	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
Engineering Physics	2020103039	Compulsory Study Program Subjects	T=3	P=0	ECTS=4.77	1	April 24, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Roswina Dianawati, S.Pd., M.Ed. ; Dr. Puput Wanarti Rusimamto, S.T., M.T. ; Dr. Hj. Euis Ismayati, M.Pd.	Prof. Dr. Bambang Suprianto, M.T.	Dr. Lusia Rakhmawati, S.T., M.T.

Learning model	**Project Based Learning**
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**
	Program Objectives (PO)
	PO - 1: Able to apply knowledge of mathematics, natural sciences, information technology, and electrical engineering to gain a thorough understanding of engineering principles
	PLO-PO Matrix

P.O
PO-1

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																

Short Course Description	This course consists of theory and practice which discusses the basic physics of engineering, especially the basics of mechanical engineering. The basic physics presented includes vector calculus, two-dimensional motion, projectile motion, circular motion, Newton's laws and dynamics, etc.
References	**Main :**
	1. Halliday, david, dan Robert Resnick (diterjemahkan oleh Pantur silaban dan Erwin Sucipto), Fisika jilid I Edisi Ketiga, jakarta: Penerbit Erlangga,1987.
	Supporters:
	1. Sears, F.W. dan M.W.Zemansky (disadur oleh Ir. Soedarjana dan Drs. Amir Achmad). Fisika untuk Universitas 1 . bandung: Penerbit ITM, 1984.
Supporting lecturer	Dr. Puput Wanarti Rusimamto, S.T., M.T. Roswina Dianawati, S.Pd., M.Ed.

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 can understand and solve problems related to two-dimensional motion	1. Understand the position of objects 2. understand the speed of objects 3. understand the acceleration of objects	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Lectures, discussions, problem solving and questions and answers 2 X 50		**Material:** Meeting material 1 **Reader:** *Halliday, David, and Robert Resnick (translated by Pantur Silaban and Erwin Sucipto), Physics volume I, Third Edition, Jakarta: Erlangga Publishers, 1987.*	5%
2	Students can understand and solve problems related to gradient, divergence and curl, line integrals, surface and volume theorems of Gauss and Stokes in Cartesian, polar and cylindrical coordinate systems	1. Understand gradients, divergence and curl. 2. Understand line, surface and volume integrals 3. Understand the Gauss and Stokes theorems on Cartesian, polar and cylindrical coordinate systems	**Criteria:** Evaluation Rubric **Form of Assessment** : Project Results Assessment / Product Assessment	Lectures, discussions and questions and answers 2 X 50		**Material:** Meeting material 2 **Bibliography:** *Halliday, David, and Robert Resnick (translated by Pantur Silaban and Erwin Sucipto), Physics volume I, Third Edition, Jakarta: Erlangga Publishers, 1987.*	5%
3	Understanding Electric Force: Electric Charge and Coulomb's LawUnderstanding the Concept of Electric Field, Electric Field by Point Charge Distribution and Electric Field by Continuous Charge DistributionUnderstanding electric field flux, Gauss's Law and applying it.	1. Students can understand Electric Force: Electric Charge and Coulomb's Law 2. Students can understand the concept of electric fields, electric fields by point charge distribution and electric fields by continuous charge distribution 3. Students can understand electric field flux, Gauss's Law and apply it.	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 3 X 50		**Material:** Meeting material 3 **Readers:** *Sears, FW and MWZemansky (adapted by Ir. Soedarjana and Drs. Amir Achmad). Physics for Universities 1 . Bandung: ITM Publishers, 1984.*	10%
4	Understanding Electric Force: Electric Charge and Coulomb's LawUnderstanding the Concept of Electric Field, Electric Field by Point Charge Distribution and Electric Field by Continuous Charge DistributionUnderstanding electric field flux, Gauss's Law and applying it.	1. Students can understand Electric Force: Electric Charge and Coulomb's Law 2. Students can understand the concept of electric fields, electric fields by point charge distribution and electric fields by continuous charge distribution 3. Students can understand electric field flux, Gauss's Law and apply it.	**Criteria:** Evaluation Rubric	Lectures, discussions and questions and answers 3 X 50		**Material:** Meeting material 4 **Reader:** *Sears, FW and MWZemansky (adapted by Ir. Soedarjana and Drs. Amir Achmad). Physics for Universities 1 . Bandung: ITM Publishers, 1984.*	5%

5	Explain and understand magnetic fields Explain the concepts of Ampere's Law and Biot Savart's Law, and apply them Understand Faraday's Law of Induction and inductance	1. Calculate the Lorentz Force experienced by a charge moving in a magnetic field. 2. Calculating the Lorentz Force experienced by an electric current in a magnetic field. 3. Calculating the torque in an electric current loop 4. Explains the concepts of Ampere's Law and Biot Savart's Law, as well 5. Calculate the magnitude of the magnetic flux in an area. 6. Calculating the induced emf in a conductor and in a coil using Faraday's Law and Lenz's Law 7. Explain the concept of inductance. 8. Calculating the self-inductance of the coil. 9. Calculate magnetic energy and density. 10. Calculate the mutual inductance of two coils	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, discussions, exercises 3 X 50		**Material:** Meeting material 5 **Bibliography:** *Halliday, David, and Robert Resnick (translated by Pantur Silaban and Erwin Sucipto), Physics volume I, Third Edition, Jakarta: Erlangga Publishers, 1987.*	0%

6	Explain and understand magnetic fields Explain the concepts of Ampere's Law and Biot Savart's Law, and apply them Understand Faraday's Law of Induction and inductance	1. Calculate the Lorentz Force experienced by a charge moving in a magnetic field. 2. Calculating the Lorentz Force experienced by an electric current in a magnetic field. 3. Calculating the torque in an electric current loop 4. Explains the concepts of Ampere's Law and Biot Savart's Law, as well 5. Calculate the magnitude of the magnetic flux in an area. 6. Calculating the induced emf in a conductor and in a coil using Faraday's Law and Lenz's Law 7. Explain the concept of inductance. 8. Calculating the self-inductance of the coil. 9. Calculate magnetic energy and density. 10. Calculate the mutual inductance of two coils	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, discussions, exercises 3 X 50		**Material:** Meeting material 6 **Reader:** *Sears, FW and MWZemansky (adapted by Ir. Soedarjana and Drs. Amir Achmad). Physics for Universities 1 . Bandung: ITM Publishers, 1984.*	10%

7	Explain and understand magnetic fields Explain the concepts of Ampere's Law and Biot Savart's Law, and apply them Understand Faraday's Law of Induction and inductance	1. Calculate the Lorentz Force experienced by a charge moving in a magnetic field. 2. Calculating the Lorentz Force experienced by an electric current in a magnetic field. 3. Calculating the torque in an electric current loop 4. Explains the concepts of Ampere's Law and Biot Savart's Law, as well 5. Calculate the magnitude of the magnetic flux in an area. 6. Calculating the induced emf in a conductor and in a coil using Faraday's Law and Lenz's Law 7. Explain the concept of inductance. 8. Calculating the self-inductance of the coil. 9. Calculate magnetic energy and density. 10. Calculate the mutual inductance of two coils	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, discussions, exercises 3 X 50		**Material:** Meeting material 7 **Reader:** *Halliday, David, and Robert Resnick (translated by Pantur Silaban and Erwin Sucipto), Physics volume I, Third Edition, Jakarta: Erlangga Publishers, 1987.*	5%
8	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 **Bibliography:** *Halliday, David, and Robert Resnick (translated by Pantur Silaban and Erwin Sucipto), Physics volume I, Third Edition, Jakarta: Erlangga Publishers, 1987.*	15%
9	Explain Current Resistance and Electric Voltage	1. Explain the various phenomena contained in the RC circuit 2. Explain the difference between electrical energy and electrical power.	**Criteria:** Evaluation Rubric **Form of Assessment** : Project Results Assessment / Product Assessment	Lectures, discussions, exercises 3 X 50		**Material:** Meeting material 9 **Reader:** *Halliday, David, and Robert Resnick (translated by Pantur Silaban and Erwin Sucipto), Physics volume I, Third Edition, Jakarta: Erlangga Publishers, 1987.*	5%

10	Explain and understand Alternating Current	1. Explain the various behaviors of resistors, capacitors and inductors in alternating electrical circuits. 2. Explain and use phasor diagrams to calculate impedance 3. Calculating the resonant frequency in an alternating electrical circuit. 4. Calculating power in an alternating electrical circuit	**Criteria:** Evaluation Rubric **Form of Assessment** : Project Results Assessment / Product Assessment	Lectures, discussions, questions and answers, exercises and assignments 3 X 50		**Material:** Meeting material 10 **Reader:** *Halliday, David, and Robert Resnick (translated by Pantur Silaban and Erwin Sucipto), Physics volume I, Third Edition, Jakarta: Erlangga Publishers, 1987.*	5%
11	Explain and use induced magnetic fields. Explain the origin of displacement currents. Explain the meaning of Maxwell's equations and use them.	1. Mention the use of induced magnetic fields 2.. Calculating shift current 3. Explain Maxwell's equations	**Criteria:** Evaluation Rubric **Form of Assessment** : Project Results Assessment / Product Assessment	Lectures, discussions, questions and answers, and 3 X 50 exercises		**Material:** Material from meeting 11 **Bibliography:** *Halliday, David, and Robert Resnick (translated by Pantur Silaban and Erwin Sucipto), Physics volume I, Third Edition, Jakarta: Erlangga Publishers, 1987.*	5%
12	Explain, understand the process of the birth of electromagnetic waves from Maxwell's equations. Explain the spectrum of electromagnetic waves. Explain the transmission path of electromagnetic waves. Explain electromagnetic waveguides. Explain electromagnetic wave radiation. Explain and how to calculate the Poynting Vector	1. Write down electromagnetic waves from Maxwell's Equations. 2. Mention the electromagnetic wave spectrum. 3. Explain the transmission path of electromagnetic waves. 4. Explain electromagnetic waveguides. 5. Explain electromagnetic wave radiation. 6. calculating Poynting Vectors.	**Criteria:** Evaluation Rubric	Lectures, discussions, questions and answers, and 3 X 50 exercises		**Material:** Meeting material 12 **Reader:** *Sears, FW and MWZemansky (adapted by Ir. Soedarjana and Drs. Amir Achmad). Physics for Universities 1 . Bandung: ITM Publishers, 1984.*	5%

13	Explain, understand the process of the birth of electromagnetic waves from Maxwell's equations. Explain the spectrum of electromagnetic waves. Explain the transmission path of electromagnetic waves. Explain electromagnetic waveguides. Explain electromagnetic wave radiation. Explain and how to calculate the Poynting Vector	1. Write down electromagnetic waves from Maxwell's Equations. 2. Mention the electromagnetic wave spectrum. 3. Explain the transmission path of electromagnetic waves. 4. Explain electromagnetic waveguides. 5. Explain electromagnetic wave radiation. 6. calculating Poynting Vectors.	**Criteria:** Evaluation Rubric **Form of Assessment** : Project Results Assessment / Product Assessment	Lectures, discussions, questions and answers, and 3 X 50 exercises		**Material:** Meeting material 13 **Reader:** *Halliday, David, and Robert Resnick (translated by Pantur Silaban and Erwin Sucipto), Physics volume I, Third Edition, Jakarta: Erlangga Publishers, 1987.*	5%

14	1. Understand the propagation properties of light 2. Understand reflection and refraction 3. Understand interference 4. Understand diffraction, grating and spectrum 5. Understand Polarization	1. Explain and calculate the energy and momentum of light. 2. Explain and use the Doppler Effect. 3. Explain and use the Laws of Reflection and Refraction 4. Explain the relationship between Huygen's Principle and the Law of Reflection and Reaction. 5. Explains the event of total internal reflection. 6. Explain and use Fermat's principle in reflection and refraction events 7. Explain the concepts of geometric optics and wave optics. 8. Explain the interaction between spherical waves and plane mirrors and spherical mirrors. 9. Explain the properties of thin lenses. 10. Explain the principle of Young's Experiment and its benefits. 11. Explain the definition of coherence. 12. Explains interference events in thin layers. 13. Explain the working principle of the Michelson interferometer. 14. Explain and use the concept of diffraction on gratings. 15. Explain and calculate the resolving power of a lattice.	**Criteria:** Evaluation Rubric **Form of Assessment** : Project Results Assessment / Product Assessment	Lectures, discussions, questions and answers, and 3 X 50 exercises		**Material:** Meeting material 14 **Reader:** *Halliday, David, and Robert Resnick (translated by Pantur Silaban and Erwin Sucipto), Physics volume I, Third Edition, Jakarta: Erlangga Publishers, 1987.*	5%

15	1. Understand the propagation properties of light 2. Understand reflection and refraction 3. Understand interference 4. Understand diffraction, grating and spectrum 5. Understand Polarization	1. Explain and calculate the energy and momentum of light. 2. Explain and use the Doppler Effect. 3. Explain and use the Laws of Reflection and Refraction 4. Explain the relationship between Huygen's Principle and the Law of Reflection and Reaction. 5. Explains the event of total internal reflection. 6. Explain and use Fermat's principle in reflection and refraction events 7. Explain the concepts of geometric optics and wave optics. 8. Explain the interaction between spherical waves and plane mirrors and spherical mirrors. 9. Explain the properties of thin lenses. 10. Explain the principle of Young's Experiment and its benefits. 11. Explain the definition of coherence. 12. Explains interference events in thin layers. 13. Explain the working principle of the Michelson interferometer. 14. Explain and use the concept of diffraction on gratings. 15. Explain and calculate the resolving power of a lattice.	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, discussions, questions and answers, and 3 X 50 exercises		**Material:** Meeting material 15 **Reader:** *Halliday, David, and Robert Resnick (translated by Pantur Silaban and Erwin Sucipto), Physics volume I, Third Edition, Jakarta: Erlangga Publishers, 1987.*	10%

16		Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Project Results Assessment / Product Assessment, Test	writing test		**Material:** Meeting material 1-15 **Bibliography:** *Halliday, David, and Robert Resnick (translated by Pantur Silaban and Erwin Sucipto), Physics volume I, Third Edition, Jakarta: Erlangga Publishers, 1987.*	15%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	27.5%
2.	Project Results Assessment / Product Assessment	50%
3.	Test	22.5%
		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.