Electromagnetism 2

Basic Course Information

Course Number	01005103	**Subject Category**	Compulsory (M)
Class Format	Lecture	**Credit Type and Number of Credits**	1
Department	Mechatronics	**Student Category**	Year 3
Period of Study	Semester 1	**Classes per Week**	2
Required Materials	The handout will be provided in hardcopy and/or electronic file format.		
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Course Objective

Electromagnetism is a branch of physics that involves the study of the electromagnetic force and the combination of electric and magnetic phenomena. A good knowledge and application of electromagnetism are required for various types of engineering problems, and it is important for understanding the operation of electrical and mechatronics systems. This course provides a review of static electric fields, including Gauss's law, divergence, multi-conductor systems, capacitance, and stored energy. It also covers magnetism, including magnetic charge and magnetic field as well as magnetic materials. The exercises and homework are designed to help students develop knowledge, problem-solving skills, and understanding of the basics of electromagnetism. Basic Vector Calculus and mathematical treatments in electromagnetism are also covered.

Evaluation/Rubric

Evaluation/Rubric	Ideal Level of Achievement (Very Good)	Standard Level of Achievement (Good)	Unacceptable Level of Achievement (Fail)
Understanding concepts of Electromagnetism and their relation	Excellent at demonstrating knowledge and understanding of concepts in Electromagnetism. Shows a good ability to connect these concepts with mathematical procedures to accurately solve problems and answer questions.	This demonstrates a good understanding of typical Electromagnetism concepts with well-connected concepts and mathematical procedures to solve problems. However, there may be occasional minor errors.	This shows a lack of appropriate knowledge and understanding of concepts in Electromagnetism with weak connections among these concepts
Mathematical and graphical representation	This is an excellent demonstration of the ability to describe Electromagnetism theorems and laws with equations, and to apply the appropriate law to calculate electromagnetic quantities. The equations show a strong understanding, and the accompanying graphs are logical and provide sufficient detail to describe electromagnetic phenomena.	This show the ability to describe Electromagnetism theorems and laws with equations and apply the appropriate law to calculate electromagnetic quantities. The equations demonstrate a good understanding, and the accompanying graphs are logical and provide sufficient detail to describe electromagnetic phenomena.	This demonstrates an insufficient description of Electromagnetism theorems and laws, with improper application of theorems or formulas. The equations are limited or inaccurate, and the accompanying graphs are incomplete or absent of information.
Problem Solving	This provides a clear and logical progression from general concepts/equations to solving a specific problem with different conditions. All final numerical answers are correct, with appropriate units and calculations.	This provides a logical progression from general concepts/equations to solving specific problems, but with minor mistakes in calculation, algebraic manipulation, or units.	This provides an unclear logical progression or solution, which is difficult to follow, with major algebraic and/or other mathematical mistakes in the solution.

Relationship with Learning Outcomes

G(1) Wide knowledge on Science and Engineering and practical ability to apply them to solve problems in the society.

M(1) Ability to design, propose and develop robotic/ mechatronic systems to solve specific problems

M(2) Ability to design, propose and develop electrical and electronic systems for robotic/ mechatronic systems

Teaching Method

Outline:	Students will study the basic concepts and principles of Electromagnetism with the expectation of developing an appreciation for the fundamental laws and principles and their applications in solving typical problems. Some topics will be demonstrated in class, and/or there will be in-class lab work.
Class Format:	Lecture and exercise
Please Note :	All materials will be posted on the Google Classroom, and students are requested to keep photocopies or files of all submitted materials to ensure further study for themselves.

Course Plan

Semester 1	Contents and Method of Course	Goals	Related MCC		
			II-A	1	71
1st week	Review of the electromagnetism I course syllabus and evaluation criteria	Recall the electromagnetism knowledge and concepts and understand the overall contents and evaluation criteria			
2nd week	Electric field observation on conductor plate	To understand electric fields and phenomena in conductor plates and multi-conductor systems.	V-C V-C	2 2	28 29
3rd week	Energy stored between a parallel conductor plate	To understand the nature of a capacitor, and be able to describe and calculate the amount of energy stored in a capacitor.	V-C V-C	2 2	28 29
4th week	Multi-conductor system and earthing	To understand the various types of conductors, electric field phenomena, and earthing systems.	V-C V-C	2 2	28 29
5th week	Self capacitance and mutual capacitance	Capable of differentiating between self-capacitance and mutual capacitance.	V-C V-C V-C	2 2 2	31 32 33
6th week	A1 Poster presentation	To summarize the overall content and present it as a group presentation.			
7th week	Review and summarize	Review and summarize			
8th week	Midterm examination	Midterm examination			
9th week	Return Midterm Exam Papers and Feedback	Review learning			
10th week	Dielectric properties and Multi-dielectric capacitor	Understand the nature and characteristics of dielectric materials.	V-C V-C V-C V-C	2 2 2 2	30 31 32 33
11th week	Boundary condition	Understand the concepts of electric fields in dielectrics, as well as the boundary conditions for electric fields and electric flux.	V-C	2	30
12th week	Introduction to magnetism	Capable of applying and developing the concepts to more advanced content.			
13th week	Magnetic force	To understand magnetic phenomena, and be able to accurately predict, sketch, and calculate magnetic forces.			
14th week	Cyclotron phenomena	To understand the cyclotron phenomena and be able to calculate and interpret it accurately.			
15th week	A1 Poster presentation	To summarize the overall content and present it as a group presentation.			
16th week	Review and summarize	Review and summarize			
17th week	Final examination	Final examination			
18th week	Return Midterm Exam Papers and Feedback	Review learning			

Do not

	Examination	Quiz	Mutual Evaluations between students	Report	Portfolio	Other
Basic Ability	50				20	
Technical Ability	10				20	
Interdisciplinary Ability						