TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

INTRDUCTION TO MATERIAL SCIENCE

by

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Depok, 26 Juli 2017

PREFACE

Praise be to our gratitude for the presence of Allah SWT for the completion of the Teaching Instructional Design (BRP) for the Introduction to Material Science course. this BRP will be used as a reference in learning the Introduction to Materials Science course for one semester. Learning will be carried out online with the blended method, which combines face-to-face lectures and virtual lectures through Scele.

The Introduction to Materials Science course is a compulsory basic course for 5th semester students who major in Material Physics. This course is a prerequisite for taking the next course.

This course is a prerequisite for taking the next course. The Introduction to Materials Science course covers material types, material structure, atomic bonds in crystals, crystal defects, material properties such as mechanical, electronic, and magnetic properties.

With the preparation of this BRP, it is hoped that this BRP can become a learning reference for lecturers and students in particular and for the wider community in general who want to learn it.

Depok, July 26th 2017

Anawati, PhD

I. General Information

1.	Name of Program / Study Level	: Physics / Undergraduate
2.	Course Name	: Introduction to Material Science
3.	SceLE URL	: https://emas.ui.ac.id/course/view.php?id=90
4.	Course Code	: SCFI603511
5.	Semester	: 5
6.	Credit	: 3
7.	Teaching Method(s)	: Blended learning with Collab & Coop
8.	Prequisite course(s)	: -
9.	Requisite for course(s)	: 1. Material Properties (SCFI603512) 2. Material Thermodynamics (SCFI603513) 3. Material Research Methods / Material Laboratory Work (SCFI603514) 4. Material Characterization Method (SCFI603515) 5. Material Phase Transformation (SCFI604511) 6. Composite Material (SCFI604513)
10.	Integration Between Other Course	: -
11.	Lecturer	: 1. Anawati, PhD : 2. Ariadne L Juwono, PhD
12.	Course Description	:

Introduction Material Science is a compulsory subject for the Undergraduate Physics Study Program with a major in Materials Physics. This course will be a prerequisite for being able to take the next courses in the Material Physics specialization. This course provides a fundamental understanding of types of materials; material structure and atomic bonds in crystals; material properties: electronic, mechanical and magnetic. The language of instruction used in lectures is Indonesian.

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

A. CLO

After completing this course, 5th semester students are able to solve simple structured questions about the structure of metals and alloys, ceramics, polymers, and composites according to the basic principles of materials (C3).

B. Sub-CLOs

After completing this course, students will be able:

1. Describe the structure and bonds of atoms. (C2)
2. Determine the direction and field of the Crystal. (C3)
3. Perform calculations of atomic packing fraction and atomic density. (C3)
4. Describe the types of defects and crystal dislocations. (C3)
5. Describe the structure and mechanical, electrical, magnetic properties of metals. (C3)
6. Describe the phase transformation of metals. (C3)
7. Describe the structure and mechanical properties of ceramics. (C3)
8. Describe the structure and mechanical / thermal properties of various types of polymers. (C3)

III. Teaching Plan:

Week	Sub-CLO	Study Materials	Teaching Method	Teaching Media	Time Required	Learning Experiences (*O-E-F)	Sub-CLO Weight on Course (%)	Sub-CLO Achievement Indicator	References
1	1	Introduction, atomic structure and bonds	Interactive Lecture	Audio-visual, Scele	150 minutes	70% O, 30% F	10	Students are able to explain atomic models, atomic structure, and the periodic table arrangement system	1) and 2) Bab 2
2	2	Crystal system	Focus group discussion.	Audio-visual, Scele	150 minutes	20% O, 50% E, 30%F	6	Students are able to explain the seven crystal systems, unit cells, and lattice parameters. Students are able to calculate atomic density and atomic packing factor	1) and 2) Bab 3
3	3	Crystal system	Home group discussion.	Web-based. Students determine the discussion time with their group. Discussions were conducted through Scele at the appointed time. The lecturer or facilitator will monitor the discussion process.	1 week	20% O, 50% E, 30%F	6	Students are able to describe the point and crystal plane as well as the direction of the plane.	1) and 2) Bab 3

4	3	Crystal system	Presentation and Clarification	Audio-visual, Scele	150 minutes	20% O, 50% E, 30% F	8	Students are able to explain point defects, intestines and substitutions in crystals. Students are able to calculate the atomic composition and weight percent of the alloy material. Students understand dislocations in crystals.	1) and 2) Bab 4, 7
5	1, 2, 3	Quiz 1	Virtual	Web-based	45 minutes	100% E			
6	4	Crystal Structure	Focus group discussion.	Audio-visual, Scele	150 minutes	20% O, 50% E, 30% F	6	Students are able to distinguish crystalline, non-crystalline, and amorphous structures.	1) and 2) Bab 4
7	4	Crystal Structure	Home group discussion.	Web-based. Students determine the discussion time with their group. Discussions were conducted through Scele at the appointed time. The lecturer or	1 week	20% O, 50% E, 30% F	6	Students are able to explain various types of metal crystal structures	1) and 2) Bab 4

				facilitator will monitor the discussion process.					
8	4	Crystal Defect	Presentation and Clarification	Audio-visual, Scele	150 minutes	20% O, 50% E, 30% F	8	Students can explain the crystal structure in ceramics and the types of crystal defects	1) and 2) Bab 4
9	1, 2, 3, 4	Mid Term Exam	In Classroom (Offline)	Written Examination	100 minutes	100% E			
10	5	Metal and Alloys	Interactive Lecture	Audio-visual, Scele	150 minutes	70% O, 30% F	10	Students can explain the mechanical, electrical, and magnetic properties of metals and alloys	1) and 2) Bab 6
11	6	Metal and Alloys	Home group discussion.	Web-based. Students determine the discussion time with their group. Discussions were conducted through Scele at the appointed time. The lecturer or facilitator will monitor the discussion process.	1 week	20% O, 50% E, 30% F	6	Students can explain and use metal phase diagrams to complete simple calculations in determining the composition, temperature, and type of alloy phase. Students understand the phenomenon of deformation and metal strengthening mechanisms.	1) and 2) Bab 7

12	7	Ceramic	Presentation and Clarification	Audio-visual, Scele	150 minutes	20% O, 50% E, 30% F	6	Students can explain the properties of ceramics based on the crystal structure and explain the effect of atomic defects on the properties of ceramics	1) and 2) Bab 9
13	5, 6, 7	Quiz 2	Virtual	Web-based	100 minutes	100% E			
14	8	Polymer	Home group discussion.	Web-based. Students determine the discussion time with their group. Discussions were conducted through Scele at the appointed time. The lecturer or facilitator will monitor the discussion process.	1 week	20% O, 50% E, 30% F	6	Students can explain polymer properties in terms of bonding, weight, shape and molecular structure	1) and 2) Bab 12, 13
15	8	Polymer	Presentation and Clarification	Audio-visual, Scele	150 minutes	20% O, 50% E, 30% F	6	Students can identify the types of bonds of various types of polymers	1) and 2) Bab 12, 13

16	5, 6, 7, 8	Final Exam	In Classroom (Offline)	Written Examination	100 minutes	100% E	

*) O : Orientation
L : Exercise
F : Feedback

References:

1) W.D. Callister, Jr. Materials Science and Engineering: An Introduction, 7th Ed, John Wiley & Sons, Inc., 2007.
2) L.H. Van Vlack, Materials Science for Engineers, 6th Ed, Addison-Wesley Pub. Co., Bab 1 – 7, 1975. 3.

IV. Assignment Design

Week	Assignment Name	Sub-CLOs	Assignment	Scope	Working Procedure	Deadline	Outcome
2, 6	Focus Group Discussion	1-4	Diskusi untuk menjawab persoalan yang diberikan dalam pemicu.	Atomic structure in metals, ceramics and polymers.	Problem is given at Scele. Discussions were held in class accompanied by 1 lecturer and 1 facilitator.	150 minutes.	Presentation Powerpoint file uploaded to Scele.
3, 7, 6, 8	Home Group Discussion	1-8	Diskusi untuk menjawab persoalan yang diberikan dalam pemicu.	Atomic structure in metals, ceramics and polymers.	Problem is given in Scele. Discussions were conducted on the web-based at Scele. Monitored by 1 lecturer and 1 facilitator.	1 minutes. The results of the discussion are uploaded on the lecture day of the week until 17.00	Presentation Powerpoint file uploaded to Scele.

Week	Assignment Name	Sub-CLOs	Assignment	Scope	Working Procedure	Deadline	Outcome
4, 8, 12, 15	Presentation	1-8	Formulate the results of the group discussion in PowerPoint.	Atomic structure and crystal in metals, ceramics and polymers.	PowerPoint or pdf files of the discussion results are collected in Scele.	Files are uploaded no later than 1 day before the presentation, until 17.00.	Presentation Powerpoint file uploaded to Scele.
3	Homework 1	2, 3	Essay Problem	Atomic density, direction and plane of the crystal.	Tasks are done individually and independently. Problem assignments are available on Scele. Homework answers (pdf) uploaded to Scele on the specified lecture day, in the 3rd week, no later than 24.00.	1 week. Answers are uploaded no later than the lecture day on the 3rd week at 17.00	PDF file for homework answers is uploaded on Scele.
5	Quiz 1	1, 2, 3	Multiple Choice Problem and short answer question	Atomic structure and bonds, atomic density, direction and plane of the crystal.	Quizzes are done online at Scele simultaneously during lecture hours.	45 minutes counted since students started doing Quiz	Answers to Quiz on Scele. Score Quiz can be broadcast live on Scele.
7	Homework 2	4	Essay Problem	Crystal direction and plane, crystal defects	Tasks are done individually and independently.	1 week. Answers are uploaded no later than the	The pdf file for homework answers is

Week	Assignment Name	Sub-CLOs	Assignment	Scope	Working Procedure	Deadline	Outcome
					Problem assignments are available on Scele. Homework answers (pdf) are uploaded to Scele on the specified lecture day, in the 3rd week, no later than 17.00.	lecture day on the 7th week at 17.00	uploaded on Scele.
9	Mid Term Exam	1, 2, 3, 4	Essay Problem	Structure, atomic density, direction and plane of the crystal,	Mid Term Exam is done in writing in the classroom. Answer sheets are collected in class.	150 minuted	Answer sheet paper
11	Homework 3	5, 6	Essay Problem	Metal structure, deformation and metal strengthening mechanism.	Tasks are done individually and independently. Problem assignments are available on Scele. Homework answers (pdf) are uploaded to Scele on the specified lecture day, in the 3rd week, no later than 17.00.	1 week. Answers are uploaded no later than the lecture day on the 3rd week at 17.00	The PDF file for homework answers is uploaded on Scele.

Week	Assignment Name	Sub-CLOs	Assignment	Scope	Working Procedure	Deadline	Outcome
13	Quiz 2	5, 6, 7	Multiple Choice Problem	Metal and Ceramics	Quizzes are done online at Scele simultaneously during lecture hours	45 minutes counted since students started doing Quiz	Answers to Quiz on Scele. Score Quiz can be broadcast live on Scele.
14	Homework 4	7, 8	Essay Problem	Ceramics and polymers	Tasks are done individually and independently. Problem assignments are available on Scele. Homework answers (pdf) are uploaded to Scele on the specified lecture day, in the 3rd week, no later than 17.00.	1 week	The PDF file for homework answers is uploaded on Scele.
15	Final Exam	5, 6, 7, 8	Essay Problem	Metals, ceramics and polymers	Final Exam is done in writing in the classroom. Answer sheets are collected in class.	150 minutes	Answer sheet paper

V. Assessment Criteria (Learning Outcome Evaluation)

Evaluation Type	Sub-CLOs	Assessment Type	Frequency	Evaluation Weight (%)
Individual Assignment	2, 3, 6, 8	Answer sheet uploaded on Scele. The assessment is done manually.	4	10
Discussion	1-8	Track record of discussions at Scele. The assessment was carried out with an online discussion form at Scele.	6	10
Presentation	1-8	Presentation forms in classroom.	4	10
Quiz	1, 2, 3, 5, 6, 7	Quizzes are done online at Scele. Quiz scores can be seen directly by students after completing the Quiz.	2	10
Mid Term Exam	1, 2, 3, 4	Answer sheet paper. Assessment is done manually.	1	30
Final Term Exam	4, 5, 6, 7, 8	Answer sheet paper. Assessment is done manually.	1	30
Total				**100**

Rubric(s):

a. Criteria of Self-Assignment (Individual Assignment, Mid Term Exam, and Final Exam)

Score	Answer Quality
100	The answer is very precise, all the definitions and main components are complete
76-99	The answer is quite precise, the meaning and main components are almost complete
51-75	Inaccurate answers, incomplete understanding and main components
26-50	The answer is very inaccurate, the meaning and the main components are very incomplete
<25	Wrong answer

b. Criteria of Group Presentation

No	Category	4	3	2	1
1	Group member cooperation	Cooperate well with members in the group and become a facilitator for the group	Lack of cooperation with the group	Very individual. Only work with one person	Does not cooperate well with group members
2	Mastery of the material	Mastering the material well and without text when presenting.	Not mastering the material and without text when presenting.	Not mastering the material and using text when presenting.	Not mastering the material.
3	Delivery of material	The material is easy to understand with good body language.	Partial material can be understood with good body language.	The material is less understandable.	The material cannot be understood.

Presentation Score = (Total Score/12) x 100

c. Criteria of Grup Discussion

No	Category	4	3	2	1
1	Involvement of group members	All members are involved in the discussion	Most of the members were involved in the discussion and a few were not	A few were involved in the discussion and most were not	All members showed no intention and effort to discuss
2	Discussion results	Answer all the questions given correctly	Answering most of the questions correctly and a few incorrectly	Answering a small number of questions given and mostly imprecise	Absolutely not answering the questions given correctly
3	Reference use	Using references appropriately to answer the problems in the discussion material	Most of them use references to answer the problems in the discussion material	A small proportion use references in answering the problems in the discussion material.	Do not use references in answering problems in the discussion material.

Discussion Score = (Total Scorel/12) x 100

The conversion of the final value (student passing grade) follows the value conversion provisions applicable at the Universitas Indonesia as follows.

Nilai Angka	Nilai Huruf	Bobot
85—100	A	4,00
80—<85	A-	3,70
75—<80	B+	3,30
70—<75	B	3,00
65—<70	B-	2,70
60—<65	C+	2,30

55—<60	C	2,00
40—<55	D	1,00
<40	E	0,00

Minimum passing grade is 5