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

SEMESTER LEARNING PLAN

Courses	**CODE**	**Course Family**	**Credit Weight**			**SEMESTER**	**Compilation Date**
Basic Physics I	4520104055	Compulsory Study Program Subjects	**T=3**	**P=1**	**ECTS=6.36**	1	August 21, 2023

AUTHORIZATION	**SP Developer**	**Course Cluster Coordinator**	**Study Program Coordinator**
	Arie Realita, M.Si.	Lydia Rohmawati, M.Si.	Prof. Dr. Munasir, S.Si., M.Si.

Learning model	**Case Studies**	
Program Learning Outcomes (PLO)	**PLO study program which is charged to the course**	
	PLO-5	Able to demonstrate as a good scientist, critical thinking skills and innovation in research and professional fields.
	PLO-7	Communicate their ideas and/or research results in academic writing and speaking effectively.
	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	PLO-5	PLO-7
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: ThomsonLearning Publ., pp. 1-1058. 4. Halliday, R. Resnick, J. Walker. 2014. Fundamental of Physics, 10th Edition. Wiley
Supporters:	
	1. Abdullah, M. 2016. Fisika Dasar 1 . Bandung: ITB Press. 2. Tim Fisika Dasar. 2014. Petunjuk Praktikum Fisika Dasar. Lab Fisika Dasar, Jurusan Fisika, FMIPA Unesa. Surabaya: Unesa Press.
Supporting lecturer	Prof. Tjipto Prastowo, Ph.D. Dr. Frida Ulfah Ermawati, M.Sc. Prof. Dr. Munasir, S.Si., M.Si. Nugrahani Primary Putri, S.Si., M.Si. Lydia Rohmawati, S.Si., M.Si. Dr. Rohim Aminullah Firdaus, S.Pd, M.Si Arie Realita, M.Si. Dr. Fitriana, S.Si. Muhammad Nurul Fahmi, S.Si., M.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 the task 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 4 X 50	Virtual face-to-face lecture (Zoom)	**Material:** Quantities, units and vectors **References:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley* **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 **Reference:** *Serway, RA 2018. College Physics. Belmont, US: ThomsonLearning Publ., pp. 1-1058.* **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.*	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 or 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 them to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** 1. complete the task completely 2. carry 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 (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 4 X 50	Virtual face-to-face lecture (Zoom)	**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: ThomsonLearning Publ., pp. 1-1058.* **Material:** Particle kinematics **References:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley* **Material:** Fisdas Practical Material 1 **Library:** *Basic Physics Team. 2014. Basic Physics Practical Instructions. Basic Physics Lab, Physics Department, FMIPA Unesa. Surabaya: Unesa Press.*	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 or 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 them to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** 1. complete the task completely 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, Practical / Performance	Form: Classical classroom Method: Case study and practicum (friction force, pulley system) Student assignments: 1) Identify the forces that work in cases related to simple planes, 2) Carry out practical activities according to the assignment topic with case studies: move goods with a simple plane concept (inclined plane and pulley) 4 X 50	Virtual face-to-face lecture (Zoom)	**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: ThomsonLearning Publ., pp. 1-1058.* **Material:** Particle Dynamics **References:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley* **Material:** Fisdas Practical Material 1 **Library:** *Basic Physics Team. 2014. Basic Physics Practical Instructions. Basic Physics Lab, Physics Department, FMIPA Unesa. Surabaya: Unesa Press.*	3%

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 or 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 them to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** 1. complete the task completely 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, Practical / Performance	Form: Classical classroom Method: Case study and practicum (friction force, pulley system) Student assignments: 1) Identify the forces that work in cases related to simple planes, 2) Carry out practical activities according to the assignment topic with case studies: move goods with a simple plane concept (inclined plane and pulley) 4 X 50	Virtual face-to-face lecture (Zoom)	**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: ThomsonLearning Publ., pp. 1-1058.* **Material:** Particle Dynamics **References:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley* **Material:** Fisdas Practical Material 1 **Library:** *Basic Physics Team. 2014. Basic Physics Practical Instructions. Basic Physics Lab, Physics Department, FMIPA Unesa. Surabaya: Unesa Press.*	3%

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 or collaborate in lecture assignment groups in the Basic Physics 1 course	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 the task completely **Forms of Assessment** : Participatory Activities, Portfolio Assessment, Practice / Performance	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 4 X 50	Virtual face-to-face lecture (Zoom)	**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 Style **References:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley* **Material:** Work, Energy and Conservative Force **Reference:** *Serway, RA 2018. College Physics. Belmont, US: ThomsonLearning Publ., pp. 1-1058.*	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 or collaborate in lecture assignment groups in the Basic Physics 1 course	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 the task completely **Forms of Assessment** : Participatory Activities, Portfolio Assessment, Practice / Performance	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 4 X 50 collision	Virtual face-to-face lecture (Zoom)	**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: ThomsonLearning Publ., pp. 1-1058.* **Material:** Impulse and momentum **References:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley* **Material:** Fisdas Practical Material 1 **Library:** *Basic Physics Team. 2014. Basic Physics Practical Instructions. Basic Physics Lab, Physics Department, FMIPA Unesa. Surabaya: Unesa Press.*	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 or 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	1. Identify problem cases 2. Identify physics concepts and relate them to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** 1. complete the task completely 2. carry 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 (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, moved 6 people) 4 X 50	Virtual face-to-face lecture (Zoom)	**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: ThomsonLearning Publ., pp. 1-1058.* **Material:** Equilibrium of rigid bodies **References:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley* **Material:** Fisdas Practical Material 1 **Library:** *Basic Physics Team. 2014. Basic Physics Practical Instructions. Basic Physics Lab, Physics Department, FMIPA Unesa. Surabaya: Unesa Press.*	5%

8	1. Able to master the concepts of 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 2. Able to understand UTS questions well	1. Identify problem cases 2. Identify physics concepts and relate them to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** do the UTS questions correctly **Form of Assessment** : Test	4 X 50 concept mastery test		**Material:** Fisdas UTS Material 1 **References:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** UTS Fisdas 1 Material **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:** Fisdas UTS Material 1 **Reference:** *Serway, RA 2018. College Physics. Belmont, US: ThomsonLearning Publ., pp. 1-1058.* **Material:** Fisdas UTS Material 1 **References:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley*	20%

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 or 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 them to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** 1. Complete assignments completely 2. carry 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 4 X 50 topic	Virtual face-to-face lecture (Zoom)	**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: ThomsonLearning Publ., pp. 1-1058.* **Material:** Static and dynamic fluids **References:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley* **Material:** Fisdas Practical Material 1 **Library:** *Basic Physics Team. 2014. Basic Physics Practical Instructions. Basic Physics Lab, Physics Department, FMIPA Unesa. Surabaya: Unesa Press.*	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 or 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 them to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** 1. Complete assignments completely 2. carry 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 and spring constant) Student assignments: 1) Calculate heart frequency 2) Visualize real string waveforms and relate the related physical quantities 4 X 50	Virtual face-to-face lecture (Zoom)	**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: ThomsonLearning Publ., pp. 1-1058.* **Material:** Vibrations and waves **References:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley* **Material:** Fisdas Practical Material 1 **Library:** *Basic Physics Team. 2014. Basic Physics Practical Instructions. Basic Physics Lab, Physics Department, FMIPA Unesa. Surabaya: Unesa Press.*	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 or 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 them to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** 1. Complete assignments completely 2. carry 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 (application of a thermometer) Student assignments: 1) Work on the questions in the book 2) Carry out practical activities according to the topic 4 X 50	Virtual face-to-face lecture (Zoom)	**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: ThomsonLearning Publ., pp. 1-1058.* **Material:** Thermometry **Bibliography:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley* **Material:** Fisdas Practical Material 1 **Library:** *Basic Physics Team. 2014. Basic Physics Practical Instructions. Basic Physics Lab, Physics Department, FMIPA Unesa. Surabaya: Unesa Press.*	4%

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 or 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 them to problem cases 3. Analyze problems with mathematical formulas and apply them	**Criteria:** 1. Complete assignments completely 2. carry 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 (specific heat of calorimeter, specific heat of solids, black principle) Student assignment: Analyze physics concepts with case studies Household physics (cooking) 4 X 50	Virtual face-to-face lecture (Zoom)	**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: ThomsonLearning Publ., pp. 1-1058.* **Material:** Temperature and Heat **References:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley* **Material:** Fisdas Practical Material 1 **Library:** *Basic Physics Team. 2014. Basic Physics Practical Instructions. Basic Physics Lab, Physics Department, FMIPA Unesa. Surabaya: Unesa Press.*	3%

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 or 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 them 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 4 X 50 guidebook	Virtual face-to-face lecture (Zoom)	**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: ThomsonLearning Publ., pp. 1-1058.* **Material:** Kinetic Theory of Gases **References:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley*	3%
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 or 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 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: Student discussion and presentation : explaining the working principles of applying thermodynamics, calculating work efficiency and relating 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.) 4 X 50	Virtual face-to-face lecture (Zoom)	**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: ThomsonLearning Publ., pp. 1-1058.* **Material:** Laws of Thermodynamics **References:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley*	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 or 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 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: Student discussion and presentation : explaining the working principles of applying thermodynamics, calculating work efficiency and relating 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.) 4 X 50	Virtual face-to-face lecture (Zoom)	**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: ThomsonLearning Publ., pp. 1-1058.* **Material:** Laws of Thermodynamics **References:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley*	3%
16	1.Able to understand UAS questions well 2.Able to master static and dynamic fluid concepts; vibrations and waves; thermometry; temperature and heat; kinetic theory of gases; and the laws of thermodynamics	1.Identify problem cases 2.Identify physics concepts and relate them to problem cases 3.Analyze problems with mathematical formulas and apply them	**Criteria:** Able to do UAS questions correctly **Form of Assessment** : Test	Test		**Material:** Mater UAS Fisdas 1 **Bibliography:** *Nowikow, I. and Heimbecker, B. 2017. Physics: concepts and connections: Book 1. Toronto, Canada: Irwin Publ., pp. 1-720.* **Material:** Mater UAS Fisdas 1 **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:** Mater UAS Fisdas 1 **Reference:** *Serway, RA 2018. College Physics. Belmont, US: ThomsonLearning Publ., pp. 1-1058.* **Material:** Mater UAS Fisdas 1 **References:** *Halliday, R. Resnick, J. Walker. 2014. Fundamentals of Physics, 10th Edition. Wiley*	30%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	15.42%

2.	Portfolio Assessment	15.42%
3.	Practical Assessment	8.25%
4.	Practice / Performance	9.92%
5.	Test	50%
		99.01%

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.