TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

COMPOSITE MATERIALS

by

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Depok, 26 Juli 2017

PREFACE

This Teaching Design Book (BRP) contains plans to prepare courses on Composite Materials for one semester for the Undergraduate Physics Study Program, Department of Physics, FMIPA UI.
The Composite Materials course is one of the compulsory subjects for students who majoring in Material Physics which is given in semester 7. This means that students who majoring in Materials Physics have taken compulsory courses in the previous semester, namely Introduction to Materials Science, Material Properties, Material Thermodynamics, Research Methods. Materials, and Material Characterization Methods.
The learning method of this course is through the active student learning method (Student-Centered Active Learning), namely the Collaborative Learning method. Students are divided into several Discussion Groups. In this Discussion Group, students are given a topic and have a discussion according to the learning objectives of that topic. Each Discussion Group gets a different topic. After one round of discussion, students exchange information (through discussions or presentations) with other student groups in the Home Group. Students also make assignments prepared on certain topics. At the end of the lecture, students present the results of a review of a paper, it can be done independently or together.
After completing this lecture, students are expected to be able to explain the basic concepts of composites, various types of composites and their applications, various types of matrices and reinforcement, selection of matrix and reinforcing materials, matrix-reinforcing interfaces, mechanical properties of isotropic composites and Rule of Mixtures, various types of composite fabrication. , nanocomposites, as well as the introduction of anisotropic models on the unbroken fiber amplifier.

Depok, December 22nd 2016

Dr. Suhardjo Poertadji

Ariadne L. Juwono, M.Eng., PhD.

I. General Information

1.	Name of Program / Study Level	: Physics / Undergraduate
2.	Course Name	: Composite Materials
3.	Course Code	: SCFI604513
4.	Semester	: 7
5.	Credit	: 3 credits
6.	Teaching Method(s)	: Collaborative Learning
7.	Prequisite course(s)	: Materials Properties
8.	Requisite for course(s)	: -
9.	Integration Between Other Course	: -
10.	Lecturer	: 1. Dr. Suhardjo Poertadji 2. Ariadne L. Juwono, M.Eng., PhD
11.	Course Description	:

The learning outcomes in this course are that students are able to explain the basic concepts of composites, various types of composites and their applications, various types of matrices and reinforcement, selection of matrix and reinforcing materials, matrix-reinforcing interfaces, mechanical properties of isotropic composites, various types of composite fabrication, nanocomposites; apply the Rule of Mixtures when given simple structured questions, and are able to explain anisotropic models on an unbroken fiber amplifier and reinforcements, matrix-reinforcement interfaces, mechanical properties of isotropic composites and Rule of Mixtures, various types of fabrication of composites, nanocomposites, and anisotropic models of uninterrupted fiber reinforcement. The language of instruction used in this course is Indonesian

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

A. CLO

After completing this course, students of Physics semester 7 are able to apply the Rule of Mixtures for particle and fiber reinforcing composites to simple structured questions, differentiate between types of composites and nanocomposites, classify composite fabrications, select materials for simple applications, and explain the mechanical properties of lamina and laminate.

B. Sub-CLOs

After completing this course, students will be able:

1. Describes the definition, concept, classification, and (in general) mechanical properties of composites (C2).
2. Calculating volume fraction, weight fraction, and weight to ratio in a simple structured problem (C3)
3. Applying the Rule of Mixture (ROM) to particle-reinforced composites in simple structured problems (C3)
4. Describe matrix and fiber interfaces (C2).
5. Calculate Poisson's ratio and critical fiber length (C3).
6. Applying the Rule of Mixture (ROM) to fiber-reinforced composites in simple structured problems (C3).
7. Distinguishing the types of structural composites (C2).
8. Classifying composite fabrication (C3).
9. Selecting composite constituent materials for simple applications (C4).
10. Distinguish the types of nanocomposites (C2).
11. Describe the mechanical properties of lamina and laminate as well as hygrothermal (C1) properties.
12. Presenting the results of scientific publications (C3)

III. Teaching Plan:

Week	Sub-CLO	Study Materials	Teaching Method	Teaching Media	Time Required	Learning Experiences (*O-E-F)	Sub-CLO Achievement Indicator	References
1	1	Introduction	Collaborative Learning	LCD, Laptop	2 x 50 minutes	30% O, 60% E, 10% F	Able to explain the definition, concept, classification, and mechanical properties (in general) of composites	Ref. 1 chapter 1 (1.1 – 1.2),; ref. 2 chapter 1 & 2, chapter 4 (4.1 – 4.3); ref. 3 chapter 16 (16.1 – 16.3)
2	2	Basic concepts	Collaborative Learning	LCD, Laptop	2 x 50 minutes	10% O, 80% E, 10%F	Able to calculate volume fraction, weight fraction, and weight to ratio on simple structured questions.	Ref. 1 chapter 3; ref. 2 chapter 4 (4.1 – 4.3, 4.8)
3-10	3-6	Particle reinforced composites: ROM; Fiber reinforced composites: Fiber-matrix interfaces; Poisson's ratio and critical fiber length;	Collaborative Learning	LCD, Laptop	8 X 50 minutes (FG 1); 6 X 50 minutes (HG 1) dan 2 X 50 minutes (clarification)	10% O, 80% E, 10%F	Able to apply the Rule of Mixture (ROM) for particle reinforced composites in simple structured problems; Be able to explain matrix and fiber interfaces; Able to calculate Poisson's ratio and critical fiber length; Be able to apply the Rule	Ref. 1 chapter 3 (3.2 – 3.3); ref. 3 chapter 16 (16.2 – 16.3) Ref 1 chapter 7; ref.2, chapter 3 (3.1 – 3.2)

		longitudinal and transverse direction					of Mixture (ROM) for composites with fiber reinforced composites in simple structured problems.	ref. 3 bab 16 (16.4 – 16.7) Ref. 1 chapter 6 (6.2); ref. 2 ref. 3 chapter 16 (16.4) Ref. 1 chapter 3 (3.2 – 3.3); ref. 2 chapter 5 (5.1 – 5.2); ref. 3 chapter 16 (16.4) ref. 1 chapter 4 (4.3)
11	Mid Term Exam			examination questions				

12-19	7-10	Structural composites and prepergs; Composite fabrication; Material selection for simple applications; Composites and nanocomposites	Collaborative Learning	LCD, Laptop	8 X 50 minutes (FG 2); 6 X 50 minutes (HG 2) dan 2 X 50 minutes (clarification)	10% O, 80% E, 10%F	able to distinguish types of structural composites; Able to classify composite fabrications; Be able to select composite constituent materials for simple applications; Be able to differentiate types of nanocomposites	Ref. 1, chapter 1 (1.3); ref. 3 chapter 16 (16.13 – 16.15) Ref. 1, chapter 1 (1.4), ref. 2, Table 1.5; ref. 3 chapter 16 (16.13); ref 4 Ref. 3, chapter 19; ref. 4 Ref. 4 dan ref. 5
20	11	Lamina and Laminate	Collaborative Learning	LCD, Laptop	2 X 50 Minutes	70% O, 20% E, 10%F	Describe the mechanical properties of lamina and laminate as well as hygrothermal properties	Ref. 1 chapter 2; ref 2, chapter 6 (6.1 & 6.2); Ref. 1 chapter 5;

21&22	12	Composites	Collaborative Learning	LCD, Laptop	4 X 50 Minutes	10% O, 80% E, 10%F	Able to present the results of scientific publications	Selected scientific publications
23	Final Exam			examination questions				

*) O : Orientation
L : Exercise
F : Feedback

References:

1. R. F. Gibson, Principle of Composite Material Mechanics, McGraw-Hill Book Co., Int. Ed, 1994. Bab 1 – 4 dan 10.
2. D. Hull, An Introduction to Composite Materials, Cambridge University Press, 6th. Ed., 1992. Bab 1 – 5.
3. Callister Jr, W.D., "Materials Science and Engineering: An Introduction", 7th. Ed., John Wiley & Sons. Inc., 2007, bab16.
4. Composite related scientific publications
5. Nanocomposite related scientific publications

IV. Assignment Design

Week	Assignment Name	Sub-CLOs	Assignment	Scope	Working Procedure	Deadline	Outcome
1	Question	2	Answering questions.	22.1. - 2.4	Individual homework	1 week	Homework answer sheet.
2-5	Reading course subject and Question	3-6	Reading material according to reference and answering the question	3.1. - 3.13	Home reading assignments and individual homework	3 week + 1 week	Student power point results from Home Group discussion
6-8	Reading course subject	7-10	Reading material according to reference	4.1. - 4.10	Home reading assignments	3 week	Student power point results from Home Group discussion
9-14	Paper reading	12	Reading material from journal papers, at least 2 papers		Individual or 2 people per group	6 week	Student power point

V. Assessment Criteria (Learning Outcome Evaluation)

Evaluation Type	Assessment Type	Frequency	Evaluation Weight (%)
Mid Term Exam	Answer sheet	1	30
Final Exam	Answer sheet	1	30
Discussion	Grading sheet	4	10
Homework	Answer sheet	2	20
Presentation	Grading sheet	1	10
Total	**100**		

Rubric(s):

a. Criteria of Presentation Score

No	Score	Delivering the presentation
1	85-90	Groups are able to convey explanations logically, smoothly and on time and are able to answer questions from fellow students and lecturer
2	75-84	The group is able to convey explanations logically and smoothly and can answer questions from fellow students and teachers,

		but cannot manage time well
3	65-74	The group is able to convey explanations smoothly but is unable to convey the logic of their reasoning.
4	55-64	The group is less able to convey explanations smoothly and on time and is less able to convey the logic of their reasoning
5	<55	

b. Criteria of Discussion Score

No	Score	Ability to do assignments	Argumentation	Teamwork Quality
1	85-90	The group is able to complete the task perfectly by answering all the questions in the group assignment guide completely and accurately which shows the ability to analyze in depth.	Groups are able to build strong arguments that are supported by logical reasoning and evidence from the text discussed.	The group shows good cooperation which is shown through an even distribution of tasks and the involvement of each member in the presentation and in answering questions.
2	75-84	The group was able to complete the task well and successfully answered most of the questions in the group	Groups are able to build strong arguments supported by logical reasoning but are unable to provide	The group lacks good cooperation which is shown by the presence of one member who is less

		assignment guide correctly and demonstrated the ability to analyze in depth.	explanations based on evidence from the text discussed.	actively involved in the presentation and in answering questions.
3	65-74	The group was able to complete the task and answer most of the questions in the group assignment guide in general but showed less in-depth analysis skills.	The group succeeded in building arguments but it was not strong because there were still several weaknesses in their reasoning and could not provide supporting evidence of the text discussed.	The group lacks good cooperation which is indicated by the dominance of some members and the passive attitude of some other members.
4	55-64	The group was only able to complete half the task or did not complete the tasks described in the group assignment guide	Groups can only build weak arguments in terms of reasoning and supporting evidence of the text being discussed.	The group lacks good cooperation which is indicated by the dominance of one member only and the passive attitude of the other members both in presentation and in answering questions.
5	<55			

The conversion of the final value follows the terms of value conversion applicable at the University of 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 55