TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

MATERIALS CHARACTERIZATION METHODS

by

Dr. Azwar Manaf M.Met.

Undergraduate Program in Physics
Faculty of Mathematics and Natural Sciences
Universitas Indonesia
Depok
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UNIVERSITAS INDONESIA
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
PHYSICS UNDERGRADUATE STUDY PROGRAM

TEACHING INSTRUCTIONAL DESIGN

Course Name	Materials Characterization Methods	**Credit(s)**	**Prerequisite course(s)**	**Requisite for course(s)**	**Integration Between Other Courses**
Course Code	SCPH603515	4	Modern Physics, Advanced Physics Laboratory Work 1 & 2, Introduction to Solid State Physics	None	None
Relation to Curriculum	Elective Course				
Semester	6^{th}				
Lecturer(s)	Dr. Azwar Manaf, M.Met.				
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.				

Program Learning Outcome (PLO)	
PLO-1	Applying the concepts of Materials Physics.
PLO-2	Formulating problems and solving Physics and its application, as well as interdisciplinary problems related to

	science and mathematics clusters critically, creatively, and innovatively.
PLO-3	Solving simple scientific problems and presenting them orally and in writing.
Course Learning Outcome (CLO)	
CLO-1	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.
Sub-CLO(s)	
Sub-CLO 1	Able to apply (C3) basic principles of physics to measurement methods and test instruments.
Sub-CLO 2	Able to apply (C3) the principles of nuclear and particle physics for material characterization.
Sub-CLO 3	Able to apply (C3) the principles of electric and magnetic physics for material characterization.
Sub-CLO 4	Able to evaluate (C4) the microstructure of the material on the characterization of the material.
Sub-CLO 5	Able to apply (C3) optical physics principles for material characterization.
Sub-CLO 6	Able to apply (C3) thermodynamic physics principles for material characterization.
Sub-CLO 7	Able to apply (C3) the principles of vibration and wave physics for material characterization.
Sub-CLO 8	Able to apply (C3) the principles of physics and mechanics for material characterization.
Study Materials	The basic principles of X-Ray, XRD, XRF, TEM, SEM, EDS, DTA, TGA, DSC, UTM, Impact Test, LPSA, AAS, ESR. Permeameter, VSM. Various test standards (including ASTM E 975-95), material phase identification, heat capacity, thermal conductivity, APD program, Match and GSAS, mechanical properties testing and standardization, ultrasonic and its applications, radiography and its applications, Eddy Current technique and its applications, optical diffraction and its applications, magnetic properties and their standardization.
Reading List	[1] B.D. Cullity, Introduction to X-Ray Diffraction, Addition Wesley, 1978 [2] P.J. Goodhew and F.J. Humphreys, Electron Microscopy and Analysis, Taylor & Francis, 1988 [3] ASM Handbook Volume 10, Materials Characterization, ASM International, 1992 [4] Scientific publications related to material methods and characterizations.

I. Teaching Plan

Week	Sub-CLO	Study Materials [with reference]	Teaching Method [with est. time]	Learning Experiences (*O-E-F)	Sub-CLO Achievement Indicator		Sub-CLO Weight on Course (%)
					General	Specific	
1	Course Introduction						
2	1	The basic principles of measurement methods and test instruments for material characterization [Books and related references]	Interactive lectures, question-based learning, self-directed study, discussion [2 x 100 minutes]	20% O, 60% E, 20% F	Able to understand and explain the basic principles of measurement and test instruments		11.11
3	1	Characterization of materials based on interactions to radiation (AAS, NMR, ESR) [Books and related references]	Interactive lectures, question-based learning, self-directed study, discussion [2 x 100 minutes]	20% O, 60% E, 20% F	Able to understand and explain the interaction of material with radiation		3.7
4	1	Characterization of materials based on interactions to radiation (ES, Tubidity Principle) [Books and related references]	Interactive lectures, question-based learning, self-directed study, discussion [2 x 100 minutes]	20% O, 60% E, 20% F	Able to understand and explain the interaction of material with radiation		3.7
5	2	Characterization of materials based on interaction to radiation (XRD) [Books and related references]	Interactive lectures, question-based learning, self-directed study, discussion [2 x 100 minutes]	20% O, 60% E, 20% F	Able to understand and explain the interaction of material with radiation		3.7
6	2	Characterization of materials based on interactions with electric and magnetic	Interactive lectures, question-based	20% O, 60% E, 20% F	Able to understand and		11.12

		fields [Books and related references]	learning, self-directed study, discussion [2 x 100 minutes]		explain the interaction of materials with electric and magnetic fields		
7	1	Characterization of materials based on the microstructure of the material (OM, TEM, SEM, AFM) [Books and related references]	Interactive lectures, question-based learning, self-directed study, discussion [2 x 100 minutes]	20% O, 60% E, 20% F	Able to understand and explain the microstructure of materials and microscope principles		11.12
8	**Mid-Term Exam**						
9	2	Characterization of materials based on the optical properties of the material [Books and related references]	Interactive lectures, question-based learning, self-directed study, discussion [2 x 100 minutes]	20% O, 60% E, 20% F	Able to understand and explain the optical properties of materials		11.12
10	3	Material characterization based on the thermal properties of the material [Books and related references]	Interactive lectures, question-based learning, self-directed study, discussion [2 x 100 minutes]	20% O, 60% E, 20% F	Able to understand and explain the thermal properties of materials		11.12
11	3	Characterization of materials based on interactions with EM waves [Books and related references]	Interactive lectures, question-based learning, self-directed study, discussion [2 x 100 minutes]	20% O, 60% E, 20% F	Able to understand and explain material interactions with EM waves		5.55
12	3	Characterization of materials based on interactions with light [Books and related references]	Interactive lectures, question-based learning, self-directed	20% O, 60% E, 20% F	Able to understand and explain the		5.55

			study, discussion [2 x 100 minutes]		interaction of material with light		
13	4	Material characterization based on the mechanical properties of the material [Books and related references]	Interactive lectures, question-based learning, self-directed study, discussion [2 x 100 minutes]	20% O, 60% E, 20% F	Able to understand and explain the mechanical properties of materials		5.55
14	4	Characterization of materials based on the fluid properties of the material [Books and related references]	Interactive lectures, question-based learning, self-directed study, discussion [2 x 100 minutes]	20% O, 60% E, 20% F	Able to understand and explain the properties of material fluids		5.55
15	4	Material inspection based on NDT principles [Books and related references]	Interactive lectures, question-based learning, self-directed study, discussion [2 x 100 minutes]	20% O, 60% E, 20% F	Able to understand and explain NDT principles for material inspection		11.11
16	**Final Exam**						

II. 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

III. 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

IV. Rubric(s)

This rubric is used as a guideline for assessing or giving levels of student performance results. a rubric usually consists of assessment criteria that include the dimensions / aspects that are assessed based on indicators of learning achievement. This assessment rubric is useful for clarifying the basics and aspects of the assessment so that students and lecturers can be guided by the same thing regarding the expected performance demands. Lecturers can choose the type of rubric according to the assessment given.

A. Conversion of the student's final score

Score	Grade	Equivalent
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 - < 50	D	1.00
< 40	E	0.00

B. Assessment rubric: 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

C. Assessment rubric: 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%)