TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

SOLID STATE PHYSICS II

by

Efta Yudiarsah, Ph.D.

Undergraduate Program in Physics
Faculty of Mathematics and Natural Sciences
Universitas Indonesia
Depok

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PREFACE

In this solid state physics II course, students study various topics in solid state physics which are related to the basic concepts of physics. These topics include transport properties in solids, superconductivity, dielectrics and ferroelectrics, diamagnetism and paramagnetism, ferromagnetism and antiferromagnetism, magnetic resonance, noncrystalline solids, point defects, physics of surfaces and interfaces, dislocations, alloys. These topics have traditionally been taught in the classroom using the teacher centered learning method. In implementing this learning method, students passively listen to lecturers' explanations about basic concepts and some examples of applications while noting things that are deemed necessary. Students practice mastery of the material by doing structured assignments in the form of homework and papers.
In order for students to actively build their knowledge and also train various abilities besides mastery of teaching materials, this course will be studied by students using the student centered learning method, namely collaborative learning. However, for important concepts, interactive lecture methods are still being used. By using these methods, students are given the opportunity to practice soft skills such as cooperation and communication skills.
This Learning Design Book was prepared as a complement to teaching in the Physics Masters Program, Department of Physics FMIPA at the University of Indonesia. This book is a guide for activities during the learning process. Thus the learning process carried out by students can be directed and in the end the learning objectives can be achieved.
I would like to thank the leadership of the Physics Department and staff, so that this book can be completed

Depok, 24 November 2016

Efta Yudiarsah, Ph.D.

I. General Information

1.	Name of Program / Study Level	:	Physics / Undergraduate
2.	Course Name	:	Solid State Physics 2
3.	Course Code	:	SCFI603612
4.	Semester	:	6
5.	Credit	:	4 credits
6.	Teaching Method(s)	:	Kuliah interaktif dan *Collaborative Learning*
7.	Prerequisite course(s)	:	Quantum Mechanics 1, Statistical Physics, Introduction to Solid State Physics
8.	Requisite for course(s)	:	Undergraduate Thesis
9.	Integration Between Other Courses	:	Introduction to Solid State Physics and Solid-State Physics 1
10.	Lecturer(s)	:	Efta Yudiarsah, Ph.D.
11.	Course Description	:	This Solid Physics II course covers eight major topics, namely the properties of transport in solids, superconductivity, dielectrics and ferroelectrics, diamagnetism and paramagnetism, ferromagnetism and antiferromagnetism, magnetic resonance, non-crystalline solids, point defects, physics surfaces and interfaces, dislocations, alloys. Students study this course with a combination of two active learning methods, namely interactive lectures and collaborative learning. Students have the opportunity to practice integrating understanding of the basic concepts of physics, and analytical skills in studying these topics. Students also practice explaining and analyzing phenomena in solid matter systems using basic concepts of physics and their application to technology. In addition, students can develop the ability to synthesize and evaluate both qualitatively and quantitatively phenomena in solid material systems using basic physics concepts. After completing this course, when faced with known modern physics problems in solid matter systems, third year fifth semester students are able to formulate simple modern physics problem solutions related to solid and well-defined substances. [Competency Based

Curriculum Dept. Physics Faculty of Mathematics and Natural Sciences UI 2011].

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

A. CLO

After completing this course, when faced with the known field of solid state physics, third year students are expected to be competent in explaining current phenomenon in solids and the mechanisms behind them. (ELO 3,5,6 and 7)

B. Sub-CLO

1. Characterize the properties of superconductivity in solids (C4)
2. Analyze dielectric and ferroelectric matter (C4)
3. Illustrate the properties of magnetic solids (C4)
4. Describe the physical properties of solids apart from crystals (C3)

III. Rencana Pembelajaran

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	1	Superconductivity	*Collaborative Learning*	200 minutes	O : Interactive Lectures (20%) E : *Collaborative Learning* (70%) U : Quiz (10%)	6	Characterizing the properties of superconductivity in solids	[1] chapter 12
2	1	Superconductivity	*Collaborative Learning*	200 minutes	O : Interactive Lectures (20%) E : *Collaborative Learning* (70%) U : Quiz (10%)	6	Characterizing the properties of superconductivity in solids	[1] chapter 12
3	2	Dielectric and ferroelectric	*Collaborative Learning*	200 minutes	O : Interactive Lectures (20%) E : *Collaborative Learning* (70%) U : Quiz (10%)	6	Analyzing dielectric and ferroelectric matter	[1] chapter 13
4	2	Dielectric and ferroelectric	*Collaborative Learning*	200 minutes	O : Interactive Lectures (20%) E : *Collaborative Learning* (70%) U : Quiz (10%)	6	Analyzing dielectric and ferroelectric matter	[1] chapter 13
5	3	Magnetism	*Collaborative Learning*	200 minutes	O : Interactive Lectures (20%) E : *Collaborative Learning* (70%) U : Quiz (10%)	6	Illustrating the properties of magnetic solids	[1] chapter 14, 15, and 16
6	3	Magnetism	*Collaborative Learning*	200 minutes	O : Interactive Lectures (20%) E : *Collaborative Learning* (70%) U : Quiz (10%)	6	Illustrating the properties of magnetic solids	[1] chapter 14,15 and 1
7	**Midterm Exam**							
8	3	Magnetism	*Collaborative Learning*	200 minutes	O : Interactive Lectures (20%) E : *Collaborative Learning* (70%) U : Quiz (10%)	8	Illustrating the magnetic properties of ferromagnetic and antiferromagnetic	[1] chapter 14,15 and 1

9	3	Magnetism	*Collaborative Learning*	200 minutes	O : Interactive Lectures (20%) E : *Collaborative Learning* (70%) U : Quiz (10%)	8	Illustrating the magnetic resonance	[1] chapter 14,15 and 1
10	4	Non-crystalline solids	*Collaborative Learning*	200 minutes	O : Interactive Lectures (20%) E : *Collaborative Learning* (70%) U : Quiz (10%)	8	Describing the physical properties of non-crystalline solids	[1] chapter 17
11	4	Non-crystalline solids	*Collaborative Learning*	200 minutes	O : Interactive Lectures (20%) E : *Collaborative Learning* (70%) U : Quiz (10%)	8	Describing point defects in non-crystals	[1] chapter 17
12	4	Non-crystalline solids	*Collaborative Learning*	200 menit	O : Interactive Lectures (20%) E : *Collaborative Learning* (70%) U : Quiz (10%)	8	Describing surface and interface physics	[1] chapter 18
13	4	Non-crystalline solids	*Collaborative Learning*	200 minutes	O : Kuliah Interaktif (20%) L : *Collaborative Learning* (70%) U : Quiz (10%)	8	Explaining Dislocation	[1] chapter 19
14	4	Non-crystalline solids	*Collaborative Learning*	200 minutes	O : Interactive Lectures (20%) E : *Collaborative Learning* (70%) U : Quiz (10%)	8	Explaining alloy	[1] chapter 20
15	4	Non-crystalline solids	*Collaborative Learning*	200 minutes	O : Interactive Lectures (20%) E : *Collaborative Learning* (70%) U : Quiz (10%)	8	Explaining alloy	[1] chapter 21
16	**Final Exam**							

*) O : Orientation
E : Exercise
F : Feedback

References:

1. C. Kittle, *Introduction to Solid State Physics* 8th Ed., Wiley, 2005.
2. J. R. Hook and H. E. Hall, *Solid State Physics* 2nd Ed, Wiley, 1991.
3. N. W. Ashcroft and N. D. Mermin, *Solid State Physics*, Saunders College Publishing, 1976
4. H. Ibach and H. Luth, *Solid-State Physics* 4th Ed., Springer, 2009

IV. Design of Assignment and Exercise

Weel	Assignment Name	Sub-CLO	Assignment	Scope	Working Procedure	Deadline	Outcome
1-2	Individual-Assignment / Homework 1	1	Question(s)	Superconductivity	Individual	one week	Written Report
3-4	Quiz 1	2	Question(s)	Dielectric and ferroelectric	Individual	40 minutes	Written Report
5-9	Individual-Assignment / Homework 2	3	Question(s)	Diamagnetic, paramagnetic, ferromagnetic, antiferromagnetic, magnetic resonance	Individual	one week	Written Report
8	Midterm Exam						
10-11	Individual-Assignment / Homework 3	4	Question(s)	Non-crystalline solids, Point defects	Individual	one week	Written Report
12-13	Quiz 2	4	Question(s)	Surface and interface physics, dislocation	Individual	40 minutes	Written Report
14-15	Individual-Assignment / Homework 4	4	Question(s)	Alloy	Individual	one week	Written Report
16	Final Exam						

V. Assessment Criteria (Learning Outcome Evaluation)

Evaluation Type	Sub-CLO	Assessment Type	Frequency	Evaluation Weight (%)
Individual Assignment / Homework	1,3,4	Assignment File	4	30
Quiz	2,4	Test Sheet	2	15
Participation	4	Scoring Sheet	1	5
Midterm Exam	1,2	Individual Assignment Evaluation	1	25
Final Exam	3,4	Individual Assignment Evaluation	1	25
Total				**100**

VI. Rubric

A. Criteria of Essay Assessment

Score	Answer Quality
100	Answers are very precise and all the concept and main component are explained completely
76-99	Answers are fairly precise and the concept and main component are explained fairly complete
51-75	Answers are less precise and the concept and main component are explained less complete
26-50	Answers are poorly precise and the concept and main component are explained poorly complete
<25	Answers are wrong

VII. Attachment: Sample of Examination Papers

Attachment 1. Sample of Assignments

1. Contoh Tugas Pekerjaan Rumah:

Pekerjaan Rumah ke-1, Struktur bahan padat. Kerjakan soal di buku teks Bab 1 soal nomor: 3.

2. Contoh Tugas Makalah: format penulisan, isi, dan logika

Tugas Makalah 1. Bacalah beberapa literature terkait topik suatu bahan superkonduktor. Tulislah sebuah makalah mengenai topik tersebut dalam bentuk review dari minimal tiga literture.

Attachment 2 . Sample of Essay

1. **Essay**

Jelaskan fenomena superkonduktivitas di bahan padat. Berikan juga contoh bahan tersebut.