



MODULE HAND BOOK
MECHANICAL ENGINEERING VOCATIONAL EDUCATION STUDY PROGRAM
FACULTY OF ENGINEERING - UNIVERSITAS NEGERI PADANG

COURSE NAME	CODE	Course classification	CU		Sem	Version
			Theory	Pract		
Industrial Automation	MES2.61.5106	Study program Compulsory Courses/ MEVE core course	1	2	1	1
Responsible	Drs. Yuprizal, M.Pd; Zainal Abadi, S.Pd., M.Eng			Signature		
<u>INFORMATION</u>	Dean		Head of Department		Coordinator of study program	
	<u>Dr. Fahmi Rizal, M.Pd., MT</u> NIP. 195912041985031004		<u>Drs. Purwantono, M.Pd</u> NIP. 196308041986031002		<u>Drs. Purwantono, M.Pd</u> NIP. 196308041986031002	
Program Learning Outcomes	Program Learning Outcomes (PLO):					
	<ol style="list-style-type: none"> 1. Possess a good ability to apply the basic science (mathematics and natural sciences) and other disciplines in profesional jobs / projects (Knowledge-understanding) <ol style="list-style-type: none"> 1.1. possess a good understanding and can apply the basic concept of mathematics to solve various technical problems 1.2. possess a good understanding and can apply basic the concept of physic to solve various technical problems 1.3. possess a good understanding and can apply basic the concept of chemistry to solve various technical problems 2. Possess a critical and creative thingking in identifying, formulating, problem solving and evaluating various problems in mechanical engineering using the most appropriate and effective scientific method (<i>Engineering analysis</i>, 					

investigations and assessment):

- 2.1. problem identification skills
- 2.2. problem analysis skills
- 2.3. problem evaluation skills
3. Possess a good ability in designing, manufacturing and operating machines (***Engineering design***)
 - 3.1. able to formulate ideas/concepts into a technical drawing, design and budget plans
 - 3.2. able to operate various machines and other engineering equipment with the correct standard operating procedure
 - 3.3. able to design a machine or machinery system based on a valid scientific theory
 - 3.4. able to realize a concept/design into a prototype, manufacturing process and engineering system
4. Possess a good ability to design, organize and evaluate the education and learning process in *mechanical engineering vocational education*. (***Education design***)
 - 4.1. able to design curriculum and learning process by considering various aspects
 - 4.2. able to organize, control, evaluate and improve the quality of the learning process
 - 4.3. able to develop an interesting, effective and efficient learning medias
5. Possess a good ability to adapt to development in science and technology and apply it into professional jobs by considering any non-technical aspects. (***Engineering practice***)
 - 5.1. able to innovate and develop technology in the field of mechanical engineering by considering social, economic and environmental aspects
 - 5.2. able to carry out the optimization process and increase the efficiency of machines or machining system.
 - 5.3. able to improve the performance of machine/ machinery system by applying the information technology
6. Possess a good softskil and spirit of lifelong learning (***Transferable skill / softskill***)
 - 6.1. possess a religious character
 - 6.2. possess a spirit of nasionalisme, social sensitivity and environmental consevation orientation
 - 6.3. possess the ability to communicate effectively and work together in teamwork
 - 6.4. possess the ability to transfer science and technology to society to improve the quality of life
 - 6.5. possess a good characters of entrepreneur

Course Learning Outcomes	Course Learning Outcomes (CP-MK)	
	CLO	PLO
	1. Understand the basic theoretical concepts of the production process	2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 5.1, 5.2, 5.3
	2. Understand the basic theoretical concepts of Industrial Automation	2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 5.1, 5.2, 5.3
	3. Mastering industrial automation design methods	2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 5.1, 5.2, 5.3
	4. Understanding Programmable Logic Controller (PLC)	2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 5.1, 5.2, 5.3
	5. Create simple industrial automation tools	2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 5.1, 5.2, 5.3
Course descriptions	Learn about Automation Systems. Understanding automation, components of automation, types and classifications of automation, automation and industrial applications	
References	Main references (RU):	
	1. Asfahl Ray C, Robots and Manufacturing Automation, John Wiley & Sons, Inc. USA, 1992. 2. Braunl, Thomas, Embedded Robotics, Mobile Robot Design and Application With Embedded Systems, Springer, 2006. 3. Darf Richard C. Kusiak Andrew. Handbook of design Manufacturing and automation, Wiley Interscience, 1994.. 4. Spong, MW Robot Dynamics and control, John Wiley & Sons, Singapore, 1989.	
	Additional references (RP)	
Learning Media	Software:	Hardware:
		Computers, whiteboards and accessories, projectors, engineering materials testing machines
Team Teaching		
Assessment	Assignments, Quis, UTS, UAS	
Requirements Subject	No	

Course Subjects

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
(1)	CLO-1: (PLO-1.1, 1.2) Students are capable Understand the basic theoretical concepts of the production process	Basic theory of the production process. Development of the production process	Material explanation [1x100'] Question and answer [1x50'] Work on assignments [1x150']	Make a summary and description of the material presented in the resume book	Able to explain the basic theory of the production process	RU-1, RU-2 and RU-4
(2)	CLO-2.1: [PLO-1.1, 1.2] Students are capable Understand the basic theoretical concepts of Industrial Automation	Introduction to automation technology. Types of industrial automation	Material explanation [1x100'] Question and answer [1x15'] Work on assignments [1x185']	<ul style="list-style-type: none"> • Make a summary and description of the material presented in the resume book. • Create structured assignments 	Able to understand the basic concepts of industrial automation	RU-1, RU-2 and RU-4
(3)	CLO-2.2: [PLO-1.1, 1.2] Students are capable Understand the basic theoretical concepts of Industrial Automation	<ul style="list-style-type: none"> • Industrial Automation Architecture. • Industrial automation system modeling 	Material explanation [1x100'] Question and answer [1x15'] Work on assignments [1x185']	<ul style="list-style-type: none"> • Make a summary and description of the material presented in the resume book. • Create structured assignments 	Able to understand the basic concepts of industrial automation modeling	RU-1, RU-2 and RU-4

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
(4)	PMK-3.1: [PLO-3.1., 3.2., 3.3., 3.4] Students are capable Mastering industrial automation design methods	Industrial automation design Industrial automation logic <ul style="list-style-type: none"> • Binary numbers and hexadecimal numbers • Boolean algebra • Logic gates • Practical application 	Material explanation [1x100 '] Question and answer [1x15 '] Work on assignments [1x185 ']	<ul style="list-style-type: none"> • Make a summary and description of the material presented in the resume book. • Create structured assignments 	Able to understand industrial automation design	RU-1, RU-2 and RU-4
(5)	PMK-3.2: [PLO-3.1., 3.2., 3.3., 3.4] Students are capable Mastering industrial automation design methods	Digital signals and circuits <ul style="list-style-type: none"> • Analog Signal • Digital Signal • Digital Circuits • Analog to Digital Conversion 	Material explanation [1x100 '] Question and answer [1x15 '] Work on assignments [1x185 ']	<ul style="list-style-type: none"> • Make a summary and description of the material presented in the resume book. • Create structured assignments 	Able to understand industrial automation design	RU-1, RU-2 and RU-4
(6)	PMK-3.3: [PLO-3.1., 3.2., 3.3., 3.4] Students are capable Mastering industrial automation design methods	Automation elements <ul style="list-style-type: none"> • Sensor • Actuator • Analyzer & Drives 	Material explanation [1x100 '] Question and answer [1x15 '] Work on assignments [1x185 ']	<ul style="list-style-type: none"> • Make a summary and description of the material presented in the resume book. • Create structured assignments 	Able to understand the elements of industrial automation	RU-1, RU-2 and RU-4
(7)	PMK-3.4: [PLO-3.1., 3.2., 3.3., 3.4] Students are capable Mastering industrial	Automation control system <ul style="list-style-type: none"> • Definition of Control System 	Material explanation [1x100 '] Question and answer [1x15 '] Work on assignments [1x185 ']	<ul style="list-style-type: none"> • Make a summary and description of the material presented in the 	Able to understand industrial automation control systems	RU-1, RU-2 and RU-4

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
	automation design methods	<ul style="list-style-type: none"> Block Diagram Components Open Loop and Close Loop 		resume book. <ul style="list-style-type: none"> Create structured assignments 		
(8)	Mid-test					
(9)	PMK-3.5: [PLO-3.1., 3.2., 3.3., 3.4] Students are capable Mastering industrial automation design methods	Industrial control system <ul style="list-style-type: none"> Process Industry vs Discrete Manufacturing Industry Continuous Control System Discrete Control System 	Material explanation [1x100 ' Question and answer [1x15 ' Work on assignments [1x185 '	<ul style="list-style-type: none"> Make a summary and description of the material presented in the resume book. Create structured assignments 	Able to understand industrial control systems	RU-1, RU-2 and RU-4
(10)	PMK-3.6: [PLO-3.1., 3.2., 3.3., 3.4] Students are capable Mastering industrial automation design methods	Computer control of the process <ul style="list-style-type: none"> Computer Process Control Computer Process Monitoring Enterprise wide Computer Control 	Material explanation [1x100 ' Question and answer [1x15 ' Work on assignments [1x185 '	<ul style="list-style-type: none"> Make a summary and description of the material presented in the resume book. Create structured assignments 	Able to understand computer control systems	RU-1, RU-2 and RU-4
(11)	PMK-4.1: [PLO-3.1., 3.2., 3.3., 3.4., 5.1., 5.2., 5.3] Students are capable Mastering industrial automation design	Programmable logic controller (PLC) <ul style="list-style-type: none"> Basic understanding and schematic of PLC 	Material explanation [1x100 ' Question and answer [1x15 ' Work on assignments [1x185 '	<ul style="list-style-type: none"> Make a summary and description of the material presented in the resume book. 	Able to understand PLC program	RU-1, RU-2 and RU-4

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
	methods	<ul style="list-style-type: none"> • PLC in industry • Hardware from the PLC 		<ul style="list-style-type: none"> • Create structured assignments 		
(12)	PMK-4.2: [PLO-3.1., 3.2., 3.3., 3.4., 5.1., 5.2., 5.3] Students are capable Mastering industrial automation design methods	Programmable logic controller (PLC) <ul style="list-style-type: none"> • PLC software • PLC Selection Criteria 	Material explanation [1x100 ' Question and answer [1x15 ' Work on assignments [1x185 '	<ul style="list-style-type: none"> • Make a summary and description of the material presented in the resume book. • Create structured assignments 	Able to understand PLC program	RU-1, RU-2 and RU-4
(13)	PMK-4.3: [PLO-3.1., 3.2., 3.3., 3.4., 5.1., 5.2., 5.3] Students are capable Understand the types of machine maintenance	Use of Computers in Industrial Automation <ul style="list-style-type: none"> • Computer Development • Hierarchical Control • Distributed Control • Heterarchical Control 	Material explanation [1x100 ' Question and answer [1x15 ' Work on assignments [1x185 '	<ul style="list-style-type: none"> • Make a summary and description of the material presented in the resume book. • Create structured assignments 	Able to understand the use of computers in industrial automation	RU-1, RU-2 and RU-4
(14)	CLO-5.1: [PLO-5.1., 5.2., 5.3] Students are capable Create simple industrial automation tools	The task of creating industrial automation <ul style="list-style-type: none"> • Creating simple automation tool designs • Planning an automation system 	Material explanation [1x100 ' Question and answer [1x15 ' Work on assignments [1x185 '	<ul style="list-style-type: none"> • Make a summary and description of the material presented in the resume book. • Create structured assignments 	Capable of making simple industrial automation tools	RU-1, RU-2 and RU-4
(15)	CLO-5.2: [PLO-5.1., 5.2., 5.3] Students are capable	The task of creating industrial automation <ul style="list-style-type: none"> • Creating simple 	Material explanation [1x100 ' Question and answer [1x15 ' Work on assignments [1x185 '	<ul style="list-style-type: none"> • Make a summary and description of the material 	Able to create simple industrial automation tools	RU-1, RU-2 and RU-4

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
	Create simple industrial automation tools	automation tools • Make a report		presented in the resume book. • Create structured assignments	and reports	
(16)	Final exams					

Note : 1 credit = (50 'TM + 60' BT + 60 'BM) / Week
 TM = Face to Face (Lecture)
 BT = Structured Learning.
 BM = Independent Study
 PS = Simulation Practicum (160 minutes / week)
 PL = Laboratory Practicum (160 minutes / week)
 T = Theory (aspects of science)
 P = Practice (aspects of work skills)

The linkage between CLO and PLO and assessment methods

MSN1.62.4 007	Assessment	Point (%)	PLO-1			PLO-2			PLO-3				PLO-4			PLO-5			PLO-6					
			1	2	3	1	2	3	1	2	3	4	1	2	3	1	2	3	4	5				
CLO-1			V	V																				
CLO-2.1			V	V																				
CLO-2.2			V	V																				
CLO-3.1									V	V	V													
CLO-3.2									V	V	V													
CLO-3.3									V	V	V													
CLO-3.4									V	V	V													
CLO-3.5									V	V	V													
CLO-3.6									V	V	V													
CLO-4.1									V	V	V					V	V	V						

CLO-4.2									V	V	V					V	V	V					
CLO-4.3									V	V	V					V	V	V					
CLO-5.1																V	V	V					
CLO-5.2																V	V	V					
Presence		10																					
TOTAL		100																					

Assessment Component

Midterm exam (UTS)	: 25%
Final exams (UAS)	: 30%
Assignment	: 35%
<u>Presence</u>	: 10%
Total	: 100%

Scoring / Grading level description

	Excellent	Good	Satisfy	Fail
ability to describe	Able to describe correctly and completely	Able to describe correctly but not complete	Able to describe but less clear and incomplete	Unable to describe
ability to formulate	Able to formulate correctly and completely	Able to formulate correctly but not complete	Able to formulate but less clear and incomplete	Unable to formulate
ability to calculate	Able to calculate correctly and completely	Able to calculate correctly but not complete	Able to calculate but less clear and incomplete	Unable to calculate
The ability to analyze	Able to analyze correctly and completely	Able to Analyze correctly but not complete	Able to Analyze But less clear and incomplete	Unable to Analyze

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Scoring and grading system

Score	Quality	Quality score	Designation	Score	Quality	Quality score	Designation
85 - 100	A	4.0	Outstanding	55 - 59	C	2.0	Acceptable
80 - 84	A-	3.6	Excellent	50 - 54	C-	1.6	Poor
75 - 79	B +	3.3	Very good	40 - 49	D	1.0	Poor
70 - 74	B	3.0	Good	≤ 39	E	0.0	Fail
65 - 69	B-	2.6	Good	-	T	-	Postpone
60 - 64	C +	2.3	Acceptable				