	Universitas Negeri Surabaya Faculty of Engineering, Electrical Engineering Undergraduate Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Electromagnetic Field	2020103080	Compulsory Study Program Subjects	T=3	P=0	ECTS=4.77	1	July 10, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Dr. Puput Wanarti Rusimamto., Prof. Dr. Joko, M.Pd. MT.	Dr. Puput Wanarti Rusimamto., ST.,MT;	Dr. Lusia Rakhmawati, S.T., M.T.

Learning model	**Case Studies**	
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**	
	PLO-5	Able to apply knowledge of mathematics, natural sciences, information technology, and engineering to gain a thorough understanding of the principles of electrical engineering
	PLO-8	Able to apply engineering principles, identify, formulate and analyze data/information to solve problems in the electrical field
	Program Objectives (PO)	
	PO - 1	Able to apply engineering principles, identify, formulate and analyze data/information to solve problems in the field of electromagnetic fields
	PO - 2	Able to convey ideas and innovation results in the field of electromagnetic fields effectively both orally and in writing
	PO - 3	Able to plan, complete and evaluate tasks related to electromagnetic fields
	PLO-PO Matrix	

P.O	PLO-5	PLO-8
PO-1		
PO-2		
PO-3		

PO Matrix at the end of each learning stage (Sub-PO)

P.O	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PO-1																
PO-2																
PO-3																

Short Course Description	Students can discuss vector analysis, identify Colomb's law, differentiate electric field intensity, determine flux and Gauss, explain divergence, deduce energy and potential, categorize conductors and capacitance, classify ampere law and magnetic fields, magnetic force and torque, inductance and magnetic circuits, EMF, magnetic effects that change over time, Maxwell's equations, electromagnetic waves, as well as exploring the latest technological developments related to electromagnetic fields using the case method in lectures.
References	**Main :**

1. Hayt, Engineering Electromagnet , fifth Edition, terjemahan oleh The Houw Liong (ITB), MacGrarw- Hill, 1981
2. Seri Buku Schaum, Elektromagnetika J.D. Kraus. 1984.
3. Liang Chi Shen, Jin An Kong , Aplikasi Elektromagnetik , edisi 3, Penerbit Erlangga, Jakarta, 1995
4. Krauss John E., Electromagnetics , McGraww-Hill Book Co. tirth Edition, 1999

Supporters:

1. Farhad Rachidi and Sergey V Tkachenko,. 2008. Electromagnetic Field Interaction with Transmission lines from casical Theory in HF Radiation Effects, . With Press
2. Jian-Ming Jin, Theory and Computation of Electromagnetic Fields, 2nd Ed. IEEE Press,John Wiley and Son, 2015

Supporting lecturer	Prof. Dr. Joko, M.Pd., M.T. Dr. Ir. Achmad Imam Agung, M.Pd. Dr. Puput Wanarti Rusimamto, S.T., M.T. Dr. Raden Roro Hapsari Peni Agustin Tjahyaningtijas, S.Si., M.T. Miftahur Rohman, S.T., M.T.

Week-	**Final abilities of each learning stage (Sub-PO)**	**Evaluation**		**Help Learning, Learning methods, Student Assignments, [Estimated time]**		**Learning materials [References]**	**Assessment Weight (%)**
		Indicator	**Criteria & Form**	**Offline (*offline*)**	**Online (*online*)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Students are able to explain the historical background and applications of electromagnetics	1. Explain the historical background 2. Explain electromagnetic applications in wireless technology, transmission line design and electromagnetic testing.	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Portfolio Assessment	Presentations, discussions, reflections and assignments 3 X 50			4%
2	Students are able to understand the use of Cartesian coordinates, cylindrical coordinates and spherical coordinates in solving electromagnetic field problems.	1. Explain vector notation 2. Explain vector algebra 3. Explain coordinate systems 4. Explain the differential volume and surface elements and lines	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Portfolio Assessment	Presentation, discussion, reflection and assignment 3 X 50		**Material:** Meeting material 2 **References:** *Schaum Book Series, JD Kraus Electromagnetics. 1984.*	4%
3	Students are able to explain theories regarding static electric fields and the application of Coulomb's and Gauss's Laws	1. Understand Coulomb's law 2. Find the electric field strength 3. Explain point charge fields 4. Explain the line charge field 5. Explain the plane charge field 6. Explain the volume charge field	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Portfolio Assessment		Group assignments, group discussions, and 3 X 50 presentations	**Material:** Meeting material 3 **Bibliography:** *Hayt, Engineering Electromagnet, fifth Edition, translation by The Houw Liong (ITB), MacGrarw-Hill, 1981*	4%
4	Students are able to explain electric flux density	1. Explaining Electric Flux 2. Explaining Electrical Flux Density Vectors 3. Explain Gauss's Law 4. Explaining the Divergence Theorem	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Portfolio Assessment		Group discussion, group presentation, and reflection 3 X 50	**Material:** Meeting material 4 **References:** *Schaum Book Series, JD Kraus Electromagnetics. 1984.*	4%
5	Students are able to understand energy and electrical potential	1. Explain the energy required to move an electric charge in an electric field 2. Explain line integrals 3. Explain potential differences 4. Explain the potential field of electric charges 5. Explain the potential field of a charge system	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Portfolio Assessment		Tracing sources of information, group discussions, and concluding the results of 3 X 50 group discussions	**Material:** Meeting material 5 **Bibliography:** *Krauss John E., Electromagnetics, McGraww-Hill Book Co. third Edition, 1999*	4%

6	Students are able to understand conductors, dielectrics and capacitance	1. Explain Current and Current Density 2. Explaining Conductors and Conductivity 3. Explain semiconductors 4. Explain the properties of dielectric materials 5. Explain capacitance	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Portfolio Assessment	Group discussions, group presentations, and reflection 3 X 50		**Material:** Meeting material 6 **Bibliography:** *Krauss John E., Electromagnetics, McGraww-Hill Book Co. third Edition, 1999*	4%
7	Students are able to understand conductors, dielectrics and capacitance	1. Explain Current and Current Density 2. Explaining Conductors and Conductivity 3. Explain semiconductors 4. Explain the properties of dielectric materials 5. Explain capacitance	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Portfolio Assessment	Presentations, discussions and reflections as well as 3 X 50 group presentations		**Material:** Meeting material 7 **References:** *Liang Chi Shen, Jin An Kong, Electromagnetic Applications, 3rd edition, Erlangga Publisher, Jakarta, 1995*	4%
8	Carrying out UTS Meetings 1 to 7	Meetings 1 to 7	**Criteria:** Evaluation Rubric **Form of Assessment** : Test	Written Test 3 X 50		**Material:** Meeting material 1-7 **References:** *Hayt, Engineering Electromagnet, fifth Edition, translation by The Houw Liong (ITB), MacGrarw-Hill, 1981*	15%
9	Students are able to explain theories regarding static magnetic fields and the application of Biot-Savart and Ampere's Laws	1. Explain Biot Savart's law 2. Explain Ampere's integral law 3. Explain Stoke's theorem 4. Explain magnetic flux and magnetic flux density 5. Explain scalar potential and magnetic vector potential 6. Explain the law of steady magnetic fields	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Presentation, discussion and reflection 3 X 50		**Material:** Meeting material 9 **Reader:** *Farhad Rachidi and Sergey V Tkachenko,. 2008. Electromagnetic Field Interaction with Transmission lines from Casical Theory in HF Radiation Effects, . With Press*	4%
10	Students are able to explain theories regarding static magnetic fields and the application of Biot-Savart and Ampere's Laws	1. Explain Biot Savart's law 2. Explain Ampere's integral law 3. Explain Stoke's theorem 4. Explain magnetic flux and magnetic flux density 5. Explain scalar potential and magnetic vector potential 6. Explain the law of steady magnetic fields	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Presentation, discussion and reflection 3 X 50		**Material:** Meeting material 10 **References:** *Jian-Ming Jin, Theory and Computation of Electromagnetic Fields, 2nd Ed. IEEE Press, John Wiley and Son, 2015*	4%

11	Students are able to explain force and torque in a magnetic field	1. Explain the magnetic force on particles. Explain the combination of electric fields and magnetic fields 2. Explain the magnetic force on a current element 3. Explain work and power 4. Explain torque 5. Explain the magnetic moment of a plane coil	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities		Discussion, presentation and reflection 3 X 50	**Material:** Meeting material 11 **Bibliography:** *Schaum Book Series, JD Kraus Electromagnetics. 1984.*	4%
12	Students are able to explain force and torque in a magnetic field	1. Explain the magnetic force on particles. Explain the combination of electric fields and magnetic fields 2. Explain the magnetic force on a current element 3. Explain work and power 4. Explain torque 5. Explain the magnetic moment of a plane coil	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Portfolio Assessment	Presentation, discussion and reflection 3 X 50		**Material:** Meeting material 12 **Reader:** *Farhad Rachidi and Sergey V Tkachenko,. 2008. Electromagnetic Field Interaction with Transmission lines from Casical Theory in HF Radiation Effects, . With Press*	4%
13	Students are able to explain inductance and magnetic circuits	1. Explain self-induction voltage 2. Explain inductors and inductance 3. Explain magnetic circuits 4. Describes a terrace with an air gap 5. Explaining double coils 6. Explain parallel magnetic circuits	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Portfolio Assessment		Group discussions, presentations, discussions and reflections (independent learning) 3 X 50	**Material:** Meeting material 13 **References:** *Liang Chi Shen, Jin An Kong, Electromagnetic Applications, 3rd edition, Erlangga Publisher, Jakarta, 1995*	4%
14	Students are able to explain displacement currents and induced electromotive forces	1. Explain displacement flow 2. Explain Faraday's law 3. Describes a conductor that moves in a field that is independent of time 4. Describes a conductor that moves in a changing field	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities		Group discussion, presentation and reflection (independent study) 3 X 50	**Material:** Meeting material 14 **References:** *Jian-Ming Jin, Theory and Computation of Electromagnetic Fields, 2nd Ed. IEEE Press, John Wiley and Son, 2015*	4%

15	Students are able to explain the theories of electromagnetic waves and solve cases	1. Explaining the Wave Equation and its Solution in Rectangular Coordinates 2. Explaining Wave Propagation in various Media 3. Explaining Interface Field Conditions for Normal Collisions 4. Explaining Oblique Collisions and Snell's Law	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Tests	Presentation, discussion and reflection 3 X 50		**Material:** Meeting material 15 **References:** *Hayt, Engineering Electromagnet, fifth Edition, translation by The Houw Liong (ITB), MacGrarw-Hill, 1981*	3%
16	Meetings 9 to 15	Meetings 9 to 15	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Tests	Written test 3 X 50			30%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	50.5%
2.	Portfolio Assessment	18%
3.	Test	31.5%
		100%

Notes

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** abilities in the process and student learning outcomes are specific and measurable statements that identify the abilities or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.