

Universitas Negeri Surabaya Faculty of Engineering, Mechanical Engineering Undergraduate Study Program

Document Code

SEMESTER LEARNING PLAN

Courses						Co	urse F	amily	/		Cre	dit We	eight		SEME	STER	Co	mpilat te	tion
Engineering	ngineering Materials 1 2120102120 Compulsory Curriculum T=2 P=0 ECTS=3.18 1								ril 28,										
AUTHORIZA	TION		SP Develo	oer		Ju	bjecis	- Nau		Course	e Clus	ster Co	oordina	tor	Study	Progra			ator
							ochamad Arif Irfa'i, ngsih, S.T., M.T.				Ir. Priyo Heru Adiwibowo, S.T., M.T.			0,					
Learning model	Case Studies																		
Program	PLO study pro	ogram t	hat is charç	ged to	the cou	urse													
Learning Outcomes	PLO-5	Work	independent	ly and i	n group:	S													
(PLO)	PLO-11	Desig	n and develo	pment	of soluti	ons th	nat take	e into	acco	ount the	e envi	ronme	nt and s	ustain	ability				
	PLO-14	Scien	ce and engin	eering I	knowled	lge													
	Program Obje	ctives (ives (PO)																
	PO - 1	particu to rela	CPMK1 a. Al ular situation ated courses performance l	(What I c. Able	knowlec to dem	lge is onstra	neede ate app	d) b. <i>i</i> propria	Able	to cha	nge r	eal wo	rld situa	tions i	nto mod	lels tha	t are a	pprop	riate
	PO - 2	compa	CO2/CPMK2 a. Able to obtain data about appropriate variables in the field of Mechanical Engineering. b. Able compare experimental data and results with appropriate theoretical models. c. Be able to explain observed difference between models and experiments.																
	PO - 3	CO3/0	CPMK3 a Abl	e to for	mulate p	oroble	ms (id	entify	and	analyz	e obs	tacles	b. Abilit	ty to se	et criteri	a			
	PLO-PO Matrix	x																	
			P.O PO-1 PO-2 PO-3		PLO-5		P	LO-11			PLO-:	14	-						
	PO Matrix at th	he end	of each lea	rning s	stage (S	Sub-F	PO)												
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			P.0								We	ek]
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		PC	D-1																
		PC)-2																
		PC	0-3																
			-						1										_
Short Course Description	This course dis formation proce classification of defects in crysta	esses. l enginee	Jnderstandin ring materials	g elect s, mech	ron no anical p	menc roper	lature, ties of	atom mater	nic a ials,	nd cr mecha	ystal inical	struct testing	ures, cł į, crysta	nemica I struct	al bond ture, Mi	s and	metal	lic bo	onds,
References	Main :																		
	2. Dieter, 0 3. Dieter, 0 4. Dieter, 0 5. Smallma	 Avner, Sidney. 1974 Dieter, George E. 1986. "Metalurgi Mekanik jilid 1". Edisi 3 Dieter, George E. 1990. Dieter, George E. 1986 Smallman, R.E. and Bishop, R.J. 1999 Suherman, Wahid, Ir. 1987. "Pengetahuan Bahan". Edisi Pertama 																	
	Supporters:																		
			1																

1. 1. Van Vlack, Djaprie, S., Ilmu dan Teknologi Bahan, Edisi IV, Erlangga, Ja	karta.
2. 2. J.F. Shackelford, Introduction to material Science for engineers, 3rd Ed,	Macmillan, 1992.
3. 3. Diktat Material 1, Novi Sukma Drastiawati, 2022.	

Supporting lecturer Mochamad Arif Irfa'i, S.Pd., M.T. Tri Hartutuk Ningsih, S.T., M.T.

Week-	Final abilities of each learning stage	Eva	luation	Learni Student) Learning, ng methods, Assignments, mated time]	Learning materials	Assessmer Weight (%
	(Sub-PO)	Indicator	Criteria & Form	Offline(offline)	Online (<i>online</i>)	[References]	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Sub CO/CPMK 1 Describes the classification of materials, classification of material properties (physical, mechanical, thermal, optical and magnetic properties), the relationship between material production, the latest material developments and their applications (nano materials, sensor materials, and magnetic materials)	a. Describe the meaning of mechanical stress, chemistry, thermal, optical and magnetic properties), the relationship between material properties and design and production, the latest material developments and their applications (nano materials) b. Be able to explain defects crystal glass, material classification, classification of material properties (physical, mechanical, thermal, optical and magnetic properties), the relationship between materials properties and design and production, the latest material developments and their applications (nano materials, sensor materials and materials magnet) c. Able to describe crystal defects, material classification of material properties (physical, mechanical, chemical, thermal, optical and magnetic properties), the relationship between materials magnet) c. Able to descification, classificatio	Criteria: 1.1. If you are able to answer all the questions correctly you will get a score of 100. 2.2. If you are able to answer two questions correctly you will get a score of 70. 3.3. If you are able to answer one question correctly you will get 40 points. 4. Score criteria: Special: 90 to 100; Very good: 76 to 89; Average: 56 to 75; Below average: 0 to 55. Form of Assessment : Participatory Activities	Lecture Case study, Discussion in groups Task-1: Explain 3 material properties with examples Explain material selection by taking one of the examples in the industrial world Describe material classification in the form of a chart 2(2x50) minutes 2 X 50		Material: a. Describe the meaning of mechanical stress, chemistry, thermal, optical and magnetic properties), the relationship between material production, the latest material developments and their applications (nano materials, sensor materials and magnetic materials) References: <i>Dieter, George</i> <i>E.</i> 1986. "Mechanical Metallurgy volume 1". Edition 3 Material: Sub CO/CPMK 1 Describes the classification of materials, classification of materials, classification of material, classification of materials properties (physical, mechanical, chemical, thermal, optical and magnetic properties, the relationship between materials properties, and design and production, the latest developments in materials, sensor materials, and magnetic materials, and magnetic ma	
2	Sub CO/CPMK 1 Describes the classification of materials, classification of material properties	a. Describe the meaning of mechanical stress, chemistry, thermal, optical and magnetic	Criteria: 1.1. If you are able to answer all the questions correctly you will	Lecture Case study, Discussion in groups Task-1:		Material: a. Describe the meaning of mechanical stress,	1%

(physical, mechanical, chemical, thermal, optical and magnetic properties), the relationship between material properties and design and production, the latest material developments and their applications (nano materials, sensor materials , and magnetic materials)

properties), the relationship between material properties and design and production, the latest material developments and their applications (nano materials, sensor materials and magnetic materials) b. Be able to explain defects crystal glass, material classification, classification of material properties (physical mechanical, chemical, thermal, optical and magnetic properties), the relationship between material properties and design and production, the latest material developments and their applications (nano materials, sensor materials and materials magnet) c. Able to describe crystal defects, material classification. classification of material properties (physical, mechanical chemical, thermal, optical and magnetic properties), the relationship between material properties and design and production, the latest material developments and their applications (nano materials, materials sensors. and magnetic materials)

100.

points.

Explain 3 get a score of material properties with 2.2. If you are able examples to answer two Explain questions material correctly you will selection by get a score of 70. taking one of 3.3. If you are able the examples to answer one in the question correctly industrial world you will get 40 Describe material 4.Score criteria: classification Special: 90 to in the form of a 100; Very good: chart 2(2x50) 76 to 89: minutes Average: 56 to 2 X 50 75; Below average: 0 to 55. Form of Assessment Participatory Activities

chemistry, thermal, optical and magnetic properties), the relationship between material properties and design and production, the latest material developments and their applications (nano materials, sensor materials and magnetic materials) b. Be able to explain crystal defects, material classification, classification of material properties (physical, mechanical, chemical. thermal, optical and magnetic properties), the relationship between material properties and design and production, the latest material developments and their applications (nano materials, sensor materials, and magnetic materials) c. Able to describe crystal defects, material classification, classification of material properties (physical, mechanical, chemical, thermal, optical and magnetic properties), the relationship between material properties and design and production, the latest material developments and their applications (nano materials, materials sensors, and magnetic materials) Bibliography: Dieter, George E. 1986. "Mechanical Metallurgy volume 1' Edition 3 Material: Able

to explain crystal defects, material classification, classification of material properties

			(physical,	
			mechanical,	
			chemical,	
			thermal, optical	
			and magnetic	
			properties), the	
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			Able to	
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1			sensors, and	
			magnetic	
			materials)	
			References:	
			Smallman, RE	
			and Bishop, RJ	
L			1999	

3	Sub CO./CPMK 1 Describe atomic	a. Describe the atomic structure,	Criteria: 1.1. If you are able	Lectures and written	Material: a. Describe the	30
	structure, crystal structure, and	crystal structure, and crystal defects	to answer 4	assignments	atomic	
	crystal defects	 b. Explain atomic 	questions	Task-2: Describe the	structure, crystal	
		structure, crystal structure, and	correctly you will	various defects	structure, and	
		crystal defects c.	get a score of	in crystals	crystal defects	
		Describe atomic	100. 2.2. If you are able	Describe the	b. Explain	
		structure, crystal structure, and	to answer 3	various crystal	atomic	
		crystal defects	questions	structures in	structure,	
			correctly you will	steel	crystal	
			get a score of 75.	Name at least 5 types of	structure, and crystal defects	
			3.3. If you are able	crystal lattices.	c. Describe	
			to answer 2		atomic	
			questions	2x50 minutes	structure,	
			correctly you will	2 X 50	crystal	
			get 50 points.		structure, and	
			4.4. If you are able		crystal defects. Reference:	
			to answer 1		Dieter, George	
			question correctly		<i>E.</i> 1986.	
			you will get 25 points.		"Mechanical	
			5.Score criteria:		Metallurgy	
			Special: 90 to		volume 1".	
			100; Very good:		Edition 3	
			76 to 89;		NA _ 1 _1 _1	
			Average: 56 to		Material: Describe	1
			75; Below		atomic	1
			average: 0 to 55		structure,	1
			Form of Accessory		crystal	
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			Participatory Activities,		crystal defects b. Explain	1
			Tests		atomic	1
					structure,	
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					structure, and	
					crystal defects	
					c. Describe	
					atomic structure,	
					crystal	
					structure, and	
					crystal defects.	
					References:	
					Suherman,	
					Wahid, Ir.	
					1987. "Materials	
					Knowledge".	
					First Edition	
				11		-
4	Sub CO/CPMK 2 Able to carry out	 Able to carry out calculations 	Criteria:	Live lecture	Material: calculations	5
	calculations related	related to crystal	1.1. If you are able	and question and answer	related to	
	to crystal structures	structures	to answer all the	Task-3:	crystal	
			questions correctly you will	Find the Miller	structures with	
			get a score of	index for the	Miller indices.	
			100.	crystal lattice	Reference:	1
			2.2. If you are able	Describe the	Avner, Sidney.	1
			to answer 3	crystal lattice	1974.	1
			questions	using the Miller Index	Material:	1
			correctly you will	Calculate the	calculations	1
			get a score of 75.	APF and VPF	related to	1
			3.3. If you are able	values for the	crystal	1
			to answer 2	BCC and FCC	structures with	1
			questions	crystal	Miller indices	1
			correctly you will	structures 2x50 minutes.	References:	1
			get 50 points. 4.4. If you are able	2 X 50 minutes.	Dieter, George E. 1986.	1
			to answer 1		E. 1986. "Mechanical	1
			question correctly		Metallurgy	1
			you will get 25		volume 1".	1
			points.		Edition 3	1
			5.Score criteria:			
			Special: 90 to		Material:	1
			100; Very good:		calculations	1
			76 to 89;		related to	
			Average: 56 to		crystal structures with	1
			75; Below		Miller indices.	1
			average: 0 to 55.		Reference:	
			Form of Assessment		Suherman,	1
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			Participatory Activities			
			Participatory Activities, Tests		"Materials	
					"Materials Knowledge". First Edition	

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and scale of metalography exercises of low carbon explaining the explaining the correctly you will get a score of 60 4. If you are shown of the results of the deficient with the results of the results of the results of the deficient with the results of the deficient with the results of the deficient with the results of the results of the results of the deficient with the results of the results of the results of the deficient with the results of the results of the results of the deficient with the results of the results of the results of the results of the deficient with the results of the re				3.3. If you are able	describe the		metallography	
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diagrams strength, calculations with the results of trial date in a study (affielde). diagrams strength, correctly you will get 40 points. 5. If you are able to answer 1 question correctly you will get 00 marks. 6.6. If you are able to answer 0 question correctly you will get 00 marks. 7. Score criteria: Special 90 to 100; Very good: 7 to 90; 7 to 90; 7 to 90; 7 to 50; Form of Assessment 1. Participatory Activities, Tests Form of Assessment 1. Participatory Activities, Tests Form of Assessment 1. Participatory Activities, Tests Form of Assessment 2. Stored 1. Participatory Activities, Tests Form of Assessment 2. Stored 1. Participatory Activities, Tests Form of Assessment 2. Stored 1. Participatory Activities, Tests Form of Assessment 1. Participatory Activities, Tests For Participatory								
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Ed, Macmillan,				1		1		
				1				
1992.				1				
					<u> </u>		1992.	

6	Sub CO/CPMK 2	a. Able to	Criteria:	Lectures,	Material:	4%
1	Describes tensile	calculate tensile	1.1. If you are able	discussions	explains the	
1	tests, hardness	strength, bending	to answer all the	and questions	calculation	
1	tests, bending tests, impact tests,	strength, impact strength, hardness	questions	and answers	results of	
1	torsion tests, and	values, torsional	correctly, you will	Task-4:	tensile	
	metallographic	strength, and	get a score of	Explain	strength,	
1	observations	scale of	100.	hardness	bending	
1		metallography test		testing using	strength,	
1		results b. Able to	2.2. If you are able	the Rockwell	impact	
1		explain the calculation results	to answer 2	method	strength,	
		of tensile strength,	questions	Explain the	hardness	
		bending strength,	correctly, you will	meallography	values,	
		impact strength,	get a score of 70.	method and	torsional	
		hardness values,	3.3. If you are able	describe the	strength, and	
		torsional strength,	to answer 1	microstructure	scale of	
		and scale of	question	of low carbon	metallography	
		metallography test	correctly, you will	steel	test results.	
		results c. test results after	get 35 points.	Draw stress	Reference:	
		carrying out	4.4. If you are	and strain	Suherman,	
		theoretical	unable to answer	diagrams	Wahid, Ir.	
1		calculations with		3 (2 x 50	1987.	
1		the results of trial	all questions	minutes)	"Materials	
1		data in a study	correctly, you will	2 X 50	Knowledge".	
1		(article)	get a score of 0.		First Edition	
1			Score criteria:			
1			Special: 90 to		Matorial	
1			100; Very good:		Material:	
1			76 to 89;		explains the	
1			Average: 56 to		calculation	
1			75; Below		results of tensile	
			average: 0 to 55.			
			areitaget e te eet		strength,	
			Form of Assessment		bending	
			:		strength,	
			Participatory Activities		impact	
					strength,	
					hardness	
					values,	
					torsional	
					strength, and	
					scale of	
					metallography	
					test results.	
					References:	
					1. Van Vlack,	
					Djaprie, S.,	
					Materials	
1					Science and	
					Technology,	
					Edition IV,	
1					Erlangga,	
1					Jakarta.	
1						
1					Material:	
1					explains the	
1					calculation	
1					results of	
1					tensile	
1					strength,	
1					bending	
1					strength,	
1					impact	
1					strength,	
1					hardness	
1					values,	
1					torsional	
1					strength, and	
1					scale of	
1					metallography	
1					test results.	
1					References:	
					3. Materials	
1					Diktat 1, Novi	
				1		
					Sukma	l I
					Sukma Drastiawati	
					Sukma Drastiawati, 2022.	

7	Sub CO/CPMK 2 Describes tensile tests, hardness tests, bending tests, impact tests, torsion tests, and metallographic observations	a. Able to calculate tensile strength, bending strength, hardness values, torsional strength, and scale of metallography test results b. Able to explain the calculation results of tensile strength, bending strength, hardness values, torsional strength, and scale of metallography test results after carrying out theoretical calculations with the results of trial data in a study (article).	Criteria: 1.1. If you are able to answer all the questions correctly, you will get a score of 100. 2.2. If you are able to answer 3 questions correctly, you will get a score of 75. 3.3. If you are able to answer 2 questions correctly, you will get 50 points. 4.4. If you are able to answer 1 question correctly, you will get 25 points. 5.4. If you cannot answer all the questions you will get a score of 0. 6.Score criteria: Special: 90 to 100; Very good: 76 to 89; Average: 56 to 75; Below average: 0 to 55. Form of Assessment : Participatory Activities, Tests	Lectures, discussions and questions and answers Task-4: Explain hardness testing using the Rockwell method. Explain the meallography method and describe the microstructure of low carbon steel. Draw stress and strain diagrams 3 (2 × 50 minutes). 2 X 50	Material: test results after carrying out theoretical calculations with the results of trial data in a study (article). Bibliography: Suherman, Wahid, Ir. 1987. "Materials Knowledge". First Edition Material: test results after carrying out theoretical calculations with the results of trial data in a study (article). References: 3. Material Diktat 1, Novi Sukma Drastiawati, 2022.	2%
8	Sub Summative Exam.	Sub Summative Exam	Criteria: Sub Summative Exam. Form of Assessment Participatory Activities	Written test. 2 X 50	Material: SUB SUMATIVE TEST Reference: Suherman, Wahid, Ir. 1987. "Materials Knowledge". First Edition Material: SUB SUMATIVE TEST Reference: Avner, Sidney. 1974. Material: SUB SUMATIVE TEST Reference: Smallman, RE and Bishop, RJ 1999.	19%

9	Sub CO/CPMK 1 Describe isomorphous and eutechic phase diagrams	Be able to explain isomorphous and eutechic phase diagrams c. Be able to draw isomorphous and eutectic phase diagrams.	Criteria: 1.4 2. The presentation was carried out coherently, with appropriate intonation and emphasis, showing a good understanding of the concept, with the help of ppt media according to media criteria, correct answers to the questioner, able to formulate suggestions for improvement 3.3 4. The presentation was carried out coherently, intonation and emphasis were appropriate, but lacking in understanding some concepts, assistance can be provided via ppt media according to media criteria, answers from the questioner are generally correct, able to formulate suggestions for improvement 5.2 6. The presentation was carried out, was not coherent and/or showed a lack of understanding of several concepts, assistance via ppt media but did not meet the media criteria, answers from the questioner were generally incorrect, able to formulate suggestions for improvement 7.1 8. The presentation was carried out, but was not coherent and/or showed a lack of understanding of many concepts, did not use pt media but did not media the suggestions for improvement 7.1 8. The presentation was carried out, but was not coherent and/or showed a lack of understanding of many concepts, did not use pt media, the answer from the questioner was incorrect, unable to formulate suggestions for improvement 9. Score criteria: Special: 90 to 10; Veny good: 76 to 2; Form of Assessment Participatory Activities	Lectures, discussions and questions and answers Task-5: Draw the Fe-C or Fe-Fe3C phase diagram along with an explanation of the phase transformation. 2 X 50		Material: isomorphous and eutectic phase diagrams and describing isomorphous and eutectic phase diagrams References: Suherman, Wahid, Ir. 1987. "Materials Knowledge". First Edition Material: isomorphous and eutectic phase diagrams and describing isomorphous and eutectic phase diagrams References: 2. JF Shackelford, Introduction to materials Science for engineers, 3rd Ed, Macmillan, 1992 Material: isomorphous and eutectic phase diagrams and describing isomorphous and eutectic phase diagrams and describing isomorphous and eutectic phase diagrams References: Avner, Sidney. 1974	5%
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Sub CO/CPMK 2 Perform phase diagram calculations.	a. Able to calculate phase diagrams (percentage of ferrite and pearlite) b. Able to explain the results of phase diagram calculations (percentage of ferrite and pearlite).	Criteria: 1.4 2. The presentation was carried out coherently, with appropriate intonation and emphasis, showing a good understanding of the concept, with the help of ppt media according to media criteria, correct answers to the questioner, able to formulate suggestions for improvement 3.3 4. The presentation was carried out coherently, intonation and emphasis were appropriate, but lacking in understanding some concepts, assistance can be provided via ppt media according to media criteria, answers from the questioner are generally correct, able to formulate suggestions for improvement 5.2 6. The presentation was carried out, was not coherent and/or showed a lack of understanding of several concepts, assistance via ppt media but did not meet the media criteria, answers from the questioner were generally incorrect, able to formulate suggestions for improvement 7.1 8. The presentation was carried out, but was not coherent and/or showed a lack of understanding of several concepts, assistance via ppt media but did not meet the media criteria, answers from the questioner were generally incorrect, able to formulate suggestions for improvement 7.1 8. The presentation was carried out, but was not coherent and/or showed a lack of understanding of many concepts, did not use pt media lack of understanding of many concepts, did not use pt answer from the questioner was incorrect, unable to formulate suggestions for improvement 9. Score criteria: Special: 90 to 100; Veng 50 to	Lecture, discussion and answer Task-6: Find the percentage of ferrite and pearlite. 2 X 50	Material: calculating explaining the results of phase diagram calculations (percentage of ferrite and pearlite) References: 3. Material: calculating explaining the results of phase diagram calculations (percentage of ferrite and pearlite) References: Diaterial: calculations (percentage of ferrite and pearlite) Reference: Smallman, RE and Bishop, RJ 1999	5%

11	Sub CO/CPMK 1	1.Able to	Criteria:	Lectures,	Material:	5%
	Able to describe	describe the	1.4	discussions	classification of	
1	the classification of	classification of	2.The presentation	and questions	ferrous metal	
	ferrous metal materials, iron	ferrous metal	was carried out	and answers	materials, iron	
1	making, steel	materials, iron	coherently, with	Task-7:	making, steel	
	making, carbon	making, steel	appropriate	Explain the	making, carbon	
	steel and alloy	making, carbon	intonation and	process of	steel and alloy	
	steel, cast iron, crystal structure of	steel and alloy	emphasis,	refining iron	steel, cast iron,	
	ferrous metals, Fe	steel, cast iron,	showing a good	and making	crystal	
	phase diagram,	crystal	understanding of	steel Describe the	structure of ferrous metals,	
	heat treatment of	structure of	the concept, with	process of	Fe phase	
	steel, mechanical properties of	ferrous metals,	the help of ppt	refining pig	diagram, heat	
	ferrous metals, and	Fe phase	media according	iron and	treatment of	
	standardization of	diagram, heat	to media criteria.	making open	steel,	
	steel materials	treatment of	correct answers	hearth furnace	mechanical	
		steel,	to the questioner,	steel	properties of	
		mechanical	able to formulate	Describe the	ferrous metals,	
		properties of	suggestions for	heat treatment	and	
		ferrous metals,	improvement	process for	standardization	
		and	3.3	steel in at least	of steel	
		standardization	4. The presentation	2 processes	materials.	
		of steel	was carried out	3 (2x50)	Reference: 3.	
		materials	coherently,	minutes	Diktat Material	
		2.Able to explain	intonation and	2 X 50	1, Novi Sukma	
		the	emphasis were		Drastiawati,	
1		classification of	appropriate, but		2022	
		ferrous metal	lacking in		Matarial	
		materials, iron	understanding		Material: classification of	
		making, steel	some concepts,		classification of ferrous metal	
		making, carbon	assistance can		materials, iron	
		steel and alloy	be provided via		making, steel	
		steel, cast iron,	ppt media		making, carbon	
		crystal	according to		steel and alloy	
		structure of	media criteria,		steel, cast iron,	
		ferrous metals,	answers from the		crystal	
		Fe phase	questioner are		structure of	
		diagram, heat	generally		ferrous metals,	
		treatment of	correct, able to		Fe phase	
		steel,	formulate		diagram, heat	
		mechanical	suggestions for		treatment of	
		properties of	improvement		steel,	
		ferrous metals,	5.2		mechanical	
		and	6.The presentation		properties of	
		standardization	was carried out,		ferrous metals,	
		of steel	was not coherent		and	
		materials	and/or showed a		standardization of steel	
		3.Able to	lack of		of steel materials.	
		describe the	understanding of		Reference:	
		classification of	several concepts,		Smallman, RE	
		ferrous metal	assistance via ppt		and Bishop, R.	
		and the second second second	media but did not		J. 1999.	
		materiais, iron making, steel	meet the media			
		making, steel making, carbon	criteria, answers		Material:	
		steel and alloy	from the		classification of	
		steel, cast iron,	questioner were		ferrous metal	
		crystal	generally		materials, ilron	
		structure of	incorrect, able to		making, steel	
		ferrous metals,	formulate		making, carbon	
		Fe phase	suggestions for		steel and alloy	
		diagram, heat	improvement		steel, cast iron,	
		treatment of	7.1		crystal	
		steel,	8.The presentation		structure of ferrous metals,	
		mechanical	was carried out,		Fe phase	
		properties of	but was not		diagram, heat	
		ferrous metals,	coherent and/or		treatment of	
		and	showed a lack of		steel,	
		standardization	understanding of		mechanical	
		of steel	many concepts,		properties of	
		materials	did not use ppt		ferrous metals,	
			media, the		and	
			answer from the		standardization	
			questioner was		of steel	
			incorrect, unable		materials.	
			to formulate		Reference: 2.	
			suggestions for		JF Shackolford	
			improvement		Shackelford, Introduction to	
			9.Score criteria:		materials	
			Special: 90 to		science for	
			100; Very good:		engineers, 3rd	
			76 to 89;		Ed, Macmillan,	
			Average: 56 to		1992.	
			75; Below			
			average: 0 to 55			
			avorage. 0 10 00			
			Form of Assessment			
			:			
			Participatory Activities			
	•	•	•	•		

12	Sub CO/CPMK 1 Able to describe the classification of ferrous metal materials, iron making, steel making, carbon steel and alloy steel, cast iron, crystal structure of ferrous metals, Fe phase diagram, heat treatment of steel, mechanical properties of ferrous metals, and standardization of steel materials	1.Able to describe the classification of ferrous metal materials, iron making, steel making, carbon steel and alloy steel, cast iron, crystal structure of ferrous metals, Fe phase diagram, heat treatment of	Criteria: 1.4 2.The presentation was carried out coherently, with appropriate intonation and emphasis, showing a good understanding of the concept, with the help of ppt media according to media criteria, correct answers to the questioner	Lectures, discussions and questions and answers Task-7: Explain the process of refining iron and making steel. Describe the process of refining pig iron and making open hearth furnace steel	Material: classification of ferrous metal materials, iron making, steel making, carbon steel and alloy steel, cast iron, crystal structure of ferrous metals, Fe phase diagram, heat treatment of steel, mechanical properties of	5%
	standardization of	diagram, heat	to media criteria, correct answers to the questioner, able to formulate suggestions for improvement 3.3 4. The presentation was carried out coherently, intonation and emphasis were appropriate, but lacking in understanding some concepts, assistance can be provided via ppt media according to media criteria, answers from the questioner are generally correct, able to formulate suggestions for improvement 5.2 6. The presentation was carried out, was not coherent and/or showed a lack of understanding of	making open	steel,	
			Average: 56 to 75; Below average: 0 to 55 Forms of Assessment : Participatory Activities, Portfolio Assessment, Tests		Materials Science and Technology, Edition IV, Erlangga, Jakarta.	

13	Sub-CO/CPMK3 Designing the manufacture of specimens for practical heat treatment on steel Laboratory practice on heat treatment on steel Designing procedures for carrying out hardness testing on steel materials after the heat treatment process	 a. Able to formulate problems (identify "needs") and analyze constraints on making specimens for heat treatment and practical process constraints. b. Ability to establish "appropriate" criteria for solutions in the evaluation process in carrying out practicums and testing after the heat treatment process. c. Produce reports on the results of heat treatment practicums and instructions on how to carry out practicums and hardness testing. 	Criteria: 1.1. If you are able to answer all the questions correctly you will get a score of 100. 2.2. If you are able to answer 1 question correctly you will get 50 points. 3. Score criteria: Special: 90 to 100; Very good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 Forms of Assessment : Participatory Activities, Practical Assessment, Practical / Performance	Lectures, discussions and questions and answers. Discussion (presentation) - Question and answer Case Method/PBL 2 X 50	Material: Paraktikum Bibliography: Dieter, George E. 1986. "Mechanical Metallurgy volume 1". Edition 3 Material: Practical Literature: Dieter, George E. 1986. Material: Practical Literature: Smallman, RE and Bishop, RJ 1999	5%
14	Sub-CO/CPMK3 Designing the manufacture of specimens for practical heat treatment on steel Laboratory practice on heat treatment on steel Designing procedures for carrying out hardness testing on steel materials after the heat treatment process	 a. Able to formulate problems (identify "needs") and analyze constraints on making specimens for heat treatment and practical process constraints. b. Ability to establish "appropriate" criteria for solutions in the evaluation process in carrying out practicums and testing after the heat treatment process. c. Produce reports on the results of heat treatment practicums and instructions on how to carry out practicums and hardness testing. 	Criteria: 1.1. If you are able to answer all the questions correctly you will get a score of 100. 2.2. If you are able to answer 1 question correctly you will get 50 points. 3. Score criteria: Special: 90 to 100; Very good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 Forms of Assessment : Participatory Activities, Project Results Assessment, Practical Assessment, Practical Assessment, Practical Assessment, Practice / Performance	Lectures, discussions and questions and answers. Discussion (presentation) - Question and answer Case Method/PBL 2 X 50	Material: Paraktikum Bibliography: Dieter, George E. 1986. "Mechanical Metallurgy volume 1". Edition 3 Material: Practical Literature: Dieter, George E. 1990. Material: Practical Literature: Suherman, Wahid, Ir. 1987. "Materials Knowledge". First Edition	2%

15	Sub-CO/CPMK3 Designing the manufacture of specimens for practical heat treatment on steel Laboratory practice on heat treatment on steel Designing procedures for carrying out hardness testing on steel materials after the heat treatment process	 a. Able to formulate problems (identify "needs") and analyze constraints on making specimens for heat treatment and practical process constraints. b. Ability to establish "appropriate" criteria for solutions in the evaluation process in carrying out practicums and testing after the heat treatment process. c. Produce reports on the results of heat treatment practicums and instructions on how to carry out practicums and hardness testing 	Criteria: 1.1. If you are able to answer all the questions correctly you will get a score of 100 2.2. If you are able to answer 1 question correctly you will get 50 points 3.Score criteria: Special: 90 to 100; Very good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 Forms of Assessment : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, discussions and questions and answers Discussion (presentation) - Questions and answers Case Method/PBL 2 X 50	Material: Paraktikum Bibliography: Dieter, George E. 1986. "Mechanical Metallurgy volume 1". Edition 3 Material: Practical Literature: 1. Van Vlack, Djaprie, S., Materials Science and Technology, Edition IV, Erlangga, Jakarta Material: Practical Library: 2. JF Shackelford, Introduction to materials Science for engineers, 3rd Ed, Macmillan, 1992.	2%
16	Final exams.	Final exams	Criteria: Written Exam. Form of Assessment Participatory Activities	Written Exam. 2 X 50	Material: Summative Examination Reader: Suherman, Wahid, Ir. 1987. "Materials Knowledge". First Edition Material: Summative Exam Bibliography: Avner, Sidney. 1974. Material at meeting 9-15 References: 2. JF Shackelford, Introduction to materials Science for engineers, 3rd Ed, Macmillan, 1992 Material: Material at meeting 9-15 References: 3. Diktat Material 1, Novi Sukma Drastiawati, 2022.	30%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	82.24%
2.	Project Results Assessment / Product Assessment	1.4%
3.	Portfolio Assessment	2.07%
4.	Practical Assessment	2.07%
5.	Practice / Performance	2.07%
6.	Test	9.17%
		99.02%

Notes

- Learning Outcomes of Study Program Graduates (PLO Study Program) are the abilities possessed by each Study
 Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study
 program obtained through the learning process.
- 2. The PLO imposed on courses are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
- 3. Program Objectives (PO) are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
- 4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
- 5. Indicators for assessing ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
- 6. Assessment Criteria are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
- 7. Forms of assessment: test and non-test.
- 8. Forms of learning: Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
- Learning Methods: Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
- 10. Learning materials are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
- 11. The assessment weight is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
- 12. TM=Face to face, PT=Structured assignments, BM=Independent study.