	Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Physics Education Undergraduate Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Basic Physics I	8420304064	Compulsory Study Program Subjects	T=3	P=1	ECTS=6.36	1	August 7, 2023

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

Program Objectives (PO)

PO - 1	Mastering basic physics concepts about matter, energy and structure of substances, as well as the application of physics in technology
PO - 2	Able to apply basic physics concepts and appropriate mathematical methods to obtain solutions to quantitative problems in physics.
PO - 3	Able to carry out Basic Physics practicum activities by applying scientific methods
PO - 4	Able to communicate physics concepts effectively during the learning process
PO - 5	Able to work independently effectively and collaborate in groups on lecture and practicum assignments
PO - 6	Able to demonstrate a scientific attitude and critical thinking in solving problems faced both academically and socially

PLO-PO Matrix

P.O
PO-1
PO-2
PO-3
PO-4
PO-5
PO-6

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																
PO-4																
PO-5																
PO-6																

Short Course Description

This course examines quantities, units and vectors, particle kinematics: 1D Motion and 2D Motion; particle dynamics; business and energy: conservation of business and energy and its application; conservative style; impulse and momentum; rigid body equilibrium; static and dynamic fluids; vibrations and waves; thermometry; temperature and heat; kinetic theory of gases; and the laws of thermodynamics through observing physical phenomena with simple mathematical analysis by applying case studies and experiential learning in laboratory activities on the topics of Newton's 2nd Law, Free Fall Motion, Pulley Systems, center of mass balance, mathematical pendulum, spring constant, resonance tube, viscosity, light thermometer, specific heat of calorimeter, specific heat of solids, heat of melting of ice.

References

Main :

	1. Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720. 2. Heimbecker, B., Nowikow, I., Howes, C. T., Mantha, J., Smith, B. P., van Bemmel, H. M. 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ., pp. 1-816. 3. Serway, R. A. 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058. 4. Halliday, R. Resnick, J. Walker. Fundamental of Physiscs, 10th Edition. Wiley: 2014.
	Supporters:
	1. Abdullah, M. 2016. Fisika Dasar 1. Bandung: ITB Press, pp. 1-1063. 2. Buku panduan Praktikum Fisika Dasar 1.
Supporting lecturer	Dr. Zainul Arifin Imam Supardi, M.Si. Dr. Titin Sunarti, M.Si. Woro Setyarsih, S.Pd., M.Si. Abu Zainuddin, S.Pd., M.Pd. Dr. Rohim Aminullah Firdaus, S.Pd, M.Si Mukhayyarotin Niswati Rodliyatul Jauhariyah, S.Pd., M.Pd. Dr. Muhammad Satriawan, M.Pd. Dr. Binar Kurnia Prahani, S.Pd., M.Pd. Muhammad Habibbulloh, M.Pd. Dr. Muhimmatul Khoiro, S. Si.

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	1. Able to master the concepts of quantities, units and vectors 2. Able to apply basic physics concepts correctly to obtain solutions to contextual problems. 3. Able to analyze data with precise explanations, and conclusions based on data and guided/independent analysis for learning and/or research	1. Identify problem cases 2. Identify physics concepts and relate them to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** Complete assignments completely **Form of Assessment** : Participatory Activities, Portfolio Assessment	Form: Classical classroom Method: Case study Student assignment: Determine the trajectory using position, speed and speed vectors using a case study of airplane flying coordinates, location/area of origin to campus via Google Map 3 X 50		**Material:** Quantities, Units and Vectors **References:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** Quantities, Units and Vectors **References:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada : Irwin Publ., pp. 1-816.* **Material:** Quantities, Units and Vectors **References:** *Serway, RA 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058.* **Material:** Quantities, Units and Vectors **References:** *Halliday, R. Resnick, J. Walker. Fundamentals of Physics, 10th Edition. Wiley: 2014.*	2%

2	1. Able to master the concept of particle kinematics: 1D Motion and 2D Motion 2. Able to apply basic physics concepts correctly to obtain solutions to contextual problems 3. Able to carry out practical activities in accordance with systematic procedures or procedures to solve problems that involve careful observation and measurement as well as scientific hypotheses 4. Able to work independently effectively and collaborate in lecture assignment groups in the Basic Physics 1 course 5. Able to analyze data with precise explanations, and conclusions based on data and guided/independent analysis for learning and/or research	1. Identify problem cases 2. Carrying out a complete series of practicums (pre-lab, data collection, reports).	**Criteria:** Full marks will be given if all questions can be solved correctly **Forms of Assessment** : Participatory Activities, Portfolio Assessment, Practical Assessment	Form: Classical classroom Method: Case study and practicum (Free Fall Movement) Student assignment: 1) Determine the speed and speed of each vehicle (foot, motorbike, car, bus) from Google map 2) Look for supporting data related to movement GMB with the example above 3) Identifying banana kicks. The assignment is with a case study: (1) airplane flight coordinates, (2) location/area of origin to campus via Google map, so that data on path length, speed, time can be obtained, from which data can be obtained. compared between translational and rotational motion 3 X 50		**Material:** Particle Kinematics **References:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** Particle Kinematics **References:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ ., pp. 1-816.* **Material:** Particle Kinematics **Reference:** *Serway, RA 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058.* **Material:** Particle Kinematics **References:** *Halliday, R. Resnick, J. Walker. Fundamentals of Physics, 10th Edition. Wiley: 2014.*	5%
3	1. Able to master the concept of particle dynamics 2. Able to apply basic physics concepts correctly to obtain solutions to contextual problems. 3. Able to carry out practical activities in accordance with systematic procedures or procedures to solve problems that involve careful observation and measurement as well as scientific hypotheses 4. Able to work independently effectively and collaborate in lecture assignment groups in the Basic Physics 1 course 5. Able to analyze data with precise explanations, and conclusions based on data and guided/independent analysis for learning and/or research	1. Identify problem cases 2. Identify physics concepts and relate physics concepts to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** 1. Complete n tasks completely 2. Carrying out a complete series of practicums (pre-lab, data collection, reports). **Forms of Assessment** : Participatory Activities, Portfolio Assessment, Practical Assessment, Practical / Performance	Form: Classical classroom Method: Case study and practicum (friction force, pulley system) Student assignment: 1) Identify the forces that work in cases related to simple planes, 2) Carry out practicum activities according to the assignment topic with case studies: move goods with a simple plane concept (inclined plane and pulley) 3 X 50		**Material:** Particle Dynamics **References:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** Particle Dynamics **References:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ ., pp. 1-816.* **Material:** Particle Dynamics **Reference:** *Serway, RA 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058.* **Material:** Particle Dynamics **References:** *Halliday, R. Resnick, J. Walker. Fundamentals of Physics, 10th Edition. Wiley: 2014.*	5%

4	1. Able to master the concept of particle dynamics 2. Able to apply basic physics concepts correctly to obtain solutions to contextual problems. 3. Able to carry out practical activities in accordance with systematic procedures or procedures to solve problems that involve careful observation and measurement as well as scientific hypotheses 4. Able to work independently effectively and collaborate in lecture assignment groups in the Basic Physics 1 course 5. Able to analyze data with precise explanations, and conclusions based on data and guided/independent analysis for learning and/or research	1. Identify problem cases 2. Identify physics concepts and relate physics concepts to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** 1. Complete n tasks completely 2. Carrying out a complete series of practicums (pre-lab, data collection, reports). **Forms of Assessment** : Participatory Activities, Portfolio Assessment, Practical Assessment, Practical / Performance	Form: Classical classroom Method: Case study and practicum (friction force, pulley system) Student assignment: 1) Identify the forces that work in cases related to simple planes, 2) Carry out practicum activities according to the assignment topic with case studies: move goods with a simple plane concept (inclined plane and pulley) 3 X 50		**Material:** Particle Dynamics **References:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** Particle Dynamics **References:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ ., pp. 1-816.* **Material:** Particle Dynamics **Reference:** *Serway, RA 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058.* **Material:** Particle Dynamics **References:** *Halliday, R. Resnick, J. Walker. Fundamentals of Physics, 10th Edition. Wiley: 2014.*	5%

5	1. Able to master the concepts of work and energy as well as conservative style 2. Able to apply basic physics concepts correctly to obtain solutions to contextual problems. 3. Able to work independently effectively and collaborate in lecture assignment groups in the Basic Physics 1 course.	1. Identify problem cases 2. Identify physics concepts and relate physics concepts to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** Complete assignments completely **Form of Assessment** : Portfolio Assessment	Form: Classical classroom Method: Case study Student assignment: Solve the problem of lato-lato collisions through independent assignments The assignment is with a case study: the lato-lato phenomenon seen from Ep and Ek 3 X 50		**Material:** Work, Energy and Conservative Forces **References:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** Work, Energy and Conservative Forces **References:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ., pp. 1-816.* **Material:** Work, Energy and Conservative Force **Reference:** *Serway, RA 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058.* **Material:** Work, Energy and Conservative Style **References:** *Halliday, R. Resnick, J. Walker. Fundamentals of Physics, 10th Edition. Wiley: 2014.*	3%

6	1. Able to master the concepts of impulse and momentum 2. Able to apply basic physics concepts correctly to obtain solutions to contextual problems. 3. Able to work independently effectively and collaborate in lecture assignment groups in the Basic Physics 1 course.	1. Identify problem cases 2. Identify physics concepts and relate physics concepts to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** Complete assignments completely	Form: Classical classroom Method: Case study Student assignment: solve the lato-lato collision problem through independent assignments The assignment is with a case study: the ato-lato phenomenon as seen from the 3 X 50 collision		**Material:** Impulse and momentum **References:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** Impulse and momentum **Bibliography:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ., pp. 1-816.* **Material:** Impulse and momentum **Reference:** *Serway, RA 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058.* **Material:** Impulse and momentum **References:** *Halliday, R. Resnick, J. Walker. Fundamentals of Physics, 10th Edition. Wiley: 2014.*	2%
7	1. Able to master the concept of equilibrium of rigid bodies 2. Able to apply basic physics concepts correctly to obtain solutions to contextual problems. 3. Able to carry out practical activities in accordance with systematic procedures or procedures to solve problems that involve careful observation and measurement as well as scientific hypotheses 4. Able to communicate physics concepts effectively during the learning process in the basic physics course 1 5. Able to work independently effectively and collaborate in lecture assignment groups in the Basic Physics 1 course 6. Able to analyze data with precise explanations, and conclusions based on data and guided/independent analysis for learning and/or research	Students are able to explain the concept of rotational dynamics and its calculations	**Criteria:** 1. Identify problem cases 2. Identify physics concepts and relate physics concepts to problem cases 3. Analyze problems with mathematical formulas and apply them **Forms of Assessment** : Participatory Activities, Portfolio Assessment, Practical Assessment	Form: Classical classroom Method: Case study and practicum (center of mass balance) Student assignment: 1) Move the 'bomb' so it doesn't explode 2) Carry out practical activities according to the topic The assignment is with a case study: bomb defusal game (illustration of a ball on a blade bamboo that had to be moved to a container, with the help of several pieces of rope attached to the bamboo, 6 people were moved) 3 X 50		**Material:** Equilibrium of rigid bodies **References:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** Equilibrium of rigid bodies **References:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ., pp. 1-816.* **Material:** Equilibrium of rigid bodies **Reference:** *Serway, RA 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058.* **Material:** Equilibrium of rigid bodies **References:** *Halliday, R. Resnick, J. Walker. Fundamentals of Physics, 10th Edition. Wiley: 2014.*	5%
							20%

8	Students are able to understand the concept of vibration	Students are able to explain the concept of vibration, and are skilled at carrying out calculations related to vibration.	**Criteria:** Accuracy in answering questions **Form of Assessment** : Test	Written Test 8 X 50		**Material:** quantities, units and vectors; particle kinematics: 1D motion (GLB, GLBB) and 2D motion (parabolic motion, uniform circular motion; particle dynamics (Newton's 1, 2 and 3 laws and their applications); work and energy: conservation of work and energy and their applications; conservative force; impulse and momentum; equilibrium of rigid bodies **References:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** quantities, units and vectors; particle kinematics: 1D motion (GLB, GLBB) and 2D motion (parabolic motion, uniform circular motion; particle dynamics (Newton's 1, 2 and 3 laws and their applications); work and energy: conservation of work and energy and their applications; conservative force; impulse and momentum; equilibrium of rigid bodies **References:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ., pp. 1-816.* **Material:** quantities, units and vectors; particle kinematics: 1D motion (GLB, GLBB) and 2D motion (parabolic motion, uniform circular motion; particle dynamics (Newton's 1, 2 and 3 laws and their applications); work and energy: conservation of work and energy and their applications; conservative force; impulse and momentum; equilibrium of rigid bodies **Bibliography:** *Serway, RA 2018. College Physics, US: Thomson•Learning*	

						Publ., pp. 1-1058.	
9	1. Able to master static and dynamic fluid concepts 2. Able to apply basic physics concepts correctly to obtain solutions to contextual problems. 3. Able to carry out practical activities in accordance with systematic procedures or procedures to solve problems that involve careful observation and measurement as well as scientific hypotheses 4. Able to work independently effectively and collaborate in lecture assignment groups in the Basic Physics 1 course 5. Able to analyze data with precise explanations, and conclusions based on data and guided/independent analysis for learning and/or research	1. Identify problem cases 2. Identify physics concepts and relate physics concepts to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** 1. Complete assignments completely 2. Carrying out a complete series of practicums (pre-lab, data collection, reports). **Forms of Assessment** : Participatory Activities, Portfolio Assessment, Practical Assessment, Practical / Performance	Form: Classical classroom Method: Case study and practicum (viscosity) Student assignments: 1) Work on the questions in the book 2) Carry out practical activities according to the topic 3 X 50		**Material:** Static and dynamic fluids **References:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** Static and dynamic fluids **References:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ., pp. 1-816.* **Material:** Static and dynamic fluids **Reference:** *Serway, RA 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058.* **Material:** Static and dynamic fluids **References:** *Halliday, R. Resnick, J. Walker. Fundamentals of Physics, 10th Edition. Wiley: 2014.*	5%
10	1. Able to master the concept of Vibrations and Waves 2. Able to apply basic physics concepts correctly to obtain solutions to contextual problems. 3. Able to carry out practical activities in accordance with systematic procedures or procedures to solve problems that involve careful observation and measurement as well as scientific hypotheses 4. Able to work independently effectively and collaborate in lecture assignment groups in the Basic Physics 1 course 5. Able to analyze data with precise explanations, and conclusions based on data and guided/independent analysis for learning and/or research	1. Identify problem cases 2. Identify physics concepts and relate physics concepts to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** 1. Complete n tasks completely 2. Carrying out a complete series of practicums (pre-lab, data collection, reports). **Forms of Assessment** : Participatory Activities, Portfolio Assessment, Practical Assessment, Practical / Performance	Form: Classical classroom Method: Case study and practicum (mathematical pendulum, spring constant, resonant tube) Student assignments: 1) Calculate heart frequency 2) Visualize the real waveform of a string and relate the related physical quantities 3 X 50		**Material:** Vibrations and Waves **References:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** Vibrations and Waves **References:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ., pp. 1-816.* **Material:** Vibrations and Waves **Reference:** *Serway, RA 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058.* **Material:** Vibrations and Waves **References:** *Halliday, R. Resnick, J. Walker. Fundamentals of Physics, 10th Edition. Wiley: 2014.*	5%

11	1. Able to master the concept of thermometry 2. Able to apply basic physics concepts correctly to obtain solutions to contextual problems. 3. Able to carry out practical activities in accordance with systematic procedures or procedures to solve problems that involve careful observation and measurement as well as scientific hypotheses 4. Able to work independently effectively and collaborate in lecture assignment groups in the Basic Physics 1 course 5. Able to analyze data with precise explanations, and conclusions based on data and guided/independent analysis for learning and/or research	1. Identify problem cases 2. Identify physics concepts and relate physics concepts to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** 1. Complete n tasks completely 2. Carrying out a complete series of practicums (pre-lab, data collection, reports). **Forms of Assessment** : Participatory Activities, Portfolio Assessment, Practical Assessment	Form: Classical classroom Method: Case study and practicum (application of a thermometer) Student assignments: 1) Work on the questions in the book 2) Carry out practical activities according to the topic 3 X 50		**Material:** Thermometry **References:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** Thermometry **References:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ. , pp. 1-816.* **Material:** Thermometry **Bibliography:** *Serway, RA 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058.*	5%
12	1. Able to master the concepts of Temperature and Heat 2. Able to apply basic physics concepts correctly to obtain solutions to contextual problems. 3. Able to carry out practical activities in accordance with systematic procedures or procedures to solve problems that involve careful observation and measurement as well as scientific hypotheses 4. Able to work independently effectively and collaborate in lecture assignment groups in the Basic Physics 1 course 5. Able to analyze data with precise explanations, and conclusions based on data and guided/independent analysis for learning and/or research	1. Identify problem cases 2. Identify physics concepts and relate physics concepts to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** 1. Complete n tasks completely 2. Carrying out a complete series of practicums (pre-lab, data collection, reports). **Forms of Assessment** : Participatory Activities, Portfolio Assessment, Practical Assessment	Form: Classical classroom Method: Method: Case study and practicum (specific heat of calorimeter, specific heat of solids, black principle) Student assignment: Analyze physics concepts with case studies Household physics (cooking) 3 X 50		**Material:** Temperature and heat **References:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** Temperature and heat **References:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ., pp. 1-816.* **Material:** Temperature and heat **Reference:** *Serway, RA 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058.*	5%

13	1. Able to master the concept of Gas Kinetic Theory 2. Able to apply basic physics concepts correctly to obtain solutions to contextual problems. 3. Able to carry out practical activities in accordance with systematic procedures or procedures to solve problems that involve careful observation and measurement as well as scientific hypotheses 4. Able to work independently effectively and collaborate in lecture assignment groups in the Basic Physics 1 course	1. Identify problem cases 2. Identify physics concepts and relate physics concepts to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** Can connect concepts in the form of mind mapping in detail **Form of Assessment** : Participatory Activities, Portfolio Assessment	Form: Classical classroom Method: Discussion and presentation Student assignment: 1) create a mind map from relevant reference sources, 2) work on the questions in the 3 X 50 guidebook		**Material:** Kinetic Theory of Gases **Bibliography:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** Kinetic Theory of Gases **Bibliography:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ., pp. 1-816.* **Material:** Kinetic Theory of Gases **References:** *Serway, RA 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058.*	5%
14	1. Able to master the concept of the Law of Thermodynamics 2. Able to apply basic physics concepts correctly to obtain solutions to contextual problems. 3. Able to carry out practical activities in accordance with systematic procedures or procedures to solve problems that involve careful observation and measurement as well as scientific hypotheses 4. Able to work independently effectively and collaborate in lecture assignment groups in the Basic Physics 1 course	1. Identify problem cases 2. Identify physics concepts and relate physics concepts to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** Complete assignments completely **Form of Assessment** : Participatory Activities, Portfolio Assessment	Form: Classical classroom Method: Discussion and presentation Student assignment: explain the working principles of applying thermodynamics, calculate work efficiency and relate work, heat and energy in the system. With case studies of the application of thermodynamics in household appliances (AC, refrigerator, car radiator, motorbike engine (2 stroke, 4 stroke), etc.) 3 X 50		**Material:** Laws of Thermodynamics **Bibliography:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** Laws of Thermodynamics **Bibliography:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ ., pp. 1-816.* **Material:** Laws of Thermodynamics **Reference:** *Serway, RA 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058.*	3%

15	1. Able to master the concept of the Law of Thermodynamics 2. Able to apply basic physics concepts correctly to obtain solutions to contextual problems. 3. Able to carry out practical activities in accordance with systematic procedures or procedures to solve problems that involve careful observation and measurement as well as scientific hypotheses 4. Able to work independently effectively and collaborate in lecture assignment groups in the Basic Physics 1 course	1. Identify problem cases 2. Identify physics concepts and relate physics concepts to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** Complete assignments completely **Form of Assessment** : Participatory Activities, Portfolio Assessment	Form: Classical classroom Method: Discussion and presentation Student assignment: explain the working principles of applying thermodynamics, calculate work efficiency and relate work, heat and energy in the system. With case studies of the application of thermodynamics in household appliances (AC, refrigerator, car radiator, motorbike engine (2 stroke, 4 stroke), etc.) 3 X 50		**Material:** Laws of Thermodynamics **Bibliography:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** Laws of Thermodynamics **Bibliography:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ ., pp. 1-816.* **Material:** Laws of Thermodynamics **Reference:** *Serway, RA 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058.*	3%
16			**Form of Assessment** : Test	Written test 2 x 50		**Material:** static and dynamic fluids; vibrations and waves; thermometry; temperature and heat; kinetic theory of gases; and laws of thermodynamics **Bibliography:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** static and dynamic fluids; vibrations and waves; thermometry; temperature and heat; kinetic theory of gases; and laws of thermodynamics **Bibliography:** *Heimbecker, B., Nowikow, I., Howes, CT, Mantha, J., Smith, BP, van Bemmel, HM 2002. Physics: concepts and connections: Book 2. Toronto, Canada: Irwin Publ. , pp. 1-816.* **Material:** static and dynamic fluids; vibrations and waves; thermometry; temperature and heat; kinetic theory of gases; and laws of thermodynamics **Bibliography:** *Serway, RA 2018. College Physics. Belmont, US: Thomson•Learning Publ., pp. 1-1058.*	26%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	18.18%
2.	Portfolio Assessment	21.18%
3.	Practical Assessment	11.68%
4.	Practice / Performance	5%
5.	Test	46%
		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** 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.