University of Macau
Faculty of Science and Technology
Department of Electrical and Computer Engineering

Part A: Course Outline

Course Title:	Propagation and Radiation		
Course Code:	ELEC 381	Year of Study:	3
Course Mode:	Mainly Theoretical with some laboratory/ practice content		
Compulsory/Elective:	Compulsory		
Course Prerequisites:	ELEC 240		
Prerequisite Knowledge	Basic Electromagnetism (Electrostatics & Magnetostatics) + Simple Differential Calculus in 3D		
Class/Laboratory Schedule:	4 lecture hours, 2 hours tutorial/lab work per week		
Duration	One semester	Credit Units	4.5
Text Books and References:	Text: Fawwaz Ulaby "***Fundamentals of Applied Electromagnetics***" 2006 Media Edition (paper back 5th Ed. @2007), Pearson or Prentice-Hall Ref.: [1] D. K. Cheng, "*Fundamentals of Engineering Electromagnetics*," Addison-Wesley (ISBN 0-201 @1993 [2] R. DuBroff, S. Marshall & G. Skitek, "*Electromagnetic Concepts and Applications*," 5th Ed., Prentice-Hall @2000 [3] Hayt & Buck, "Engineering Electromagnetics" 7th Ed., McGraw-Hill @2006 [4] **F. T. Ulaby workgroup** web-page: at http://www.eecs.umich.edu/emag/		
Course Description:	Propagation and Radiation are core subjects for Electrical, Electronics and Communication Engineering. They provide a basic knowledge of concept in electromagnetic propagation and conversion between localized electrical/electronic power and unbounded media radiations with health concerns		
Topics Covered	1. Continuity of Transmission Lines (from last semester ELEC240) 2. Time-varying Electromagnetic Fields and Maxwell's Equations 2a. Sample applications for EM 2b. EM in heating application (optional -- if time permitted) 3. Antennas and Simple Antenna Arrays 4. Analysis and Design of Linear Antennas: Short pole, dipoles, and etc. as illustrated examples 5. Skin Depth Effect and Plane Wave Propagation 6. Satellite Communication and Radar Systems		
Course Objectives:	1. To give students foundation principles on Time-varying Electromagnetic Fields [a, e, k] 2. To introduce students with basic engineering knowledge on *how electromagnetic signal/energy propagates* **(guided)** *and radiates* (**freely**) with exposure of some engineering applications [a, b, c, e, k]		
Course Assessment:	Pop Quizzes : 7% HWs : 20% Simulation Projects and Experiments: 12% Mid-term Exam. : 18%		

<table>
<tr><td></td><td>Final Exam. : 43%</td></tr>
<tr><td>Relationship to Program Objectives and Outcomes</td><td>This course primarily contributes to ECE 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 ECE 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.
d. Ability to function on multidisciplinary teams.</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>2</td><td>Continuity of Transmission Lines & its applications (such as TDR)</td><td>DIC, ES, CS</td></tr>
<tr><td>2.5</td><td>General EM Theory & Principles Time-varying Electromagnetic Fields and Maxwell’s Equations</td><td>DIC, ES, DE, CV, LA</td></tr>
<tr><td>5</td><td>Antennas and Antenna Arrays; Linear Antennas: Short pole, dipoles, and etc. as illustrated examples</td><td>DIC, ES, CS, DE</td></tr>
<tr><td>2.5</td><td>Skin depth & Plane Wave Propagation</td><td>ES, DIC,</td></tr>
<tr><td>1.5</td><td>Satellite Communication and Radar Systems</td><td>ES,</td></tr>
</table>
</td></tr>
<tr><td>Contribution of Course to meet the professional component:</td><td>This course prepares students to work professionally in the arenas of Electromagnetic Propagation and Radiation Engineering. Students should be able to apply knowledge of mathematics and engineering, and identify formulas to solve practical EM engineering problems at least in approximation level</td></tr>
<tr><td>Course Instructor(s):</td><td>Dr. Pun, Sio Hang or et al.</td></tr>
<tr><td>Prepared by:</td><td>Dr. Pun, Sio Hang</td></tr>
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Part B: General Course Information and Policies

(2012 Fall) Instructor: Dr. Pun, Sio Hang Phone: 4276 Office: NG05
Office Hour: Tue. 11:30-12:30 + Fri. 14:30-15:30 or by appointment
e-mail: lodgepun@umac.mo Assignment E-turn-in: ummoodle.umac.mo
Our course supplementary page is http://course.eee.umac.mo/elec381/ (intranet only)
TA/GA: Ms. Chen, XiMei Contact Info.: sammy.cxm@gmail.com
Class times: Lectures Thu. 10:30 -11:30 & Thu. 14:00 -16:00 Tutorials: Fri. 15:30 -17:30
Class Venue: WLG104, N201 (or lab)

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**
Propagation and Radiation	2	3	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 given by this course.
- Objective for "Market Acceptance" can be achieved by the course subject that is related to electromagnetic communication 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
Propagation and Radiation		2	2	3	1	3	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
Propagation and Radiation	H	S	S	S	H	N	S	S	N	S	H	S

The electrical and computer 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 381 Propagation and Radiation

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**
4	1.5	0.5	14	84	2/4-4.5 hours	61	39

Term: 5th

Hours			**Percentage content of**					
Lecturer	Lab/tut	Other	Maths	Basic Science	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies
56	7/21	0	20	10	45	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 software shall be used in simulations
- 1 mid-term exam and 1 final exam will be performed with 1-1.5 hours and 3 hours

respectively.

- If time is permitted, on-site visit to nearby company or facilities shall be arranged!
- Please regularly check your email for updated course information. It is your OWN responsibility if not to be informed on time.
- Please follow additional guidelines (in separate file) for close participations (such as handin format, etc.) with this course

Remarks: Useful teaching material will be available from our following **Intranet webpage**: http://course.eee.umac.mo/elec381/

Good Interactive Software Educational Web-page resources: http://www.amanogawa.com/index.html

Also **F. T. Ulaby workgroup** web-page: http://www.eecs.umich.edu/emag/ maybe useful.