

City University of Hong Kong

Information on a Course  
offered by Department of Electronic Engineering  
with effect from Semester A in 2011/2012

This form is for completion by the Course Co-ordinator/Examiner. The information provided on this form will be deemed to be the official record of the details of the course. It has multipurpose use: for the University's database, and for publishing in various University publications including the Blackboard, and documents for students and others as necessary.

Please refer to the Explanatory Notes attached to this Form on the various items of information required.

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**Part I**

Course Title:	Applied Electromagnetics in Electronic Design
Course Code:	EE5604
Course Duration:	One Semester (13 weeks)
No. of credits:	3
Level:	P5
Medium of Instruction:	English
Prerequisites ( <i>Course Code and Title</i> ):	Nil
Precursors ( <i>Course Code and Title</i> ):	EE2104 Introduction to Electromagnetics or EE3109 Applied Electromagnetics or equivalent
Equivalent Course ( <i>Course Code and Title</i> ):	Nil
Exclusive Courses: ( <i>Course Code and Title</i> ):	Nil

**Part II**

**1. Course Aims:**

The course aims to provide students with an understanding of the principles of *electromagnetic field theory*, with emphasis on some basic problem-solving techniques, leading to the solutions of more advance and practical electromagnetic problems in circuit or product design, commonly faced by electronic engineers in the industry.

**2. Course Intended Learning Outcomes (CILOs)**

Upon successful completion of this course, students should be able to:

No.	CILOs
1.	Apply the Maxwell's equations in solving quasi-static electromagnetic problems.
2.	Understand the Maxwell's equations, and the on-the-market EM field computation softwares.

3.	Apply EM field theories in solving some practical classical problems.
4.	Apply practical techniques for solving some industrial EM problems.

### 3. Teaching and learning Activities (TLAs)

CILO	Teaching and Learning Activities
1, 2, 3, 4	Lecture, tutorial, in-class exercise, self-study, case study and laboratory sessions.

#### Timetabling Information

Pattern	Hours
Lecture:	39
Tutorials:	
Laboratory:	
Other activities:	

\*Some of the lectures will be conducted in the laboratory.

### 4. Assessment Tasks/Activities

	Type of assessment tasks	Weighting (if applicable)
Continuous Assessment	Assignments, test, lab work and lab report	50%
Examination	Written exam	50% 2 hours

Remarks: To pass the course, students are required to achieve at least 30% in the examination and a minimum of 75% attendance in the laboratory.

### 5. Grading of Student Achievement: - Pls consider amending it according to the recommended sample attached.

Letter Grade	Grade Point	Grade Definitions
A+	4.3	Excellent
A	4.0	
A-	3.7	
B+	3.3	Good
B	3.0	
B-	2.7	
C+	2.3	Adequate
C	2.0	
C-	1.7	
D	1.0	Marginal
F	0.0	Failure

### 6. Constructive Alignment with Programme Outcomes

PILO	How the course contribute to the specific PILO(s)
1,2,3,4	The application of EM field to engineering problems is central to the aim of this course.
2,3,4,5	Students are required to complete an assignment/case study designed to gain practical hands-on experience on how computational

	electromagnetic field in some practical problems, including analytical approach using Maxwell's Equations and Wave equations, to the use of more advance commercial available EM simulation tools such as IE3D, Fidelity, and HFSS.
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### Part III

#### Keyword Syllabus:

##### Fundamental of Electromagnetic Field ( 5 weeks)

Revision and applications of Coulomb's law. Gauss's law. Ampere's law. Biot-Savart law. Maxwell's Equations. Wave propagation, Wave transmission and reflection.

Field evaluation of Static Electric field, Static Magnetic Field, and Quasi-Static Electromagnetic Field, Time varying Electromagnetic Field, Wave propagation, Wave transmission and reflection.

##### Common EM problems in electronic design industry. ( 2 weeks)

Mutual coupling in PCBs, Radiation problem in PCB, Coupling between equipments, Conduction and signal integrity problem in industry.

##### Numerical methods and tools for solving Electromagnetic Field problems ( 3 weeks)

Method of Moment, Finite-different method, Finite-Different-Time Domain Method, Finite-element method, Introduction to software IE3D, Fidelity, and HFSS.

##### EM techniques in solving industry EM problems ( 4 weeks)

Grounding, filtering, shielding, impedance matching, coupling in traces of PCB.

#### Related Links and References

- [Department of Electronic Engineering](#)
- <http://www.mentor.com/electromagnetic-simulation/>
- **“Fundamentals of Applied Electromagnetics”** by Fawwaz Ulaby, Prentice Hall
- **“Electromagnetics”** by John Kraus, McGraw Hill.

#### Examples of Case Studies :

1. Evaluation of L,R,C of traces of PCB –circuit modeling, using simple circuit equations for PCB design purpose.
2. Evaluation of mutual capacitance and mutual inductance of traces of PCB –circuit modeling, using simple circuit equations for cross talk, and cross coupling of digital PCB design purpose.
3. Comparison of analytical outcomes with Empirical equations, e.g. 3W rules, 10H rules of PCB designs.
4. Evaluation of shielding effectiveness of various materials using wave propagation equations.
5. Calculation of shielding effectiveness, of casing with aperture using simple numerical approach driving from *Possions'* Equations.
6. Evaluation of shielding effectiveness of electronic equipment casing with apertures, using commercial numerical soft ware.
7. Evaluation of shielding effectiveness ferrite magnetic materials in for magnetic field interferences at power frequency.
8. Evaluation of electric and/or magnetic emission of simple geometry using Maxwell's Equations.
9. Evaluation of emission characteristics of equipment commercial available numerical software to more complex geometry.
10. Evaluation of radiation patterns using commercial available numerical software to more complex geometries.

**Returned by:**

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