TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

PHASE TRANSFORMATION OF MATERIALS

by

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Depok
November 2016

PREFACE

The Teaching Instructional Design (BRP) in Phase Transformation of Materials course was prepared to be used as a reference for learning the Phase Transformation of Materials course in the Undergraduate Physics Study Program of the Faculty of Mathematics and Natural Sciences, Universitas Indonesia, which was attended by physics students who were interested in Material Physics in semester 7 on the condition that the student had taken the Introduction to Materials Science. In the Phase Transformation of Materials course, students will be taught to properly analyze the phase formation process of the material and the phenomena that occur in the material during thermal application. It is hoped that this BRP can become a reference or reference in the learning process for both lecturers as teachers and students as course participants so that the material is conveyed properly and perfectly.

Depok, 20 November 2016

Dr. Azwar Manaf, M.Met.

I. General Information

1.	Name of Program / Study Level	:	Physics / Undergraduate
2.	Course Name	:	Phase Transformation of Materials
3.	Course Code	:	SCFI604511
4.	Semester	:	7th
5.	Credit	:	3 credits
6.	Teaching Method(s)	:	Interactive lectures, question-based learning, self-directed study, discussion, individual assignments, and written exams.
7.	Prerequisite course(s)	:	Introduction to Material Science
8.	Requisite for course(s)	:	None
9.	Integration Between Other Courses	:	None
10.	Lecturer(s)	:	Dr. Azwar Manaf, M.Met.
11.	Course Description	:	After completing this lecture, physics students with a special interest in Material Physics in semester 7 are able to analyze (C4) the process of material phase formation and the phenomena that occur in the material during thermal application in accordance with the applicable laws of physics. The language of instruction used in this course is Indonesian.

II. Course Learning Outcome (CLO) and Sub-CLOs

A. CLO

Students are able to correctly analyze (C4) the process of material phase formation and the phenomena that occur in the material during thermal application. (ELO (s) 3, 5, 6, 8).

B. Sub-CLOs

1. Able to apply (C3) systematic material kinetics principles in stages from basic principles to application.
2. Be able to correlate (C4) the response of the material with a given thermal effect and phase diagram.
3. Able to apply (C3) thermodynamic principles in the solidification process (liquid-solid phase transformation).
4. Able to build (C3) Time Temperature Transformation (TTT) and Continuous Cooling Transformation (CCT) diagrams.
5. Be able to apply (C3) thermodynamic principles in analyzing phase diagrams.

II. Teaching Plan

Week	Sub-CLO	Study Materials	Teaching Method	Time Required	Learning Experiences (*O-E-F)	Sub-CLO Weight on Course (%)	Sub-CLO Achievement Indicator	References
1	Course Introduction							
2	1	Understanding the composition in the material	Interactive lectures, question-based learning, self-directed study, discussion	150 minutes	40% O, 30% E, 30% F	8	Able to understand and explain material composition	[1]
3	1	The principle of stoichiometry in material preparation	Interactive lectures, question-based learning, self-directed study, discussion	150 minutes	40% O, 30% E, 30% F	8	Able to understand and explain the principles of stoichiometry in materials	[1]
4	2	The formation of the phase of the material through a thermal process	Interactive lectures, question-based learning, self-directed study, discussion	150 minutes	40% O, 30% E, 30% F	8	Able to understand and explain the process of material phase formation	[1]
5	2	Phase / equilibrium diagram	Interactive lectures, question-based learning, self-directed study, discussion	150 minutes	40% O, 30% E, 30% F	8	Able to understand and explain phase diagrams	[1]
6	3	Thermodynamics in the liquid-solid phase transformation	Interactive lectures, question-based learning, self-directed study, discussion	150 minutes	40% O, 30% E, 30% F	8	Able to understand and explain the liquid-solid phase transformation of materials	[1]
7	3	Diffusion and no diffusion transformation	Interactive lectures, question-based learning,	150 minutes	40% O, 30% E, 30% F	8	Able to understand and explain the concept of diffusion and non-	[1]

			self-directed study, discussion				diffusion transformation	
8	**Mid-Term Exam**							
9	4	TTT (Time Temperature Transformation) diagram	Interactive lectures, question-based learning, self-directed study, discussion	150 minutes	40% O, 30% E, 30% F	8	Able to understand and explain TTT diagram	[1]
10	4	CCT (Continuous Cooling Transformation) diagram	Interactive lectures, question-based learning, self-directed study, discussion	150 minutes	40% O, 30% E, 30% F	8	Able to understand and explain CCT diagram	[1]
11	4	Phase transformation kinetics	Interactive lectures, question-based learning, self-directed study, discussion	150 minutes	40% O, 30% E, 30% F	8	Able to understand and explain the concept of phase transformation kinetics of materials	[1]
12	5	Phase fraction at equilibrium	Interactive lectures, question-based learning, self-directed study, discussion	150 minutes	40% O, 30% E, 30% F	8	Able to understand and explain the concept of phase fraction in material equilibrium	[1]
13	5	The technique for determining the phase fraction of the transformation	Interactive lectures, question-based learning, self-directed study, discussion	150 minutes	40% O, 30% E, 30% F	8	Able to understand and explain the technique of determining the transformation phase fraction	[1]
14	1-5	Readout and data processing	Interactive lectures, question-based learning, self-directed study, discussion	150 minutes	40% O, 30% E, 30% F	10	Able to understand and process material phase transformation data	[1]
15	1-5	Example of measurement system design	Interactive lectures, question-	150 minutes	40% O, 30% E, 30% F	10	Able to understand and explain material	[1]

			based learning, self-directed study, discussion				transformation measurement system designs	
16	**Final Exam**							

*) O : Orientation
E : Exercise
F : Feedback

References:

[1] D.A. Porter and K.F. Easterling, *Phase Transformation in Metals and Alloys*, Van Nostrand Reinhold, New York, 1981.
[2] A.K. Jena and M.C. Chaturvedi, *Phase Transformations in Materials*, Prentice Hall, New Jersey, 1982.
[3] Lecture notes / Phase Transformation power points from the internet; Publications related to phase transformation kinetics.

III. Assignment Design

Week	Assignment Name	Sub-CLOs	Assignment	Scope	Time limit	Outcome
2-7, 9-15	Individual assignments	1-5	Problem set via EMAS platform	The entire range of material on the relevant week.	40 minutes	Answer sheets uploaded to EMAS
8	Mid-Term Exam	1-3	Problem set via EMAS platform	• Understanding the composition in the material • Principles of stoichiometry in material preparation • Formation of material phase by thermal process • Phase / equilibrium diagram • Thermodynamics in the liquid-solid phase transformation • Diffusion and non-diffusion transformations	120 minutes	Answer sheets uploaded to EMAS
16	Final Exam	4-5	Problem set via EMAS platform	• TTT diagram • CCT diagram • Phase transformation kinetics • Phase fraction at equilibrium • The technique of determining the phase fraction of the transformation • Readout and data processing • Examples of measurement system designs	120 minutes	Answer sheets uploaded to EMAS

IV. Assessment Criteria (Learning Outcome Evaluation)

Evaluation Type	Sub-CLO	Assessment Type	Frequency	Evaluation Weight (%)
Individual assignments	1-5	Summary or home work	1 per week	40
Mid-Term Exam	1-3	Exam questions via EMAS UI	1	30
Final Exam	4-5	Exam questions via EMAS UI	1	30
			Total	**100**

V. Rubric(s)

A. Criteria for Individual Assignments

Score	Presentation Delivery
>90	If students can complete more than 90% of the questions correctly
70-89	If students can complete more than 70% to 89% of the questions correctly
60-69	If students can complete more than 60% to 69% of the questions correctly
55-59	If students can complete more than 55% to 59% of the questions correctly
50-54	If students can complete more than 50% to 54% of the questions correctly

B. Criteria for Mid-Term Exam and Final Exam

1. Able to express ideas in solving problems (25%)
2. Able to determine the right basic concepts in problem-solving (35%)
3. Able to formulate the final solution to correct language errors (30%)
4. Able to use the appropriate important units and figures (10%)