Electromagnetism 4

Basic Course Information			
Course Number	0100S105	Subject Category	Compulsory (M)
Class Format	Lecture	Credit Type and Number of Credits	1
Department	Mechatronics	Student Category	Year 4
Period of Study	Semester 1	Classes per Week	1
Required Materials	Handout materials based on "Applied physics of Kosen", ISBN978-4-627-15103		
Instructor	Takeshi TOSHIMA	Arnon Sakonkanapong	

Course Objective

It is aimed to express the following electromagnetism phenomena and understand that they are mathematically interlocked and are analyzable events.
Electromagnetic induction, induced electromotive force, self - inductance and mutual - inductance, oscillation solutions of LC and LCR circuit, vector operator, vector integral formula, Maxwell's equations, wave equation
Specifically, each item of the following rubric will be the target.

Evaluation(Rubric)	Ideal Level of Achievement (Very Good)	Standard Level of Achievement (Good)	Unacceptable Level of Achievement (Fail)
It is possible to explain electromagnetic induc	Ability to solve not only basic problems but also applied problems on midterm and/or final exams about this category.	It is possible to explain electromagnetic induction and calculate induced electromotive force.	Can not explain electromagnetic induction and calculate induced electromotive force.
It is possible to explain self-induction and mutual induction.	Ability to solve not only basic problems but also applied problems on midterm and/or final exams about this category.	It is possible to explain self-induction and mutual induction.	Can not explain self-induction and mutual induction.
It is possible to explain self-inductance and mutual inductance.	Ability to solve not only basic problems but also applied problems on midterm and/or final exams about this category.	It is possible to explain self-inductance and mutual inductance.	Can not explain self-inductance and mutual inductance.
It is possible to explain Green's theorem, Stokes' theorem, and Gauss' theorem	Ability to solve not only basic problems but also applied problems on midterm and/or final exams about this category.	It is possible to explain Green's theorem, Stokes' theorem, and Gauss' theorem	Can not explain Green's theorem, Stokes' theorem, and Gauss' theorem
It is possible to perform calculations using vector operators \div, rot, grad \	Ability to solve not only basic problems but also applied problems on midterm and/or final exams about this category.	It is possible to perform calculations using vector operators \div, rot, grad	Can not perform calculations using vector operators \div, rot, grad
It is possible to describe Maxwell's equations \displacement current, ampere's law, Gauss's law\	Ability to solve not only basic problems but also applied problems on midterm and/or final exams about this category.	It is possible to describe Maxwell's equations \displacement current, ampere's law, Gauss's law\	Can not describe Maxwell's equations \displacement current, ampere's law, Gauss's law\
It is possible to derive the wave equation from Maxwell's equations	Ability to solve not only basic problems but also applied problems on midterm and/or final exams about this category.	It is possible to derive the wave equation from Maxwell's equations	Can not derive the wave equation from Maxwell's equations

Relationship with Learning Outcomes

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

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

Please change

Teaching Method

Outline:	Expression of physical phenomena in electromagnetism using mathematical expressions, \electromagnetic induction, Lenz's law, Neumann's law, Faraday's law of electromagnetic induction, self inductance, mutual inductance, vector operators, Maxwell's equations and wave equation\ In addition, the goal is set to be able to explain that physical quantities can combine and analyze physical phenomena using mathematics.
Class Format:	Lecture and exercise
Please Note :	All materials will be posted on the Google classroom. The student is requested to keep photo copies or files of all submitted material to ensure further study by [illegible]

Course Plan

Semester 1	Contents and Method of Course	Goals	Related MCC
1st week	Guidance: Review of the electromagnetism \ Relationship between current and magnetic field \Biot-Savart law and Ampere's law\	Review Biot-Savart's law and Ampere's law for the relationship between electric current and magnetic field.	V-C 2 34 V-C 2 35
2nd week	Review of the electromagnetism \ Lorentz force\electric current or carrier, lead moving in a magnetic field\	Review Lorentz force acting on a charged body moving in a magnetic field.	V-C 2 36 V-C 2 37
3rd week	Derivation of the law of electromagnetic induction	Understand the electromagnetic induction and induced electromotive force.	V-C 2 40
4th week	Mutual inductance and self-inductance	Understand the self-induction and self-inductance, mutual-induction and mutual-inductance.	V-C 2 41 V-C 2 42
5th week	Energy stored in coil, LC circuit	Can derive the energy stored in the coil. Be able to write the equation for LC circuits.	V-C 2 38 V-C 2 39 V-A 3 76
6th week	Spring Vibration and LC and LCR circuit	Understand the universality shared by LC and LCR circuits and spring oscillation solutions.	V-A 3 77 V-A 3 78 V-A 3 79
7th week	Perform calculations using knowledge of electromagnetic induction, self and mutual induction and energy stored in LC circuit.	Mock examination	
8th week	Wrap-up of 1st half of semester \Review\	Review and summarize learning	
9th week	Midterm Examination	For week 1-8	
10th week	Return Midterm Exam Papers and Feedback	Review learning	
11th week	Vector operator I learn concepts about scalar fields and gradients and understand grad operations using differential operators	Understand the vector operator \gradient\	
12th week	Vector operator II learn the concept of vector field and divergence and understand div operation using differential operator	Understand the vector operator \divergence\	
13th week	Vector operator III learn the concepts of vector fields and rotations and understand rot \curl\ operation using differential operators	Understand the vector operator \rotation\	
14th week	Vector integral formula I Understand the relationship of Green's theorem, Stokes' theorem and Gauss's divergence theorem.	Understand the relationship of Green's theorem, Stokes theorem and Gauss's divergence theorem.	
15th week	Maxwell's equations	Can describe Maxwell's equations, understand the displacement current, ampere's law, Gauss's law	
16th week	Hertzian dipole radiation experiments, electromagnetic waves propagating in space.	Can derive the wave equation from Maxwell's equations	
17th week	Perform calculations using knowledge of vector operator, vector integral formula and Maxwell's equations.	Mock examination	
18th week	Wrap-up of 1st half of semester \Review\	Review and summarize learning	
19th week	Final Examination	For week 11-18	
20th week	Return Exam Papers and Feedback, and special sessions	Review and summarize learning	

Do not

	Examination	Quiz	Mutual Evaluations between students	Report	Portfolio	Other
Basic Ability	60	0	0	40	0	0
Technical Ability	0	0	0	0	0	0
Interdisciplinary Ability	0	0	0	0	0	0