



**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
Alloy Material	4520102243		T=2 P=0 ECTS=3.18	8	July 18, 2024
<b>AUTHORIZATION</b>	<b>SP Developer</b>		<b>Course Cluster Coordinator</b>	<b>Study Program Coordinator</b>	
	Lydia Rohmawati, M.Si.		Dr. ZA Imam Supardi, M.Si.	Prof. Dr. Munasir, S.Si., M.Si.	

<b>Learning model</b>	<b>Project Based Learning</b>
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<b>Program Learning Outcomes (PLO)</b>	<b>PLO study program that is charged to the course</b>																																																																																																																						
	<b>Program Objectives (PO)</b>																																																																																																																						
	<b>PO - 1</b>	Mastering the meaning, types/classification, characteristics, manufacturing processes and applications of alloy materials																																																																																																																					
	<b>PO - 2</b>	Have the ability to utilize learning resources from around and ICT to study alloy materials																																																																																																																					
	<b>PO - 3</b>	Have the skills to design the manufacture of useful alloy materials based on situation analysis and supporting data, as well as making prototypes of alloy materials according to design, carrying out analysis and making conclusions based on experimental data																																																																																																																					
	<b>PO - 4</b>	Have the character of life skills (decision making, wise use of resources, communication, accepting differences, leadership, useful marketable skills and self-responsibility) which are reflected in the activities carried out and product activities/designs for making realistic alloy materials.																																																																																																																					
	<b>PO - 5</b>	Have an entrepreneurial character (action oriented, simple thinking, always looking for new opportunities, focused on execution and focusing the energy of everyone in the business) from activities to realizing the design for making alloy materials																																																																																																																					
	<b>PLO-PO Matrix</b>																																																																																																																						
		<table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>P.O</td></tr> <tr><td>PO-1</td></tr> <tr><td>PO-2</td></tr> <tr><td>PO-3</td></tr> <tr><td>PO-4</td></tr> <tr><td>PO-5</td></tr> </table>	P.O	PO-1	PO-2	PO-3	PO-4	PO-5																																																																																																															
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<b>PO Matrix at the end of each learning stage (Sub-PO)</b>																																																																																																																							
	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <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> </thead> <tbody> <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> <tr><td>PO-4</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-5</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> </tbody> </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																	PO-4																	PO-5																
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<b>Short Course Description</b>	This course examines the study of metal alloys and non-metallic alloys, including composites that begin classifying materials according to their composition, characteristics, processing/manufacturing of materials, and application of materials through paper and visual literacy guidance as group investigation-based projects. Assessment of learning outcomes is carried out through experimental results reports (conformity with design, theoretical studies, experimental methods, results and discussions, conclusions, literature), presentation materials in the form of PPT (performance structure, ideas for each presentation, creativity, IT applications), presentation skills (delivery techniques, the ability to defend ideas, respond to the opinions of others, cohesiveness)
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<b>References</b>	<b>Main :</b>
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1. Callister, William D. 2007. Materials Science and Engineering: An Introduction . 7ed. New York: John Wiley & Sons.
2. Chung, Deborah D.L. 2010. Composite Materials: Science and Application . Second Edition. Springer-Verlag London Limited.
3. Chawla, A. K. 2002. Composite Materials: Science and Engeneering. Third Edition. Springer: New York.
4. Kaw, Authar K.. 2006. Mechanics of Composite Materials. Second Edition. Taylor & Francis Group, CRC Press.
5. Setyarsih, W. dan Rohmawati L. 2014. Bahan Ajar Bahan Paduan . Jurusan Fisika Unesa.
6. Anonim. 2014. Kumpulan Artikel Bahan Paduan Jurnal Internasional. Koleksi Tim Bahan Paduan Jurusan Fisika Unesa.

**Supporters:**

**Supporting lecturer** Lydia Rohmawati, 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	Classifying metal alloys based on the composition of the constituent materials, mechanical characteristics, and uses of the materials	a. Identify metal alloys from the composition of the constituent materials, mechanical characteristics, and uses of the materials. Classifying metal alloys based on the composition of the constituent materials, mechanical characteristics, and uses of the materials	<p><b>Criteria:</b> Full score if all tasks are completed within the specified time</p> <p><b>Form of Assessment :</b> Participatory Activities, Portfolio Assessment</p>	Literacy paper, Discussion 2 X 50	Literacy paper, Discussion 2 x 50	<p><b>Materials:</b> Ferrous and non ferrous</p> <p><b>Reference:</b> <i>Callister, William D. 2007. Materials Science and Engineering: An Introduction. 7th ed. New York: John Wiley &amp; Sons.</i></p> <p><b>Material:</b> Classification of metal alloys: (a) Ferrous alloy, (b) Non ferrous alloy, (c) Mechanical characteristics, (d) Use of materials</p> <p><b>Library:</b> <i>Setyarsih, W. and Rohmawati L. 2014. Teaching Materials for Alloy Materials. Unesa Physics Department.</i></p>	2%
2	Describe the process of making metal alloys	a. Explain the mechanism for making metal alloys using forming operations, casting and powder metallurgy in a coherent manner. mention several differences, advantages and disadvantages of each metal manufacturing process	<p><b>Criteria:</b> • Full score if all assignments are completed within the specified time</p> <p><b>Form of Assessment :</b> Participatory Activities, Portfolio Assessment</p>	Visual paper literacy, Discussion, Presentation 2 X 50	Visual paper literacy, Discussion, Presentation 2 x 50	<p><b>Material:</b> Forming Operation of alloy</p> <p><b>Reference:</b> <i>Callister, William D. 2007. Materials Science and Engineering: An Introduction. 7th ed. New York: John Wiley &amp; Sons.</i></p> <p><b>Material:</b> Process of Making Alloy Metals</p> <p><b>Reference:</b> <i>Setyarsih, W. and Rohmawati L. 2014. Teaching Materials for Alloy Materials. Unesa Physics Department.</i></p>	2%

3	Analyzing the heating process in metal alloys	a. Explain the heating process in metal alloys. Analyze the graph of weight composition against heating temperature. Analyze the morphology of materials due to heating	<b>Criteria:</b> • Full score if all assignments are completed within the specified time	Paper and visual literacy, Discussion, Presentation 2 X 50	Paper and visual literacy, Discussion, Presentation 2 x 50	<b>Material:</b> Heat treatment: Annealing process, stress relief, Annealing ferrous alloy <b>Reference:</b> <i>Callister, William D. 2007. Materials Science and Engineering: An Introduction. 7th ed. New York: John Wiley &amp; Sons.</i> <hr/> <b>Material:</b> Heating process in metal alloys <b>Reference:</b> <i>Setyarsih, W. and Rohmawati L. 2014. Teaching materials for alloy materials. Unesa Physics Department.</i>	2%
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4	Analyze the characteristics of various composites according to their matrix materials and their applications in everyday life	<p>a. Identifying differences in strengthening mechanisms for large particle composites and dispersion particle composites.</p> <p>b. Classifying composite types based on their matrix.</p> <p>c. Identify objects around you according to their composite classification</p>	<p><b>Criteria:</b></p> <ul style="list-style-type: none"> <li>• Full score if all assignments are completed within the specified time.</li> <li>• Full score if they match the answer key</li> </ul> <p><b>Form of Assessment :</b> Participatory Activities, Portfolio Assessment</p>	Paper and visual literacy, Discussion, Presentation 2 X 50	Paper and visual literacy, Discussion, Presentation 2 x 50	<p><b>Material:</b> Composite</p> <p><b>Bibliography:</b> <i>Callister, William D. 2007. Materials Science and Engineering: An Introduction . 7th ed. New York: John Wiley &amp; Sons.</i></p> <hr/> <p><b>Material:</b> Composite</p> <p><b>Reference:</b> <i>Chung, Deborah DL 2010. Composite Materials: Science and Application. Second Edition. Springer-Verlag London Limited.</i></p> <hr/> <p><b>Material:</b> Composite</p> <p><b>Reference:</b> <i>Chawla, AK 2002. Composite Materials: Science and Engineering. Third Edition. Springer: New York.</i></p> <hr/> <p><b>Material:</b> Composite</p> <p><b>Reference:</b> <i>Kaw, Authar K.. 2006. Mechanics of Composite Materials. Second Edition. Taylor &amp; Francis Group, CRC Press.</i></p> <hr/> <p><b>Material:</b> Composites</p> <p><b>Library:</b> <i>Setyarsih, W. and Rohmawati L. 2014. Teaching Materials Alloy Materials. Unesa Physics Department.</i></p>	2%
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5	Describe the structure of composites, their processing and applications in everyday life	a. Classify composites according to their structure. Explains the manufacturing process and application	<b>Criteria:</b> • Full score if all assignments are completed within the specified time	Paper and visual literacy, Discussion, Presentation 2 X 50	Paper and visual literacy, Discussion, Presentation 2 x 50	<b>Material:</b> Structural Composite <b>Reference:</b> <i>Callister, William D. 2007. Materials Science and Engineering: An Introduction. 7th ed. New York: John Wiley &amp; Sons.</i> <hr/> <b>Material:</b> Structural Composite <b>Reference:</b> <i>Chung, Deborah DL 2010. Composite Materials: Science and Application. Second Edition. Springer-Verlag London Limited.</i> <hr/> <b>Materials:</b> Composites (Chapter 16) <b>References:</b> <i>Chawla, AK 2002. Composite Materials: Science and Engineering. Third Edition. Springer: New York.</i> <hr/> <b>Material:</b> Mixing Laws <b>Bibliography:</b> <i>Kaw, Authar K.. 2006. Mechanics of Composite Materials. Second Edition. Taylor &amp; Francis Group, CRC Press.</i> <hr/> <b>Material:</b> Composites <b>Library:</b> <i>Setyarsih, W. and Rohmawati L. 2014. Teaching Materials Alloy Materials. Unesa Physics Department.</i>	2%
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6	Review articles on alloy materials that are relevant to the project assignment topic	a. Get articles that are relevant to the project topic. Analyze all components of the article carefully. Determine journal articles as appropriate references for project assignments	<p><b>Criteria:</b> a. The score for each aspect is 1-5, and it is appropriate if it has a score of 4-5b. Full score if all study components are met</p> <p><b>Form of Assessment :</b> Participatory Activities, Practice/Performance</p>	Literacy Group paper, Discussion, Presentation 2 X 50	Literacy paper Group, Discussion, Presentation 2 x 50	<p><b>Material:</b> material application <b>References:</b> <i>Setyarsih, W. and Rohmawati L. 2014. Teaching materials for alloy materials. Unesa Physics Department.</i></p> <p><b>Material:</b> Application of composite materials <b>Reference:</b> <i>Anonymous. 2014. Collection of International Journal Alloy Materials Articles. Collection of the Unesa Physics Department Alloy Materials Team.</i></p>	0%
7	Make alloy material designs based on relevant and realistic references	a. Apply some/all of the article components to the alloy material project design. Propose plans to obtain input and approval. Improve the design according to input	<p><b>Criteria:</b> a. There are 3 assessments: Draft, PPT, and Presentation. Each aspect is given a score of 0-10c. Value of each form of assessment: total score/number of aspects. Final grade: total marks/3</p> <p><b>Form of Assessment :</b> Participatory Activities</p>	a. Project- Investigative Group b. Discussion Group c. Presentation 3 X 50		<p><b>Material:</b> material application <b>References:</b> <i>Setyarsih, W. and Rohmawati L. 2014. Teaching materials for alloy materials. Unesa Physics Department.</i></p> <p><b>Material:</b> Composite material <b>Reference:</b> <i>Anonymous. 2014. Collection of International Journal Alloy Materials Articles. Collection of the Unesa Physics Department Alloy Materials Team.</i></p>	0%
8	UTS	UTS	<p><b>Forms of Assessment :</b> Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment</p>	UTS 2 X 50	UTS 2 x 50		20%
9	Realize the design made in the form of a prototype (trial) and report it in written and oral form	a. Carrying out experiments to make prototypes of alloy materials according to design. Prepare project activity reports. Present the results of project activities	<p><b>Criteria:</b> a. There are 3 assessments: Report, PPT, and Presentation. Each aspect is given a score of 0-10c. Value of each form of assessment: total score/number of aspects. Final grade: total marks/3</p> <p><b>Forms of Assessment :</b> Participatory Activities, Practical Assessment, Practical / Performance</p>	Investigation group, Guided discovery, Discussion group, 2 X 50 presentations	Investigation group, Guided discovery, Discussion group, Presentation 2 x 50	<p><b>Material:</b> Composite applications <b>References:</b> <i>Anonymous. 2014. Collection of International Journal Alloy Materials Articles. Collection of the Unesa Physics Department Alloy Materials Team.</i></p>	5%

10	Realize the design made in the form of a prototype (trial) and report it in written and oral form	a. Carrying out experiments to make prototypes of alloy materials according to design. Prepare project activity reports. Present the results of project activities	<p><b>Criteria:</b> a. There are 3 assessments: Report, PPT, and Presentation. Each aspect is given a score of 0-10. Value of each form of assessment: total score/number of aspects. Final grade: total marks/3</p> <p><b>Form of Assessment :</b> Practical Assessment, Practice/Performance</p>	Investigation group, Guided discovery, Discussion group, 2 X 50 presentations	Investigation group, Guided discovery, Discussion group, Presentation 2 x 50	<p><b>Material:</b> Composite applications</p> <p><b>References:</b> <i>Anonymous. 2014. Collection of International Journal Alloy Materials Articles. Collection of the Unesa Physics Department Alloy Materials Team.</i></p>	5%
11	Realize the design made in the form of a prototype (trial) and report it in written and oral form	a. Carrying out experiments to make prototypes of alloy materials according to design. Prepare project activity reports. Present the results of project activities	<p><b>Criteria:</b> a. There are 3 assessments: Report, PPT, and Presentation. Each aspect is given a score of 0-10. Value of each form of assessment: total score/number of aspects. Final grade: total marks/3</p> <p><b>Form of Assessment :</b> Practical Assessment, Practice/Performance</p>	Investigation group, Guided discovery, Discussion group, 2 X 50 presentations	Investigation group, Guided discovery, Discussion group, Presentation 2 x 50	<p><b>Material:</b> Composite applications</p> <p><b>References:</b> <i>Anonymous. 2014. Collection of International Journal Alloy Materials Articles. Collection of the Unesa Physics Department Alloy Materials Team.</i></p>	5%
12	Realize the design made in the form of a prototype (trial) and report it in written and oral form	a. Carrying out experiments to make prototypes of alloy materials according to design. Prepare project activity reports. Present the results of project activities	<p><b>Criteria:</b> a. There are 3 assessments: Report, PPT, and Presentation. Each aspect is given a score of 0-10. Value of each form of assessment: total score/number of aspects. Final grade: total marks/3</p> <p><b>Forms of Assessment :</b> Participatory Activities, Practical Assessment, Practical / Performance</p>	Investigation group, Guided discovery, Discussion group, 2 X 50 presentations	Investigation group, Guided discovery, Discussion group, Presentation 2 x 50	<p><b>Material:</b> Composite applications</p> <p><b>References:</b> <i>Anonymous. 2014. Collection of International Journal Alloy Materials Articles. Collection of the Unesa Physics Department Alloy Materials Team.</i></p>	5%
13	Realize the design made in the form of a prototype (trial) and report it in written and oral form	a. Carrying out experiments to make prototypes of alloy materials according to design. Prepare project activity reports. Present the results of project activities	<p><b>Criteria:</b> a. There are 3 assessments: Report, PPT, and Presentation. Each aspect is given a score of 0-10. Value of each form of assessment: total score/number of aspects. Final grade: total marks/3</p> <p><b>Forms of Assessment :</b> Participatory Activities, Practical Assessment, Practical / Performance</p>	Investigation group, Guided discovery, Discussion group, 2 X 50 presentations	Investigation group, Guided discovery, Discussion group, Presentation 2 x 50	<p><b>Material:</b> Composite applications</p> <p><b>References:</b> <i>Anonymous. 2014. Collection of International Journal Alloy Materials Articles. Collection of the Unesa Physics Department Alloy Materials Team.</i></p>	5%
14	Realize the design made in the form of a prototype (trial) and report it in written and oral form	a. Carrying out experiments to make prototypes of alloy materials according to design. Prepare project activity reports. Present the results of project activities	<p><b>Criteria:</b> a. There are 3 assessments: Report, PPT, and Presentation. Each aspect is given a score of 0-10. Value of each form of assessment: total score/number of aspects. Final grade: total marks/3</p> <p><b>Forms of Assessment :</b> Participatory Activities, Practical Assessment, Practical / Performance</p>	Investigation group, Guided discovery, Discussion group, 2 X 50 presentations	Investigation group, Guided discovery, Discussion group, Presentation 2 x 50	<p><b>Material:</b> Composite applications</p> <p><b>References:</b> <i>Anonymous. 2014. Collection of International Journal Alloy Materials Articles. Collection of the Unesa Physics Department Alloy Materials Team.</i></p>	2%

15	Realize the design made in the form of a prototype (trial) and report it in written and oral form	a. Carrying out experiments to make prototypes of alloy materials according to design. Prepare project activity reports. Present the results of project activities	<b>Criteria:</b> a. There are 3 assessments: Report, PPT, and Presentation. Each aspect is given a score of 0-10. Value of each form of assessment: total score/number of aspects. Final grade: total marks/3  <b>Forms of Assessment :</b> Participatory Activities, Practical Assessment, Practical / Performance	Investigation group, Guided discovery, Discussion group, 2 X 50 presentations	Investigation group, Guided discovery, Discussion group, Presentation 2 x 50	<b>Material:</b> Composite applications <b>References:</b> Anonymous. 2014. <i>Collection of International Journal Alloy Materials Articles.</i> <i>Collection of the Unesa Physics Department Alloy Materials Team.</i>	2%
16	UAS		<b>Forms of Assessment :</b> Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment	Investigation group, Guided discovery, Discussion group, 2 X 50 presentations	Investigation group, Guided discovery, Discussion group, Presentation 2 x 50		30%

#### Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	26.02%
2.	Project Results Assessment / Product Assessment	16.67%
3.	Portfolio Assessment	19.67%
4.	Practical Assessment	11.35%
5.	Practice / Performance	11.35%
		85.06%

#### 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.**