	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
Crystallography	4520102110		T=2	P=0	ECTS=3.18	0	July 18, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Prof. Dr. Munasir, S.Si., M.Si.

Learning model	**Case Studies**
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**
	Program Objectives (PO)
	PLO-PO Matrix

	P.O

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

Short Course Description	Crystal Structure: Bravais Lattices, Miller Index, Symmetry, Space Groups and Their Relation to Physical Properties of Materials. Crystal Geometry, Density and Packing Factor. Single Crystal and Polycrystalline. Crystal Imperfections and Defects. Methods for Determining Crystal Structure: Optical Methods, X-Ray Diffraction Methods, and their application in crystallization analysis with certain software. Non-Crystalline Materials: Structure and Properties. Structure and Properties of Amorphous and Semi-Crystalline Polymers.
References	**Main :**

1. [1]. Callister Jr, W.D., 2007 , 1CFundamental of Materials Science & Engineering 1D, 7th Edition , John Willey and Son, New York,
   [2]. Sands, D. E., 1975, 1CIntroduction to Crystallography 1D, Massachussets: W. A. Benjamin, Inc.
   [3]. Kittel, C., 1955, 1CIntroduction to Solid State Physics 1D, 3th Edition, John Wiley & Sons, N. Y.
   [4]. www.crystallography.net
   [5]. Jurnal yang relevan

	Supporters:
Supporting lecturer	Dr. Frida Ulfah Ermawati, M.Sc. Nugrahani Primary Putri, S.Si., M.Si. 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	Understand Crystal structure and geometry	1. Mention the characteristics of crystals when viewed from their structure and geometry (Miller index, Branvais lattice) 2. Distinguish between crystalline and amorphous in terms of lattice, structure and geometry 3. Explain and understand the characteristics of single crystal and polycrystalline materials	**Criteria:** Full marks will be given if all points of the assessment instrument can be answered correctly	Direct learning, 2 X 50 discussions			0%
2	Understand Crystal structure and geometry	1. Distinguish between crystalline and amorphous in terms of lattice, structure and geometry 2. Explain and understand the characteristics of single crystal and polycrystalline materials	**Criteria:** Full marks will be given if all questions can be solved correctly	Direct learning, 2 X 50 discussions			0%
3	Understand Crystal structure and geometry	1. Explain and understand the characteristics of single crystal and polycrystalline materials 2. Name materials that are classified as single crystals or polycrystals	**Criteria:** Full marks will be given if the questions can be solved correctly	Direct learning, 2 X 50 discussions			0%
4	Skilled in operating Match! as a tool for phase identification analysis of crystalline materials	1. Get to know the features of the Match software! 2. Explain the features in No. 1 correctly 3. Explain the workflow of the Match! software well in accordance with the existing instructions as an analysis medium for identifying crystalline phases 4. Testing the Match! for simple cases	**Criteria:** Full marks will be given if the task of identifying the phase of crystalline materials using software can be completed correctly	Direct learning, 6 X 50 discussions			0%

5	Skilled in operating Match! as a tool for phase identification analysis of crystalline materials	1. Get to know the features of the Match software! 2. Explain the features in No. 1 correctly 3. Explain the workflow of the Match! software well in accordance with the existing instructions as an analysis medium for identifying crystalline phases 4. Testing the Match! for simple cases	**Criteria:** Full marks will be given if the task of identifying the phase of crystalline materials using software can be completed correctly	Direct learning, 6 X 50 discussions			0%
6	Skilled in operating Match! as a tool for phase identification analysis of crystalline materials	1. Get to know the features of the Match software! 2. Explain the features in No. 1 correctly 3. Explain the workflow of the Match! software well in accordance with the existing instructions as an analysis medium for identifying crystalline phases 4. Testing the Match! for simple cases	**Criteria:** Full marks will be given if the task of identifying the phase of crystalline materials using software can be completed correctly	Direct learning, 6 X 50 discussions			0%
7	Skilled in operating High score plus software as alternative software for phase identification analysis of crystalline materials	1. Get to know the features of the Highscore Plus software 2. Explain the features in No. 1 correctly 3. Explain the workflow of the Highscore Plus software as a tool for analyzing the identification of crystalline phases 4. Testing the Highscore Plus software to identify simple case phases	**Criteria:** The maximum score will be given if all questions can be solved correctly	Direct learning and discussion 8 X 50			0%

8	Skilled in operating High score plus software as alternative software for phase identification analysis of crystalline materials	1. Get to know the features of the Highscore Plus software 2. Explain the features in No. 1 correctly 3. Explain the workflow of the Highscore Plus software as a tool for analyzing the identification of crystalline phases 4. Testing the Highscore Plus software to identify simple case phases	**Criteria:** The maximum score will be given if all questions can be solved correctly	Direct learning and discussion 8 X 50			0%
9	Skilled in operating High score plus software as alternative software for phase identification analysis of crystalline materials	1. Get to know the features of the Highscore Plus software 2. Explain the features in No. 1 correctly 3. Explain the workflow of the Highscore Plus software as a tool for analyzing the identification of crystalline phases 4. Testing the Highscore Plus software to identify simple case phases	**Criteria:** The maximum score will be given if all questions can be solved correctly	Direct learning and discussion 8 X 50			0%
10	Skilled in operating High score plus software as alternative software for phase identification analysis of crystalline materials	1. Get to know the features of the Highscore Plus software 2. Explain the features in No. 1 correctly 3. Explain the workflow of the Highscore Plus software as a tool for analyzing the identification of crystalline phases 4. Testing the Highscore Plus software to identify simple case phases	**Criteria:** The maximum score will be given if all questions can be solved correctly	Direct learning and discussion 8 X 50			0%

11	Skilled in operating Rietica crystalline phase composition analysis software	1. Get to know the features of the Rietica software 2. Explain the features in No. 1 correctly 3. Explain the workflow of Rietica software as a tool for analyzing the composition of crystalline phases 4. Testing Rietica software for simple case phase composition analysis	**Criteria:** The maximum score will be given if all the original questions can be completed correctly	Direct learning, discussion, demonstration and practice 10 X 50			0%
12	Skilled in operating Rietica crystalline phase composition analysis software	1. Get to know the features of the Rietica software 2. Explain the features in No. 1 correctly 3. Explain the workflow of Rietica software as a tool for analyzing the composition of crystalline phases 4. Testing Rietica software for simple case phase composition analysis	**Criteria:** The maximum score will be given if all the original questions can be completed correctly	Direct learning, discussion, demonstration and practice 10 X 50			0%
13	Skilled in operating Rietica crystalline phase composition analysis software	1. Get to know the features of the Rietica software 2. Explain the features in No. 1 correctly 3. Explain the workflow of Rietica software as a tool for analyzing the composition of crystalline phases 4. Testing Rietica software for simple case phase composition analysis	**Criteria:** The maximum score will be given if all the original questions can be completed correctly	Direct learning, discussion, demonstration and practice 10 X 50			0%

14	Skilled in operating Rietica crystalline phase composition analysis software	1. Get to know the features of the Rietica software 2. Explain the features in No. 1 correctly 3. Explain the workflow of Rietica software as a tool for analyzing the composition of crystalline phases 4. Testing Rietica software for simple case phase composition analysis	**Criteria:** The maximum score will be given if all the original questions can be completed correctly	Direct learning, discussion, demonstration and practice 10 X 50			0%
15	Skilled in operating Rietica crystalline phase composition analysis software	1. Get to know the features of the Rietica software 2. Explain the features in No. 1 correctly 3. Explain the workflow of Rietica software as a tool for analyzing the composition of crystalline phases 4. Testing Rietica software for simple case phase composition analysis	**Criteria:** The maximum score will be given if all the original questions can be completed correctly	Direct learning, discussion, demonstration and practice 10 X 50			0%
16							0%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
		0%

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.