Perancangan Mengajar

FAKULTI KEJURUTERAAN ELEKTRIK
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ELECTROMAGNETIC THEORY

BEKP 2453	SEMESTER 2	SESI 2010/2011

1. Learning Outcomes

Upon completion of this subject, the student should be able to:

1. Apply vector analysis in order to solve problems regarding electromagnetic phenomena.
2. Explain the principle of electrostatics and calculate basic & intermediate electrostatic problems.
3. Explain the principle of magnetostatics and calculate basic & intermediate magnetostatic problems.
4. Identify and utilize the Maxwell's equation in static and dynamic electromagnetic fields.
5. Analyze the electromagnetic application in plane-wave propagation.

2. Synopsis

This subject begins by teaching about vector calculus, an essential mathematical tool for gaining a quantitative understanding of the electromagnetic phenomena. It is then followed by the study of electrostatic fields; covering Coulomb's Law, Gauss's Law, conductors, dielectrics, and electric boundary conditions. Next, magnetostatic fields are covered; its sub-topic include Biot-Savart's Law, Ampere's Law, magnetic forces and torque, and magnetic boundary conditions. After that, the subject will examine the situations in which electric and magnetic fields are dynamic (i.e. varies with time) using Maxwell's equations. Finally, the applications of electromagnetic theory in wave propagation, and transmission lines are studied.

3. Pre requisite

None

4. References

1. Sadiku, M.N.O., *Elements of Electromagnetics*, 4th Edition, Oxford University Press, 2007.
2. Ulaby, F., *Electromagnetics for Engineers*, Pearson Education, 2005
3. Rao, N.P., *Elements of Engineering Electromagnetics,* 6th Edition, Pearson Education, 2004.
4. Raju, G.S.N., *Electromagnetic Field Theory and Transmission Lines*, 1st Edition, Pearson Education, 2006.

5. Subject Implementations

i) Lectures - 3 hours per week for 14 weeks (Total = 42 hours)
ii) Tutorials - 1 hour per week for a total of 4 - 6 weeks (Total = 4 to 6 hours)

6. Subject Evaluations

Assessment*	Marks
Test 1	15%
Test 2	15%
Assignment	15%
Quiz	5%
Final Examination	50%
Total	**100%**

*The marks for Assignment/PBL/Mini Project should not be more than 20%.

7. Detail Syllabus and Teaching Plan

Note: 1. Odd numbered lectures = 2 hours sessions. Even numbered lectures = 1 hour session.
2. Tutorial sessions (1 hour per session): 4 – 6 hours for each group throughout the semester.

Week	Session	Contents	References
1 (3/1-7/1)	**Lectures 1 & 2 (W1)**	**Introduction to EM Theory** • Historical Review • Concept of Electric and Magnetic Fields • Electromagnetic Spectrum **Vector Algebra** • Scalars and Vectors • Unit Vectors • Position and Distance Vectors • Vector Addition and Subtraction • Vector Multiplication • Components of a Vector	[1],[2],[3],[4]
2 (10/1-14/1)	**Lectures 3 & 4 (W2)**	**Coordinate Systems and Transformation** • Cartesian, Cylindrical & Spherical Coordinates • Cartesian to Cylindrical Transformation • Cartesian to Spherical Transformation • Cylindrical to Spherical Transformation	[1],[2],[3],[4]
3 (17/1-21/1)	**Lectures 5 & 6 (W3)**	**Vector Calculus** • Differential Length, Area and Volume • Line, Surface and Volume Integrals • Del Operator **Vector Calculus (cont.)** • Gradient of a Scalar • Divergence of a Vector and Divergence Theorem • Curl of a Vector and Stokes's Theorem • Laplacian of a Scalar	[1],[2],[3],[4]
	Assignment 1		

Week	Session	Contents	References
4 (24/1-28/1)	**Lectures 7 & 8 (W4)**	**Electrostatic Fields** • Charge and Current Distributions • Coulomb's Law • Gauss's Law – Maxwell's Equation • Applications of Gauss's Law	[1],[2],[3],[4]
5 (31/1-4/2)		MID-SEMESTER BREAK	
6 (7/2-11-2)	**Lectures 9 & 10 (W5)**	**Electrostatic Fields (cont.)** • Electric Scalar Potential • Relationship between **E** and V – Maxwell's Equation • An Electric Dipole and Flux Lines • Conductors and Resistance	[1],[2],[3],[4]
	Test 1		
7 (14/2-18/2)	**Lectures 11 & 12 (W6)**	**Electrostatic Fields (cont.)** • Dielectrics and Capacitance • Electric Boundary Conditions • Poisson's and Laplace's Equations	[1],[2],[3],[4]
8 (21/2-25/2)	**Lectures 13 & 14 (W7)**	**Electrostatic Fields (cont.)** • Energy Density in Electrostatic Fields • Electrical Properties of Materials	[1],[2],[3],[4]
	Due Assignment 1		
9 (28/2-4/3)	**Lectures 15 & 16 (W8)**	**Magnetostatic Fields** • Magnetic Forces and Torques • The Biot-Savart's Law	[1],[2],[3],[4]
10 (7/3-11/3)	**Lectures 17 & 18 (W9)**	**Magnetostatic Fields (cont.)** • Gauss's Law for Magnetism • Ampere's Law for Magnetism • Application for Ampere's Law	[1],[2],[3],[4]
11 (14/3-18/3)	**Lectures 19 & 20 (W10)**	**Magnetostatic Fields (cont.)** • Vector Magnetic Potential • Magnetic Boundary Condition • Inductance • Magnetic Energy	[1],[2],[3],[4]
	Test 2		

12 (21/3-25/3)	**Lectures 21 & 22 (W11)**	**Maxwell's Equation for Time-Varying Fields** • Faraday's Law • Stationary Loop in a Time-Varying Magnetic Field • The Ideal Transformer	[1],[2],[3],[4]
	Assignment 2		
13 (28/3-1/4)	**Lectures 23 & 24 (W12)**	**Maxwell's Equation for Time-Varying Fields** • Displacement Current • Moving Conductor in Static and Time-Varying Magnetic Field • Boundary Conditions for Electromagnetics	[1],[2],[3],[4]
14 (4/4-8/4)	**Lectures 25 & 26 (W13)**	**Plane-Wave Propagation** • Review of Waves and Phasors • Time Harmonic Fields • Plane Wave Propagation in Lossless Media	[1],[2],[3],[4]
15 (11/4-15/4)	**Lectures 27 & 28 (W14)**	**Plane-Wave Propagation (cont.)** • Wave Polarization • Plane Wave Propagation in Lossy Media • Current Flow in a Good Conductor • Electromagnetic Power Density	[1],[2],[3],[4]
	Due Assignment 2		
16 (18/4-22/4)		STUDY WEEK	
17-18 (25/4-7/5)		EXAM WEEK	

8. Matrix Learning Outcome (LO) Versus Program Outcome (PO) & Taxonomy

	Matrix LO VS PO											Matrix LO VS Taxonomy																	
	PO											Cognitive						Psychomotor							Affective					Assessment
LO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**	**4**	**5**	
1	X			X								X	X	X				X	X	X					X	X				**Test 1, Final**
2	X			X								X	X	X	X			X	X	X					X	X				**Test 1, Final**
3	X			X								X	X	X	X			X	X	X					X	X				**Test 2, Final**
4	X			X								X	X	X				X	X	X					X	X				**Test 2, Final**
5	X			X					X			X	X	X	X			X	X	X					X	X				**Assignment, Final**
Ave	X			X								X	X	X	X			X	X	X					X	X				

9. Matrix Learning Outcome (LO) Versus Soft Skills (KI)

	LL			CS								CTPS							ES				TPS	K	TS					EM			LS			
LO	1	2	3	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	1	2	3	4	1	1	1	2	3	4	5	1	2	3	1	2	3	4
1												X	X																								
2												X	X																								
3												X	X																								
4												X	X																								
5												X	X																								
Ave												X	X																								

Note: **LL**: Life Long Learning **CS**: Communication Skills **CTPS**: Critical Thinking & Problem Solving **ES**: Entrepreneurship Skills
TPS: Technical & Practical Skills **K**: Knowledge **TS**: Teamwork Skills **EM**: Ethic & Moral
LS: Leadership Skills

TEACHING PLAN APPROVAL

Prepared by;

…….
Name : Kyairul Azmi bin Baharin
Hyreil Anuar Bin Kasdirin
Muhammad Nizam bin Kamarudin

Stamp :

Date :

Approved by;

……..
Dean/Deputy Dean(Academic)/
HOD

Stamp :

Date :

TEACHING PLAN IMPLEMENTATION (MID SEMESTER BREAK)

Comment :

Checked by ;

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Dean/Deputy Dean(Academic)/ HOD
Stamp :

Date : _____

TEACHING PLAN IMPLEMENTATION (WEEK 16)

Comment :

Checked by ;

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Dean/Deputy Dean(Academic)/ HOD
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Date : _____