



**Universitas Negeri Surabaya
Faculty of Engineering,
Mechanical Engineering Undergraduate Study Program**

Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Physics 1	2120103109		T=3	P=0	ECTS=4.77	1	July 16, 2024
AUTHORIZATION	SP Developer		Course Cluster Coordinator			Study Program Coordinator	
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Learning model	Case Studies																																																																																			
Program Learning Outcomes (PLO)	PLO study program that is charged to the course																																																																																			
	PLO-5 Work independently and in groups																																																																																			
	PLO-11 Design and development of solutions that take into account the environment and sustainability																																																																																			
	PLO-14 Science and engineering knowledge																																																																																			
	Program Objectives (PO)																																																																																			
	PO - 1 Knowledge of science and engineering																																																																																			
	PO - 2 Experimentation and data analysis																																																																																			
	PO - 3 Problem analysis																																																																																			
	PLO-PO Matrix																																																																																			
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	PO Matrix at the end of each learning stage (Sub-PO)																																																																																			
<table border="1" style="margin: auto;"> <tr> <th rowspan="2">P.O</th> <th colspan="16">Week</th> </tr> <tr> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th> </tr> <tr> <td>PO-1</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>PO-2</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>PO-3</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>	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																
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Short Course Description | This course discusses the study of basic physics concepts and their application in mechanical engineering, including quantities, systems of units, Newton's law, mechanical waves, impulse momentum, kinematics, dynamics, elasticity, temperature and heat.

References

Main :

1. Frederick j. Buece. 2006.Schaums Outline of theory and problems of College Physics, edisi kesepuluh. Erlangga
2. Halliday, Resnic, Jearl Walker. 2011.Principles of Physics, Ninth Edition. John Wiley & Son.
3. Sears Zemansky. 1986.Fisika Untuk Universitas I. Binacipta.
4. Raymond A. Serway, Jhon W. Jewett, Jr., 2008. Physics for Scientists and Engineers with modern physics, seventh edition, Thomson, USA.
5. Young and Freedman. 2008. Sears and Zemansky's University Physics:with modern physics, 12th edition, Pearson Addison-Wesley.

Supporters:

1. Frederick J. Bueche & David A. Jerde.1995 .Principles of Physics Sixth Edition (H). ISBN-10: 0070088179 / ISBN-13: 9780070088177							
Supporting lecturer		Bellina Yunitasari, S.Si., M.Si. Hanna Zakiyya, S.T., M.T. Handini Novita Sari, S.Pd., 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 communicate their understanding of Units, Quantities and Vectors in physics	<p>1.Students can: Determine quantities in physics</p> <p>2.Explain the symbols and units of physical quantities</p> <p>3.Students are able to carry out operations on vector quantities and apply them (addition, subtraction, multiplication of vectors, resultant force by decomposing vectors)</p> <p>4.Convey ideas/questions</p>	<p>Criteria: student activeness in the teaching and learning process</p> <p>Form of Assessment : Participatory Activities</p>	Discussion lectures and questions and answers 3 X 50		<p>Material: Units, Quantities and Vectors References: Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</p> <hr/> <p>Material: Units, Quantities and Vectors Reference: Frederick j. Buece. 2006.Schaums Outline of theory and problems of College Physics, tenth edition. Erlangga</p>	5%
2	Students are able to communicate their understanding of the kinematics of particles in systems	<p>1.Students can differentiate displacement, speed, acceleration</p> <p>2.Students are able to study and discuss uniform rectilinear motion, uniform rectilinear motion</p> <p>3.Students are able to study and discuss motion in two and three dimensions</p> <p>4.Convey ideas/questions</p>	<p>Criteria: Completeness of reports on the results of particle kinematic analysis in the system</p> <p>Form of Assessment : Participatory Activities</p>	Discussion lectures and questions and answers 3 X 50		<p>Material: Kinematics of particles in systems. References: Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</p> <hr/> <p>Material: Kinematics of particles in systems Reference: Frederick j. Buece. 2006.Schaums Outline of theory and problems of College Physics, tenth edition. Erlangga</p>	5%

3	Students are able to communicate their understanding of the dynamics of a system	<ol style="list-style-type: none"> Students can study and discuss Newton's Laws I, II, III Students can study and discuss equilibrium Students can study, discuss, solve $F=ma$ problems in free fall motion, parabolic motion and circular motion Convey ideas/questions 	<p>Criteria: Completeness of reports on the results of dynamic analysis of a system</p> <p>Form of Assessment : Participatory Activities</p>	Discussion lectures and questions and answers 3 X 50		<p>Material: Dynamics in a system</p> <p>Readers: <i>Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</i></p> <hr/> <p>Material: Dynamics of a system</p> <p>Reference: <i>Frederick j. Buece. 2006. Schaums Outline of theory and problems of College Physics, tenth edition. Erlangga</i></p>	5%
4	Students are able to communicate their understanding of work and kinetic energy	<ol style="list-style-type: none"> Students are able to study, discuss, write work equations and graphs (force-vs-displacement) Students are able to solve problems related to energy and kinetic energy Convey ideas/questions 	<p>Criteria: Completeness of reports on work and kinetic energy analysis results</p> <p>Form of Assessment : Participatory Activities</p>	Discussion lectures and questions and answers 3 X 50		<p>Material: Work and Kinetic Energy</p> <p>References: <i>Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</i></p> <hr/> <p>Material: Work and Kinetic Energy</p> <p>Bibliography: <i>Sears Zemansky. 1986. Physics for I. Binakreati University.</i></p> <hr/> <p>Material: Work and Kinetic Energy</p> <p>References: <i>Raymond A. Serway, Jhon W. Jewett, Jr.,. 2008. Physics for Scientists and Engineers with modern physics, seventh edition, Thomson, USA.</i></p>	5%

5	Students are able to communicate their understanding of potential energy and conservation of energy	<ol style="list-style-type: none"> 1. Students can study and discuss issues related to energy and the law of conservation of mechanical energy 2. Students can apply the law of conservation of energy and use the power formula correctly 3. Convey ideas/questions 	<p>Criteria: Completeness of the report on the results of potential energy analysis and energy conservation</p> <p>Form of Assessment : Participatory Activities</p>	Discussion lectures and questions and answers 3 X 50		<p>Material: Potential Energy and Conservation of Energy</p> <p>References: <i>Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</i></p> <hr/> <p>Material: Potential Energy and Conservation of Energy</p> <p>Reference: <i>Frederick j. Buece. 2006. Schaums Outline of theory and problems of College Physics, tenth edition. Erlangga</i></p> <hr/> <p>Material: Potential Energy and Conservation of Energy</p> <p>References: <i>Young and Freedman. 2008. Sears and Zemansky's University Physics: with modern physics, 12th edition, Pearson Addition-Wesley.</i></p>	5%
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6	Students are able to communicate their understanding of momentum, impulse and collision	<ol style="list-style-type: none"> Students can understand the concepts of momentum, impulse, collision, the law of conservation of momentum Students can analyze impulse and its relationship with momentum Students can solve momentum and impulse problems in the law of conservation of momentum correctly Convey ideas/questions 	<p>Criteria: Complete report on momentum, impulse and collision analysis results</p> <p>Form of Assessment : Participatory Activities</p>	Discussion lectures and questions and answers 3 X 50		<p>Material: Momentum, Impulse and Collision Literature: <i>Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</i></p> <hr/> <p>Material: Momentum, Impulse and Collision Reference: <i>Frederick j. Buece. 2006. Schaums Outline of theory and problems of College Physics, tenth edition. Erlangga</i></p> <hr/> <p>Material: Momentum, Impulse and Collision Bibliography: <i>Frederick J. Bueche & David A. Jerde. 1995. Principles of Physics Sixth Edition (H). ISBN-10: 0070088179 / ISBN-13: 9780070088177</i></p>	5%
7	Students are able to communicate their understanding of the rotation of rigid bodies and the dynamics of rotational motion	<ol style="list-style-type: none"> Students can solve rotational motion problems Students can understand the concept of equilibrium of rigid bodies, moments of inertia and problems with them Students can understand energy changes during rolling motion from a height on a sloping surface 	<p>Criteria: Completeness of the report on the results of the rotational analysis of rigid bodies and the dynamics of rotational motion</p> <p>Form of Assessment : Participatory Activities</p>	Discussion lectures and questions and answers 3 X 50		<p>Material: Rotation of rigid bodies and dynamics of rotational motion. References: <i>Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</i></p> <hr/> <p>Material: Rotation of rigid bodies and dynamics of rotational motion Reference: <i>Frederick j. Buece. 2006. Schaums Outline of theory and problems of College Physics, tenth edition. Erlangga</i></p>	5%

8	Midterm Exam (UTS)	Able to do all the questions correctly	Criteria: Full marks are obtained if you do all the questions correctly	Close book 2 X 50		Material: 1-7 Bibliography: <i>Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</i> <hr/> Material: 1-7 Bibliography: <i>Frederick j. Buece. 2006.Schaums Outline of theory and problems of College Physics, tenth edition. Erlangga</i>	10%
9	Students are able to communicate their understanding of periodic motion	1.Students are able to analyze and discuss a spring that is loaded and then stretched with additional force so that the spring experiences oscillatory motion when the force is released 2.Students are able to solve problems of harmonious motion of objects 3.Accuracy determines the pattern of harmonious motion of objects	Criteria: Completeness of task reports resulting from periodic motion analysis Form of Assessment : Participatory Activities	Lectures, discussions and questions and answers 3 X 50		Material: Periodic motion Reader: <i>Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</i> <hr/> Material: Periodic motion Reference: <i>Raymond A. Serway, Jhon W. Jewett, Jr.,... 2008. Physics for Scientists and Engineers with modern physics, seventh edition, Thomson, USA.</i> <hr/> Material: Periodic motion Reference: <i>Frederick j. Buece. 2006.Schaums Outline of theory and problems of College Physics, tenth edition. Erlangga</i> <hr/> Material: Potential Energy and Conservation of Energy References: <i>Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</i>	5%

10	Students are able to communicate their understanding of mechanical waves	<ol style="list-style-type: none"> 1. Students can understand the concept of mechanical waves 2. Students are able to differentiate between types of mechanical waves 3. Students are able to solve problems related to the characteristics of mechanical waves (wavelength, period, frequency,) 	<p>Criteria: Full marks are obtained if you do all the questions correctly</p> <p>Form of Assessment : Participatory Activities, Tests</p>	Lectures, discussions and questions and answers 3 X 50		<p>Material: Mechanical waves Reader: <i>Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</i></p> <hr/> <p>Material: Mechanical waves Reference: <i>Frederick j. Buece. 2006. Schaums Outline of theory and problems of College Physics, tenth edition. Erlangga</i></p> <hr/> <p>Material: Mechanical waves Reader: <i>Young and Freedman. 2008. Sears and Zemansky's University Physics: with modern physics, 12th edition, Pearson Addition-Wesley.</i></p>	10%
11	Students are able to communicate their understanding of sound and gravity	<ol style="list-style-type: none"> 1. Students can understand the concepts, characteristics, properties, classification of sounds 2. Students are able to calculate the speed of sound propagation in solid, liquid and gas media 3. Students are able to apply the concept of calculating the Doppler effect to sound correctly 4. Students are able to understand the concepts of Gravitational Force, Function, Laws & Gravitational Fields 5. Students are able to apply the concept of Kepler's Law calculations related to Earth's gravity correctly 6. Convey ideas/questions 	<p>Criteria: Complete report on sound and gravity analysis results</p> <p>Form of Assessment : Participatory Activities</p>	Lectures, discussions and questions and answers 3 X 50		<p>Material: Sound and gravity Reader: <i>Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</i></p> <hr/> <p>Material: Sound and gravity Reference: <i>Raymond A. Serway, Jhon W. Jewett, Jr... 2008. Physics for Scientists and Engineers with modern physics, seventh edition, Thomson, USA.</i></p>	5%

12	Students are able to communicate their understanding of balance and elasticity	<ol style="list-style-type: none"> 1.Students can differentiate stress, strain and modulus 2.Students can draw stress vs strain graphs 3.Students can plot modulus from stress vs strain graphs 4.Students can solve the problem of the influence of force on the characteristics of materials 5.Students can solve problems regarding the modulus characteristics of materials 6.Convey ideas/questions 	<p>Criteria: Completeness of the report on the results of the Balance and Elasticity analysis</p> <p>Form of Assessment : Participatory Activities</p>	Lectures, discussions and questions and answers 3 X 50		<p>Material: Balance and Elasticity</p> <p>References: <i>Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</i></p> <hr/> <p>Material: Balance and Elasticity</p> <p>Reader: <i>Sears Zemansky. 1986. Physics for I. Binakreati University.</i></p> <hr/> <p>Material: Equilibrium and Elasticity</p> <p>Bibliography: <i>Frederick J. Bueche & David A. Jerde. 1995. Principles of Physics Sixth Edition (H). ISBN-10: 0070088179 / ISBN-13: 9780070088177</i></p>	5%
13	Students are able to communicate their understanding of fluids and fluid dynamics	<ol style="list-style-type: none"> 1.Students can understand the concept of hydrostatic pressure, Pascal's law, Archimedes' law, fluid dynamics, Bernoulli's equation 2.Students can solve fluid and fluid dynamics problems correctly 3.Convey ideas/questions 	<p>Criteria: Full marks are obtained if you do all the questions correctly</p> <p>Form of Assessment : Participatory Activities</p>	Lectures, discussions and questions and answers 3 X 50		<p>Material: Fluids and fluid dynamics</p> <p>References: <i>Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</i></p> <hr/> <p>Material: Fluids and fluid dynamics</p> <p>Reference: <i>Frederick j. Buece. 2006.Schaums Outline of theory and problems of College Physics, tenth edition. Erlangga</i></p> <hr/> <p>Material: Fluids and fluid dynamics</p> <p>References: <i>Raymond A. Serway, Jhon W. Jewett, Jr.,. 2008. Physics for Scientists and Engineers with modern physics, seventh edition, Thomson, USA.</i></p>	10%

14	Students are able to communicate their understanding of energy and heat	<ol style="list-style-type: none"> 1. Students can: Understand the concepts of energy and heat 2. Explain the concept of temperature equilibrium between two objects 3. Students can analyze the heat energy needed to change the state of materials 4. Students are able to solve heat transfer problems between materials and heat energy problems correctly 5. ask ideas/questions 	<p>Criteria: Full marks are obtained if you are able to apply the practice correctly</p> <p>Form of Assessment : Participatory Activities</p>	Lectures, discussions and questions and answers 3 X 50		<p>Material: Energy and heat</p> <p>Bibliography: <i>Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</i></p> <hr/> <p>Material: Energy and heat</p> <p>Reader: <i>Young and Freedman. 2008. Sears and Zemansky's University Physics: with modern physics, 12th edition, Pearson Addition-Wesley.</i></p>	5%
15	Students are able to communicate their understanding of gas kinetics and ideal gases	<ol style="list-style-type: none"> 1. Students are able to understand the concepts of kinetic theory of gases, ideal gases, and thermodynamics 2. Students are able to analyze gas kinetics in ideal conditions in isochoric, isobaric and isothermic processes 3. Students are able to analyze energy changes in isochoric, isobaric and isobaric processes 4. Accuracy in solving gas characteristic problems and gas kinetics problems 	<p>Criteria: Full marks are obtained if you do all the questions correctly</p> <p>Form of Assessment : Participatory Activities</p>	Lectures, discussions and questions and answers 3 X 50		<p>Material: Gas kinetics and ideal gas</p> <p>References: <i>Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</i></p> <hr/> <p>Material: Gas kinetics and ideal gas</p> <p>Reference: <i>Sears Zemansky. 1986. Physics for I. Binakreati University.</i></p>	5%
16	Final Semester Examination (UAS)	Able to answer all questions correctly	<p>Criteria: Full marks are obtained if you are able to answer all questions correctly</p>	Close book 2 X 50		<p>Material: 9-15</p> <p>Bibliography: <i>Halliday, Resnic, Jearl Walker. 2011. Principles of Physics, Ninth Edition. John Wiley & Son.</i></p> <hr/> <p>Material: 9-15</p> <p>Bibliography: <i>Sears Zemansky. 1986. Physics for I. Binakreati University.</i></p>	10%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	75%
2.	Test	5%
		80%

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** ability in the process and student learning outcomes are specific and measurable statements that identify the ability 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.