	Universitas Negeri Surabaya Vocational Faculty, D4 Mechanical Engineering Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Materials Science	xx21401020293		T=3	P=0	ECTS=4.77	1	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
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Learning model	**Case Studies**

Program Learning Outcomes (PLO)

PLO study program that is charged to the course

PLO-9	Able to apply knowledge of mathematics, science and/or materials, and engineering to gain a thorough understanding of engineering principles.

Program Objectives (PO)

PO - 1	Students are able to explain various material properties, material testing, material applications along with standards and codes
PO - 2	Students are able to understand the formation of materials, classification of materials, and the mechanical properties of materials
PO - 3	Students have the ability to carry out analyzes on material classification, material formation, and material properties
PO - 4	Students are able to collaborate and be responsible in developing materials science according to applications in everyday life

PLO-PO Matrix

P.O	PLO-9
PO-1	
PO-2	
PO-3	
PO-4	

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																

Short Course Description

Understanding the theory of material formation processes, definition of scope, concepts regarding material formation processes. Understanding of electron nomenclature, atomic and crystal structures, chemical bonds and metallic bonds, classification of engineering materials, mechanical properties of materials, phase diagrams for the formation of materials: ferrous metals, non-ferrous metals, polymers, composites and alloys, as well as treatments: digestion, foundry, casting.

References

Main :

1. Srieati Japri : 1D Ilmu dan Teknologi Bahan 1D.Avner, Sidney H., 1C Introduction to Physical Metallurgy 1C.Vlak Van. 1D Ilmu dan Teknologi Bahan 1C .Surdia, Tata. 1C Pengetahuan Bahan Teknik 1C.
2. WILLIAM D. CALLISTER, JR., DAVID G. RETHWISCH, 2014, MATERIALS SCIENCE AND ENGINEERING: An Introduction, John Willey and Son, ISBN: 978-1-118-32457-8, USA

Supporters:

	1. . ASM Hand Book Vol 21 Composite, ASM International Hand Book, ISBN: 0-87170-703-9, 2001 2. C. Barry Carter, M. Grant Norton, 2013, CERAMIC MATERIALS: Science and Engineering, Second Edition, Springer, ISBN 978-1-4614-3522-8, DOI 10.1007/978-1-4614-3523-5, Washington DC
Supporting lecturer	Arya Mahendra Sakti, S.T., M.T. Andita Nataria Fitri Ganda, S.T., M.Sc. Dewi Puspitasari, S.Pd., M.Sc.

Week-	Final abilities of each learning stage (Sub-PO)	Evaluation		Help Learning, Learning methods, Student Assignments, [Estimated time]		Learning materials [References]	Assessment Weight (%)
		Indicator	Criteria & Form	Offline (*offline*)	Online (*online*)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Students can: 1. Understand the process stages of engineering materials 2. Understand atomic bonds	1.Students can: 1. Explain the definition of engineering materials 2.Analyze the use of engineering materials 3.Explain the definition of an atom	**Criteria:** Question and answer **Form of Assessment** : Participatory Activities	Presentation, Discussion, Assignment 2 X 50		**Material:** Introduction of materials **Bibliography:** *WILLIAM D. CALLISTER, JR., DAVID G. RETHWISCH, 2014, MATERIALS SCIENCE AND ENGINEERING: An Introduction, John Willey and Son, ISBN: 978-1-118-32457-8, USA*	4%
2	Students can: 1. Understand the process stages of engineering materials 2. Understand atomic bonds	1.Students can explain the stages of the engineering materials process 2.Describe the stages of the engineering materials process 3.Explain the types of atomic bonds 4.Describe the types of atomic bonds	**Criteria:** Question and answer **Form of Assessment** : Participatory Activities	Presentation, Discussion, Assignment 2 X 50		**Material:** Introduction of materials **Bibliography:** *WILLIAM D. CALLISTER, JR., DAVID G. RETHWISCH, 2014, MATERIALS SCIENCE AND ENGINEERING: An Introduction, John Willey and Son, ISBN: 978-1-118-32457-8, USA*	4%
3	Students can understand crystal structures	1.Students can: Explain the crystal structure of materials 2.Describe the crystal structure	**Form of Assessment** : Participatory Activities, Tests	Lectures, discussions and questions and answers 2 X 50		**Material:** introduction to materials science **Bibliography:** *WILLIAM D. CALLISTER, JR., DAVID G. RETHWISCH, 2014, MATERIALS SCIENCE AND ENGINEERING: An Introduction, John Willey and Son, ISBN: 978-1-118-32457-8, USA*	4%
4	1.Students can: 1. Understand shear fields in crystal structures 2.Know how to determine the length of the side of a cube in the crystal plane 3.Know how to determine the Miller index on the crystal plane	1.Students can do: Explain the shear plane in a crystal structure. Describe the shear plane 2.Describe how to determine the length of the side of a cube in the crystal plane 3.Explains how to determine the Miller index 4.Describe the crystal plane using the Miller index	**Form of Assessment** : Participatory Activities, Tests	Lectures, discussions and questions and answers 2 X 50		**Material:** introduction to materials science **Bibliography:** *WILLIAM D. CALLISTER, JR., DAVID G. RETHWISCH, 2014, MATERIALS SCIENCE AND ENGINEERING: An Introduction, John Willey and Son, ISBN: 978-1-118-32457-8, USA*	4%

5	1. Students can: 1. Understand shear fields in crystal structures 2. Know how to determine the length of the side of a cube in the crystal plane 3. Know how to determine the Miller index on the crystal plane	1. Students can do: Explain the shear plane in a crystal structure. Describe the shear plane 2. Describe how to determine the length of the side of a cube in the crystal plane 3. Explains how to determine the Miller index 4. Describe the crystal plane using the Miller index	**Criteria:** Question and answer **Form of Assessment** : Participatory Activities, Tests	Lectures, discussions and questions and answers 2 X 50		**Material:** introduction to materials science **Bibliography:** *WILLIAM D. CALLISTER, JR., DAVID G. RETHWISCH, 2014, MATERIALS SCIENCE AND ENGINEERING: An Introduction, John Willey and Son, ISBN: 978-1-118-32457-8, USA*	4%
6	1. Understanding defects in crystals 2. Understand the process of plastic deformation in crystals 3. Understand the cold working process of materials	1. Students can explain the defects in crystals 2. Describe the defects in the crystal 3. Analyze defects in crystals 4. Explain the process of cold working materials	**Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 2 X 50		**Material:** introduction to materials science **Bibliography:** *WILLIAM D. CALLISTER, JR., DAVID G. RETHWISCH, 2014, MATERIALS SCIENCE AND ENGINEERING: An Introduction, John Willey and Son, ISBN: 978-1-118-32457-8, USA*	4%
7	1. Understand the recrystallization process 2. Understand the meaning of iron and steel	1. Explain the recrystallization process 2. Describe the recrystallization process 3. Explain the manufacture of iron and steel 4. Describes the manufacture of iron and steel 5. Analyzing iron refining 6. Describe how iron is purified	**Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 2 X 50		**Material:** introduction to materials science **Bibliography:** *WILLIAM D. CALLISTER, JR., DAVID G. RETHWISCH, 2014, MATERIALS SCIENCE AND ENGINEERING: An Introduction, John Willey and Son, ISBN: 978-1-118-32457-8, USA*	4%
8	Midterm Evaluation / Midterm Exam	Students can carry out ignition system competency according to the SOP within the specified time		Lectures, discussions and questions and answers 2 X 50			20%
9	1. Understand about steelmaking 2. Understand the uses of steel	1. Students can describe how steel is made 2. Analyze how steel is made 3. Explain the uses of steel 4. Demonstrate the use of steel 5. Analyze the uses of steel in the industrial world	**Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 2 X 50		**Material:** introduction to materials science **Bibliography:** *WILLIAM D. CALLISTER, JR., DAVID G. RETHWISCH, 2014, MATERIALS SCIENCE AND ENGINEERING: An Introduction, John Willey and Son, ISBN: 978-1-118-32457-8, USA*	4%

10	1. Understanding about non-ferrous metals 2. Understanding the composition of alloys in a material 3. Understand phase diagrams 4. Understand the iron-iron carbide balance diagram 5. Using the iron carbide diagram to determine the carbon content in a material	1. Students can explain about non-ferrous metals 2. Analyzing non ferrous metals 3. Explains the composition of a material's alloy 4. Describes the alloy composition of a material 5. Explain phase diagrams 6. Draw a phase diagram 7. Analyzing phase diagrams 8. Explain the iron-iron carbide balance diagram 9. Draw an iron-iron carbide balance diagram 10. Analyze the iron-iron carbide balance diagram to determine the value of carbon content in a material	**Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 2 X 50		**Material:** introduction to materials science **Bibliography:** *WILLIAM D. CALLISTER, JR., DAVID G. RETHWISCH, 2014, MATERIALS SCIENCE AND ENGINEERING: An Introduction, John Willey and Son, ISBN: 978-1-118-32457-8, USA*	4%
11	1. Understanding about non-ferrous metals 2. Understanding the composition of alloys in a material 3. Understand phase diagrams 4. Understand the iron-iron carbide balance diagram 5. Using the iron carbide diagram to determine the carbon content in a material	1. Students can explain about non-ferrous metals 2. Analyzing non ferrous metals 3. Explains the composition of a material's alloy 4. Describes the alloy composition of a material 5. Explain phase diagrams 6. Draw a phase diagram 7. Analyzing phase diagrams 8. Explain the iron-iron carbide balance diagram 9. Draw an iron-iron carbide balance diagram 10. Analyze the iron-iron carbide balance diagram to determine the value of carbon content in a material	**Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 2 X 50		**Material:** introduction to materials science **Bibliography:** *WILLIAM D. CALLISTER, JR., DAVID G. RETHWISCH, 2014, MATERIALS SCIENCE AND ENGINEERING: An Introduction, John Willey and Son, ISBN: 978-1-118-32457-8, USA*	4%

12	1. Understanding about non-ferrous metals 2. Understanding the composition of alloys in a material 3. Understand phase diagrams 4. Understand the iron-iron carbide balance diagram 5. Using the iron carbide diagram to determine the carbon content in a material	1. Students can explain about non-ferrous metals 2. Analyzing non ferrous metals 3. Explains the composition of a material's alloy 4. Describes the alloy composition of a material 5. Explain phase diagrams 6. Draw a phase diagram 7. Analyzing phase diagrams 8. Explain the iron-iron carbide balance diagram 9. Draw an iron-iron carbide balance diagram 10. Analyze the iron-iron carbide balance diagram to determine the value of carbon content in a material	**Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 2 X 50		**Material:** introduction to materials science **Bibliography:** *Srieati Japri : 1D Materials Science and Technology 1D.Avner, Sidney H., 1C Introduction to Physical Metallurgy 1C.Vlak Van. 1D Materials Science and Technology 1C .Surdia, Tata. 1C Knowledge of 1C Engineering Materials.*	4%
13	1. Understand the mechanical properties of materials, destructive testing and non-destructive testing of materials 2. Understand non-metallic materials	1. Students can explain the mechanical properties of materials 2. Exemplify the mechanical properties of materials 3. Analyze the mechanical properties of materials 4. Describe non-metallic materials 5. Examples of non-metallic materials Classify non-metallic materials	**Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 2 X 50		**Material:** introduction to materials science **Bibliography:** *Srieati Japri : 1D Materials Science and Technology 1D.Avner, Sidney H., 1C Introduction to Physical Metallurgy 1C.Vlak Van. 1D Materials Science and Technology 1C .Surdia, Tata. 1C Knowledge of 1C Engineering Materials.*	4%
14	1. Understand the mechanical properties of materials, destructive testing and non-destructive testing of materials 2. Understand non-metallic materials	1. Students can explain the mechanical properties of materials 2. Exemplify the mechanical properties of materials 3. Analyze the mechanical properties of materials 4. Describe non-metallic materials 5. Examples of non-metallic materials Classify non-metallic materials	**Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 2 X 50		**Material:** introduction to materials science **Bibliography:** . *ASM Hand Book Vol 21 Composite, ASM International Hand Book, ISBN: 0-87170-703-9, 2001*	4%

15	1. Understand the mechanical properties of materials, destructive testing and non-destructive testing of materials 2. Understand non-metallic materials	1. Students can explain the mechanical properties of materials 2. Exemplify the mechanical properties of materials 3. Analyze the mechanical properties of materials 4. Describe non-metallic materials 5. Examples of non-metallic materials Classify non-metallic materials	**Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 2 X 50		**Material:** introduction to materials science **Bibliography:** *C. Barry Carter, M. Grant Norton, 2013, CERAMIC MATERIALS: Science and Engineering, Second Edition, Springer, ISBN 978-1-4614-3522-8, DOI 10.1007/978-1-4614-3523-5, Washington DC*	4%
16	UAS	UAS	**Form of Assessment** : Test	3 X 50			44%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	50%
2.	Test	50%
		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.