultation times	Students may consult with the teaching team during normal office hours or by email

Teaching Team Details	Nathan
Lecturer (Diffraction)	Dr Till Weinhold
Email	t.weinhold@griffith.edu.au
Office Location	N34_ -1.30
Phone	(07) 373 54401
Fax	(07) 373 54426
Consultation times	Students may consult with the teaching team during normal office hours or by email

COURSE COMMUNICATIONS

Students may communicate to the Convenor and teaching team members via email or in person. Formal communications will be through email and the Learning@Griffith website. Students should check the notice section at least once a week for any important notices.

TEXTS AND SUPPORTING MATERIALS

Course notes and tutorials will be given on the Learning@Griffith website.

Recommended Reading

Text Book:s

Field and Wave Electromagnetics (Second Edition) by David K. Cheng (ISBN:0-201-52820-7)

Optics (second edition) by Eugene Hecht (ISBN:0-201-11611-1).

SECTION B – ADDITIONAL COURSE INFORMATION

Nil

SECTION C – KEY UNIVERSITY INFORMATION

ACADEMIC MISCONDUCT

Students must conduct their studies at the University honestly, ethically and in accordance with accepted standards of academic conduct. Any form of academic conduct that is contrary to these standards is academic misconduct and is unacceptable.

Some students engage deliberately in academic misconduct, with intent to deceive. This conscious, pre-mediated form of cheating is one of the worst forms of fraudulent academic behaviour, for which the University has zero tolerance and for which penalties, including exclusion from the University, will be applied.

However the University recognises many students commit academic misconduct without intent to deceive. These students may be required to undertake additional educational activities to remediate their behaviour.

Specifically it is academic misconduct for a student to:

- ***Cheat in examinations and tests*** by communicating, or attempting to communicate, with a fellow individual who is neither an invigilator or member of staff; by copying, or attempting to copy from a fellow candidate; attempting to introduce or consult during the examination, any unauthorised printed or written material, or electronic calculating or information storage device; or mobile phones or other communication device, or impersonates another.

- ***Fabricate results*** by claiming to have carried out tests, experiments or observations that have not taken place or by presenting results not supported by the evidence with the object of obtaining an unfair advantage.

- ***Misrepresent themselves*** by presenting an untrue statement or not disclosing where there is a duty to disclose in order to create a false appearance or identity.

- ***Plagiarise*** by representing the work of another as their own original work, without appropriate acknowledgement of the author or the source. This category of cheating includes the following:

1. collusion, where a piece of work prepared by a group is represented as if it were the student's own;
2. acquiring or commissioning a piece of work, which is not his/her own and representing it as if it were, by
    - purchasing a paper from a commercial service, including internet sites, whether pre-written or specially prepared for the student concerned
    - submitting a paper written by another person, either by a fellow student or a person who is not a member of the University;
3. duplication of the same or almost identical work for more than one assessment item;
4. copying ideas, concepts, research data, images, sounds or text;
5. paraphrasing a paper from a source text, whether in manuscript, printed or electronic form, without appropriate acknowledgement;
6. cutting or pasting statements from multiple sources or piecing together work of others and representing them as original work;
7. submitting, as one own work, all or part of another student's work, even with the student's knowledge or consent.

A student who willingly assists another student to plagiarise (for example by willingly giving them their own work to copy from) is also breaching academic integrity, and may be subject to disciplinary action.

Visit the University's Institutional Framework for Promoting Academic Integrity Among Students for further details.

PLAGIARISM DETECTION SOFTWARE

The University uses plagiarism detection software. Students should be aware that your Course Convenor may use this software to check submitted assignments. If this is the case your Course Convenor will provide more detailed information about how the detection software will be used for individual assessment items.

HEALTH AND SAFETY

Griffith University is committed to providing a safe work and study environment, however all students, staff and visitors have an obligation to ensure the safety of themselves and those whose safety may be affected by their actions. Staff in control of learning activities will ensure as far as reasonably practical, that those activities are safe and that all safety obligations are being met. Students are required to comply with all safety instructions and are requested to report safety concerns to the University.

General health and safety information can be obtained from http://www.griffith.edu.au/hrm/health_and_safety/

Information about Laboratory safety can be obtained from
http://www.griffith.edu.au/ots/secure/health/content_labsafety.html

KEY STUDENT-RELATED POLICIES

All University policy documents are accessible to students via the University's Policy Library website at: www.griffith.edu.au/policylibrary. Links to key policy documents are included below for easy reference:

- *Academic Calendar*
- *Academic Standing, Progression and Exclusion Policy*
- *Assessment Policy*
- *Examinations Timetabling Policy and Procedures*
- *Guideline on Student E-Mail*
- *Health and Safety Policy*
- *Institutional Framework for Promoting Academic Integrity Among Students*
- *Policy on Student Grievances and Appeals*
- *Student Administration Policy*
- *Student Charter*

UNIVERSITY SUPPORT RESOURCES

The University provides many facilities and support services to assist students in their studies. Links to information about University support resources available to students are included below for easy reference:

Learning Centres - the University provides access to common use computing facilities for educational purposes. For details visit www.griffith.edu.au/cuse

Learning@Griffith - there is a dedicated website for this course via the Learning@Griffith student portal.

Student Services facilitate student access to and success at their academic studies. Student Services includes: Careers and Employment Service; Chaplaincy; Counselling Service; Health Service; Student Equity Services (incorporating the Disabilities Service); and the Welfare Office.

Learning Services within the Division of Information Services provides learning support in three skill areas: computing skills; library skills; and academic skills. The study skills resources on the website include self-help tasks focusing on critical thinking, exam skills, note taking, preparing presentations, referencing, writing, proof reading, and time management.