TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

METHODS OF MATERIALS CHARACTERIZATION

by

Dr. Azwar Manaf M.Met.

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

The Teaching Instructional Design (BRP) in Methods of Materials Characterization course was prepared to be used as a reference for learning the Methods of Materials Characterization 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 6 on the condition that the student had taken the Introduction to Materials Science. In the Methods of Materials Characterization course, students will be taught to apply physics principles to test instruments and evaluate standard methods for testing and characterizing materials in processing material properties data appropriately. 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, 21 November 2016

Dr. Azwar Manaf, M.Met.

I. General Information

1.	Name of Program / Study Level	:	Physics / Undergraduate
2.	Course Name	:	Methods of Materials Characterization
3.	Course Code	:	SCFI603515
4.	Semester	:	6th
5.	Credit	:	4 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 an interest in material physics in semester 6 are able to apply (C3) physics principles to test instruments and evaluate (C4) standard methods for testing and characterizing materials in processing material properties data precisely in accordance with the laws of physics applies. The language of instruction used in this course is Indonesian.

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

A. CLO

Students are able to apply (C3) physics principles to test instruments and evaluate (C4) standard methods for testing and characterizing materials in processing material properties data appropriately. (ELO (s) 3, 4, 6, 8)

B. Sub-CLOs

1. Able to apply (C3) basic principles of physics to measurement methods and test instruments.
2. Able to apply (C3) the principles of nuclear and particle physics for material characterization.
3. Able to apply (C3) the principles of electric and magnetic physics for material characterization.
4. Able to evaluate (C4) the microstructure of the material on the characterization of the material.
5. Able to apply (C3) optical physics principles for material characterization.
6. Able to apply (C3) thermodynamic physics principles for material characterization.
7. Able to apply (C3) the principles of vibration and wave physics for material characterization.
8. Able to apply (C3) the principles of physics and mechanics for material characterization.

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	The basic principles of measurement methods and test instruments for material characterization	Interactive lectures, question-based learning, self-directed study, discussion	2x100 minutes	20% O, 60% E, 20% F	11.11	Able to understand and explain the basic principles of measurement and test instruments	Books and related references
3	1	Characterization of materials based on interactions to radiation (AAS, NMR, ESR)	Interactive lectures, question-based learning, self-directed study, discussion	2x100 minutes	20% O, 60% E, 20% F	3.7	Able to understand and explain the interaction of material with radiation	Books and related references
4	1	Characterization of materials based on interactions to radiation (ES, Tubidity Principle)	Interactive lectures, question-based learning, self-directed study, discussion	2x100 minutes	20% O, 60% E, 20% F	3.7	Able to understand and explain the interaction of material with radiation	Books and related references
5	2	Characterization of materials based on interaction to radiation (XRD)	Interactive lectures, question-based learning, self-directed study, discussion	2x100 minutes	20% O, 60% E, 20% F	3.7	Able to understand and explain the interaction of material with radiation	Books and related references
6	2	Characterization of materials based on interactions with electric and magnetic fields	Interactive lectures, question-based learning, self-directed study, discussion	2x100 minutes	20% O, 60% E, 20% F	11.12	Able to understand and explain the interaction of materials with electric and magnetic fields	Books and related references
7	1	Characterization of materials based on the microstructure of the material (OM, TEM,	Interactive lectures, question-based learning,	2x100 minutes	20% O, 60% E, 20% F	11.12	Able to understand and explain the microstructure of	Books and related references

		SEM, AFM)	self-directed study, discussion				materials and microscope principles	
8	**Mid-Term Exam**							
9	2	Characterization of materials based on the optical properties of the material	Interactive lectures, question-based learning, self-directed study, discussion	2x100 minutes	20% O, 60% E, 20% F	11.12	Able to understand and explain the optical properties of materials	Books and related references
10	3	Material characterization based on the thermal properties of the material	Interactive lectures, question-based learning, self-directed study, discussion	2x100 minutes	20% O, 60% E, 20% F	11.12	Able to understand and explain the thermal properties of materials	Books and related references
11	3	Characterization of materials based on interactions with EM waves	Interactive lectures, question-based learning, self-directed study, discussion	2x100 minutes	20% O, 60% E, 20% F	5.55	Able to understand and explain material interactions with EM waves	Books and related references
12	3	Characterization of materials based on interactions with light	Interactive lectures, question-based learning, self-directed study, discussion	2x100 minutes	20% O, 60% E, 20% F	5.55	Able to understand and explain the interaction of material with light	Books and related references
13	4	Material characterization based on the mechanical properties of the material	Interactive lectures, question-based learning, self-directed study, discussion	2x100 minutes	20% O, 60% E, 20% F	5.55	Able to understand and explain the mechanical properties of materials	Books and related references
14	4	Characterization of materials based on the fluid properties of the material	Interactive lectures, question-based learning, self-directed study, discussion	2x100 minutes	20% O, 60% E, 20% F	5.55	Able to understand and explain the properties of material fluids	Books and related references
15	4	Material inspection based on NDT principles	Interactive lectures, question-	2x100 minutes	20% O, 60% E, 20% F	11.11	Able to understand and explain NDT principles	Books and related

			based learning, self-directed study, discussion				for material inspection	references
16	**Final Exam**							

*) O : Orientation
E : Exercise
F : Feedback

References:

[1] Characterization of Materials (Materials Science and Technology: A Comprehensive Treatment, Vl 2A &2B, VCH (1992).

[2] Materials Characterization Techniques, S Zhang, L.Li and Ashok and RK Wild, IOP Publishing (2003).

[3] Analytical Method Validatioan and Instrument Perfomance Verification. Chan C.C., Lam, H., Lee, Y.C., dan Zhang, X..John Willey and Sons. Canada. (2004)

[4] Fundamental of Analytical Chemistry, seventh edition, Douglas A. Skoog Stanford University, Donald M. West Sna Jose State University, F. James Holler University of Kentucky.

[5] Introduction to NMR Spectroscopy, R.J. Abraham (University of Liverpool), J. Fisher (University of Leicester), P.Lotfus (Stuart Pharmacetuticals, Wilmington, USA), Jhon Wiley & Sons.

[6] Fundamentals of Molecular Spectroscopy, second edition, CN Banwell, Lecture in Chemistry University of Sussex, Falmer, Sussex, Perfik

[7] Semiconductor Material and Device Characterization, 3rd edition,D.K. Schroder, Wiley – IEEE Press (2006).

[8] Reaction Kinetics in Differential Thermal Analysis, Homer E. Kissinger , National Bureau of Standards, Washington, D. C.

[9] Characterization of Nanophase Materials, Ed. Z L Wang, Wilet-VCH(2000).

[10] ASM Handbook Vol.10: Materials Characterization, ASM International

III. Assignment Design

Week	Assignment Name	Sub-CLOs	Assignment	Scope	Working Procedure	Deadline	Outcome
12, 15	Individual assignments	7, 9	Problem set via EMAS platform	The entire range of material on the relevant week.	140 minutes		Answer sheets uploaded to EMAS
8	Mid-Term Exam	1-4	Problem set via EMAS platform	• The basic principles of measurement methods and test instruments for material characterization • Characterization of materials based on interactions with radiation • Characterization of materials based on interactions with electric and magnetic fields • Material characterization based on the microstructure of the material	100 minutes		Answer sheets uploaded to EMAS
16	Final Exam	5-9	Problem set via EMAS platform	• Characterization of materials based on the optical properties of the material • Material characterization based on the thermal properties of the material • Characterization of materials based on interactions with EM waves • Characterization of materials based on interactions with light • Material characterization based on the mechanical properties of the material • Material inspection based on NDT principles	100 minutes		Answer sheets uploaded to EMAS

IV. Assessment Criteria (Learning Outcome Evaluation)

Evaluation Type	Sub-CLO	Assessment Type	Frequency	Evaluation Weight (%)
Individual assignments	7, 9	Problem set	1	20
Mid-Term Exam	1-4	Exam questions via EMAS UI	1	40
Final Exam	5-9	Exam questions via EMAS UI	1	40
			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%)