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

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Welding Metallurgy	2120102053		T=2	P=0	ECTS=3.18	7	July 18, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Ir. Priyo Heru Adiwibowo, S.T., M.T.

Learning model	**Case Studies**
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**
	Program Objectives (PO)
	PLO-PO Matrix

	P.O

PO Matrix at the end of each learning stage (Sub-PO)

P.O	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Short Course Description	Understanding various welding processes, heat flow in welding, phase transformations and weld micrometal structure, HAZ, characteristics of the HAZ area, continuous cooling transformation (CCT) diagram, Carbon Equivalent (Cr-Equivalent), Scaffler diagram, residual stress and welding distortion, weld location and prevention.
References	**Main :**

1. Surdia,Tata dan Shironku, 1992,*PengetahuanBahanTeknik*,PT PradnyaParamita, Jakarta.
   Wiryosumarto,H., Okumura, T., 2000,*TeknologiPengelasanLogam*,PT PradnyaParamita, Jakarta.
   American WeldingSociety, 2001,*Structural WeldingCode-Steel*, International Standard Book, 18thEdition, USA.
   Bahan-bahan dari Internet dan kepustakaan lain

	Supporters:
Supporting lecturer	Mochamad Arif Irfa'i, S.Pd., M.T.

Week-	Final abilities of each learning stage (Sub-PO)	Evaluation		Help Learning, Learning methods, Student Assignments, [Estimated time]		Learning materials [References]	Assessment Weight (%)
		Indicator	Criteria & Form	Offline (*offline*)	Online (*online*)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

1	Skilled in explaining types of welding and welding procedures Skilled in explaining metallurgical applications in the welding field Able to coordinate with friends in confirming knowledge	1. skilled at explaining the types of welding and welding procedures 2. Skilled in explaining metallurgical applications in the welding field 3. Able to coordinate with friends in confirming knowledge		method: demonstration lecture Learning strategy: Constructivist, scientific observation 5M (observing, asking, collecting information, associating, communicating) 2 X 50			0%
2	Skilled in explaining the distribution of heat and energy in welding Skilled in determining welding voltage and current through heat input calculations Skilled in predicting changes in properties due to welding Skilled in explaining the heat transfer process in welding Able to work together	1. Skilled in explaining the distribution of heat and energy in welding 2. Skilled in determining welding voltage and current through heat input calculations 3. Skilled in predicting changes in properties due to welding 4. Skilled in explaining the heat transfer process in welding		Method ; demonstration lecture, discussion Learning Strategy: constructivist, scientific observation 5M (observing, asking, gathering information, associating, communicating) 4 X 50			0%
3	Skilled in explaining the distribution of heat and energy in welding Skilled in determining welding voltage and current through heat input calculations Skilled in predicting changes in properties due to welding Skilled in explaining the heat transfer process in welding Able to work together	1. Skilled in explaining the distribution of heat and energy in welding 2. Skilled in determining welding voltage and current through heat input calculations 3. Skilled in predicting changes in properties due to welding 4. Skilled in explaining the heat transfer process in welding		Method ; demonstration lecture, discussion Learning Strategy: constructivist, scientific observation 5M (observing, asking, gathering information, associating, communicating) 4 X 50			0%
4	Skilled in proposing solutions to avoid residual stress and distortion in welded metal. Able to apply an honest and responsible attitude	1. able to explain residual stresses and distortions in welded metal 2. able to put forward solutions to avoid distortion and reduce residual stress 3. able to identify the direction of distortion		Method: demonstration lecture, discussion Learning strategy: Constructivist, scientific observation 5M (observing, asking, gathering information, associating, communicating) 2 X 50			0%

5	Skilled in proposing solutions to avoid residual stress and distortion in welded metal. Able to apply an honest and responsible attitude	1. able to explain residual stresses and distortions in welded metal 2. able to put forward solutions to avoid distortion and reduce residual stress 3. able to identify the direction of distortion		Method: demonstration lecture, discussion Learning strategy: Constructivist, scientific observation 5M (observing, asking, gathering information, associating, communicating) 2 X 50			0%
6	Skilled in identifying phases formed by welding based on the CCT diagram. Demonstrates independent, disciplined and ethical behavior	1. able to explain phase transformations and microstructure of weld metal 2. Be able to describe the scheme of phase changes due to welding 3. Able to describe the application of CCT diagrams in welding applications		Method: Demonstration lecture, discussion Learning strategy: constructivist, scientific observation 5M (observing, asking, collecting information, associating, communicating) 4 X 50			0%
7	Skilled in identifying phases formed by welding based on the CCT diagram. Demonstrates independent, disciplined and ethical behavior	1. able to explain phase transformations and microstructure of weld metal 2. Be able to describe the scheme of phase changes due to welding 3. Able to describe the application of CCT diagrams in welding applications		Method: Demonstration lecture, discussion Learning strategy: constructivist, scientific observation 5M (observing, asking, collecting information, associating, communicating) 4 X 50			0%
8	Midterm Exam (UTS)	Mastering the material from meetings 1 to 7		Written Exam 2 X 50			0%
9	Skilled in explaining the freezing process and the weld area	1. able to explain the process of metal freezing after welding 2. Able to identify techniques for freezing metal from welding results 3. able to analyze areas formed by welding		method: demonstration lecture, discussion learning strategy: constructivist, scientific observation 5M (observing, asking, gathering information, associating, communicating) 2 X 50			0%
10	Skilled at explaining HAZ	1. able to explain the mechanism of HAZ (Heat Affected Zone) formation in various metals 2. Able to calculate the HAZ area based on heat input 3. Able to put forward a solution		method: lecture demonstration, discussion Learning strategy: constructivist, scientific observation 5M (Observe, ask, gather information, associate, communicate) 2 X 50			0%

11	Skilled in explaining the types of metallurgical defects in welding	1. able to identify metallurgical defects in welded metal 2. able to identify the causes of weld metallurgical defects 3. able to propose solutions to metallurgical defects in welding		method: lecture demonstration, discussion Learning Strategy: constructivist, scientific observation 5M (observing, asking, gathering information, associating, communicating) 4 X 50			0%
12	Skilled in explaining the types of metallurgical defects in welding	1. able to identify metallurgical defects in welded metal 2. able to identify the causes of weld metallurgical defects 3. able to propose solutions to metallurgical defects in welding		method: lecture demonstration, discussion Learning Strategy: constructivist, scientific observation 5M (observing, asking, gathering information, associating, communicating) 4 X 50			0%
13	Skilled in classifying welding methods suitable for special metals	1. able to explain the welding process on special metals 2. able to classify fillers and heat input suitable for the welding process 3. able to explain the mechanism of phase changes in each weld metal		method: demonstration lecture, discussion learning strategy: constructivist, scientific observation 5M (observing, asking, gathering information, associating, communicating) 4 X 50			0%
14	Skilled in classifying welding methods suitable for special metals	1. able to explain the welding process on special metals 2. able to classify fillers and heat input suitable for the welding process 3. able to explain the mechanism of phase changes in each weld metal		method: demonstration lecture, discussion learning strategy: constructivist, scientific observation 5M (observing, asking, gathering information, associating, communicating) 4 X 50			0%
15	termapil identify test weld results Carefully and thoroughly	1. able to identify filler metal 2. able to explain the benefits of testing after welding 3. able to interpret welding test results data		model: lecture, demonstration, discussion learning strategy: constructivist learning, scientific observation 5M 2 X 50			0%
16	termapil identify test weld results Carefully and thoroughly	1. able to identify filler metal 2. able to explain the benefits of testing after welding 3. able to interpret welding test results data		model: lecture, demonstration, discussion learning strategy: constructivist learning, scientific observation 5M 2 X 50			0%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
		0%

Notes

1. **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.
9. **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.