University of Macau

Faculty of Science and Technology

Department of Electrical and Electronics Engineering

Part A: Course Outline

Course Title:	**Applied Electromagnetism**		
Course Code:	ELEC240	Year of Study:	2
Course Mode:	Mainly Theoretical with some laboratory/ practice content		
Compulsory/Elective:	Compulsory		
Course Prerequisites:	Physics II		
Prerequisite Knowledge	Sound University Physics (especially EM portion) + Brief vector Calculus in 3D		
Class/Laboratory Schedule:	3 lecture hours, 2 hours tutorial/lab work per week		
Duration	One semester	Credit Units	4
Text Books and References:	Text: Fawwaz Ulaby "***Fundamentals of Applied Electromagnetics"*** 2007 Media Edition (or paper back 5th Ed. @2007), Pearson or Prentice-Hall Ref.: [1] D. K. Cheng, "*Fundamentals of Engineering Electromagnetics*," Addison-Wesle 0-201-56611-7) @1993 [2] R. DuBroff, S. Marshall & G. Skitek, "*Electromagnetic Concepts and Applications*," 5th Ed., Prentice-Hall @2000 or newer version [3] B.S. Guru and H.R. Hiziroqlu, "*Electromagnetic Field Theory Fundamentals*," Int'l Thomson Pub. (PWS division) 2nd Edition @2001 [4] **F. T. Ulaby workgroup** web-page: at http://www.eecs.umich.edu/emag/		
Course Description:	**Engineering Electromagnetics** is the application of the oldest EEE knowledge into engineering areas. As newer and advanced ICs (especially high speed & high frequency) evolve, the need of more accuracy on the calculation demand people looking back the fundamental EM principles.		
Topics Covered	1. Introduction to Why EM?, Wave & Phasor Notations Transmission Lines 2. Quick Review of Commonly used coordinates & Vector Analysis 3. Brief Electrostatic Fields Principle & Application Points with Dielectric Materials 4. Steady Electric Currents Principle & its implications 5. Brief Magneto-static Fields & Application Points with Magnetic Materials 6. Ferromagnetic Materials and Magnetic Circuits 7. Analytical, Numerical and Computational EM Techniques (elementary BVP, FDM, MOM) 8. Introduction to Transmission Lines		
Course Objectives:	1. To provide students with the elementary knowledge & techniques on **Basic Engineering Electromagnetics** [a, e, i]		

<table>
<tr><td></td><td>2. To relate the basic circuit parameters (R, L, C) in terms of fundamental EM point of view + related interesting applications [a, e, k]
3. To introduce Computational Electromagnetic techniques & demo/provide hands-on simulation practices on both Electromagnetism [b, d, e]</td></tr>
<tr><td>Course Assessment:</td><td>Pop Quizzes : 7%
HW Assignments: 18%
Simulation Projects and Experiments: 15%
Mid-term Exam. : 17%
Final Exam. : 43%</td></tr>
<tr><td>Relationship to Program Objectives and Outcomes</td><td>This course primarily contributes to EEE program outcomes that develop students abilities to:
a. Ability to apply knowledge of mathematics, science and engineering.
e. Ability to identify, formulate and solve engineering problems.
k. Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.
This course secondarily contributes to EEE program outcomes that develop students abilities to:
b. Ability to design and conduct experiments.
c. Ability to design a system, component or process to meet desired needs.
l. Ability to use the computer/IT tools relevant to the discipline along with an understanding of their processes and limitations</td></tr>
<tr><td>Course Contents and Relationship to Program Criteria:</td><td>
<table>
<tr><th>Week no.</th><th>Topics</th><th>Program Criteria</th></tr>
<tr><td>0.5</td><td>Why study EM and EM introduction</td><td>BS, ES</td></tr>
<tr><td>1.5</td><td>Quick Review of Commonly used coordinates & Vector Analysis</td><td>DIC, CS, LA</td></tr>
<tr><td>3</td><td>Brief Electrostatic Fields Principle & Application Points with Dielectric Materials</td><td>DIC, ES, CS, DE</td></tr>
<tr><td>2</td><td>Steady Electric Currents Principle & its implications</td><td>ES, DIC, BS</td></tr>
<tr><td>3</td><td>Brief Magneto-static Fields & Application Points with Magnetic Materials</td><td>DIC, ES, BS, DE</td></tr>
<tr><td>1</td><td>Ferromagnetic Materials & Magnetic Circuits</td><td>ES</td></tr>
<tr><td>2</td><td>Analytical, Numerical and Computational EM Techniques (elementary BVP, FDM, MOM)</td><td>DIC, ES, CS,</td></tr>
<tr><td>1</td><td>Basics of Transmission Lines</td><td>DIC, ES, CS,</td></tr>
</table>
</td></tr>
<tr><td>Contribution of Course to meet the professional</td><td>This course is continuation of EM Physics with emphasis on engineering applications/concepts that can be encounter in the arenas of Engineering Electromagntics (such as Lightning, etc.). Students should be able to apply knowledge of mathematics &</td></tr>
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component:	engineering, & identify formulas to solve practical EM engineering problems from basic science.
Course Instructor(s):	Dr. Mak, Peng Un, and/or et al.
Prepared by:	Dr. Mak, Peng Un

Part B: General Course Information and Policies

(2011 Spring) Instructor: Dr. Mak, Peng Un Phone: 4393 Office: N313
Class times & venue: TBA
Office Hour: TBA or by appointment
e-mail: fstpum@umac.mo Assignment E-turn-in email: maksirhandin@gmail.com
Our course supplementary page is http://eecl1.cl.eee.umac.mo/~fstpum/ (intranet only)
TA/GA: TBA **Office:** NG05 E-mail: TBA

Programme Educational Objectives

1. **Problem Solving:** Graduates have the ability to think in a critical and evaluative manner and to consider a broad perspective, in order to solve technical and nontechnical problems.
2. **Leadership and Communication:** Graduates will provide effective leadership, act in an ethical manner and skills will include the ability to communicate well and to work successfully within diverse groups.
3. **Market Acceptance:** Graduates will have successful careers in the academic environment, industrial and government organizations.
4. **Technical Competence:** Graduates will be technically competent and have a thorough grounding in the fundamentals of math and science in electrical and computer engineering and experience in engineering design. They will be able to use modern engineering techniques, skills, and tools to fulfill societal needs.

Scale: 1 (Highest) to 4 (Lowest)

	Problem Solving	**Leadership and Communication**	**Market Acceptance**	**Technical Competence**
Applied Electromagnetism	2	4	2	1

Remark:

- Objective for “Problem Solving” can be achieved by assignments, quizzes, mid-term exam, final exam and projects.
- Objective for “Leadership and Communication” can be achieved by report writing and presentation. However, leadership training is not formally given by this course.

- Objective for “Market Acceptance” can be achieved by the course subject that is related to basic EM knowledge applying into different EE careers.
- Objective for “Technical Competence” can be achieved by using fundamentals of math and science in electrical and computer engineering and experience in engineering HW, computer simulation and assignments.

Program Criteria Policy:

Course vs. Program Criteria

Scale: 1 (Highest) to 4 (Lowest)

Course	PS	DIC	BS	CS	ES	DE	LA	CV	DM
Applied Electromagnetism		2	2	3	1	2	4	4	

Terms:

Probability and Statistics (PS), Differential and Integral Calculus (DIC), Basic Science (BS), Computer Science (CS), Engineering Science (ES), Differential Equation (DE), Linear Algebra (LA), Complex Variables (CV), Discrete Mathematics (DM)

Program Outcome Policy:

Course vs. Course Outcomes

(H= Highly Related, S = Supportive, N = None)

Course	a	b	c	d	e	f	g	h	i	j	k	l
Applied Electromagnetism	H	S	S	S	H	N	N	S	N	S	H	S

The electrical and electronics engineering program outcomes are:

a. Ability to apply knowledge of mathematics, science and engineering.

b. Ability to design and conduct experiments.

c. Ability to design a system, component or process to meet desired needs.

d. Ability to function on multidisciplinary teams.

e. Ability to identify, formulate and solve engineering problems.

f. Understanding of professional and ethical responsibility.

g. Ability to communicate effectively.

h. Broad education necessary to understand the impact of engineering solutions in global and societal context.

i. Recognition of the need for and an ability to engage in life-long learning.

j. Knowledge of contemporary issues.

k. Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

l. Ability to use the computer/IT tools relevant to the discipline along with an understanding of their processes and limitations

Curriculum Detail:

ELEC 240 Applied Electromagnetism

Timetabled work in hours per week (on average)			**No of teaching weeks**	**Total hours**	**No /Duration of exam papers**	**Max marks available from:**	
Lecturer	**Tutor**	**Practice**				**Exams**	**Course**
3	1.5	0.5	14	70	2/4-4.5 hours	67	43

Term: 5th

Hours			**Percentage content of**					
Lecturer	Lab/tut	Other	Maths	Basic Science	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies
42	7/21	0	20	15	40	15	0	10

Design Elements

% of Design Content	**Design Content in Course Work**	**Design Project**	**Design Content in Laboratories**
15%	X	x	X

X: has some

Course Assessment Policy:

- Homework assignments will be given to students according to the course progress, no late homework is accepted. Zero mark will be given when homework is copied.
- A number of pop quizzes will be held during the semester randomly.
- Some experiments will be performed during the semester. 2 students form one group and group report should be handed in.
- Commercial simulation tools shall be used to perform engineering calculation with visualization
- 1 mid-term exam and 1 final exam will be performed with 1.5 hours and 3 hours respectively.
- If time is permitted, on-site visit to nearby company or facilities shall be arranged!