



MODULE HAND BOOK

MECHANICAL ENGINEERING VOCATIONAL EDUCATION STUDY PROGRAM

FACULTY OF ENGINEERING – UNIVERSITAS NEGERI PADANG

COURSE NAME	CODE	Course classification	CU		Sem	Versio n
			Theory	Pract		
Production technology and NCN programming	MES2.61.6105	Elective Subjects compulsory Expertise/ Proficiency	1	2	6	1
Responsible	Drs. Yufrizal A, M.Pd, Eko susilo. ST, M.PdT, Rifelino, S.Pd., M..T, Febri Prasetya., M.Pd, T			Signature		
INFORMATION	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 thinking in identifying, formulating, problem solving and evaluating various problems in mechanical engineering using the most appropriate and effective scientific method (<i>Engineering analysis, investigations and assessment</i>): <ol style="list-style-type: none"> 2.1. problem identification skills 					

	<ul style="list-style-type: none"> 2.2. problem analysis skills 2.3. problem evaluation skills 3. Possess a good ability in designing, manufacturing and operating machines (Engineering design) <ul style="list-style-type: none"> 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 <i>mechanical engineering vocational education</i>. (Education design) <ul style="list-style-type: none"> 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) <ul style="list-style-type: none"> 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) <ul style="list-style-type: none"> 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	Course Learning Outcomes (CLO)

Outcomes	CLO		PLO
	1. Students are expected to be able to study and apply programming theory using CAD / CAM		2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 5.1, 5.2
	2. Students are able to operate the PU-2A type ET 120 CNC machine tools; ET-242		2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 5.1, 5.2
	3. Students are able to design and produce simple components using the PU-2A type ET 120 CNC machine tool; ET-242		2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 5.1, 5.2
	4. Students are able to operate the PU-3A type VMC-100 CNC milling machine; VMC 200 and FEELER		2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 5.1, 5.2
	5. Students are able to design and produce simple components using the PU-3A CNC machine Type VMC-100; VMC 200 and FEELER		2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 5.1, 5.2
Course descriptions	This course aims to study and apply programming theory manually and using CAD / CAM as well as the operation of CNC machine tools and manufacture (produce) simple or complex machining components using a PU-2A CNC machine (Type EMCO ET-120; ET242) and PU-3A (Emco VMC-100 type; VMC-200, FEELER-MVP-4A)		
References	Main references (RU):		
	1. Emco Maier, (1990). EMCO ET-120 Student's Handbook. Austria: Hallein		
	2. Emco Maier, (1990). EMCO ET-242 Student's Handbook. Austria: Hallein		
	3. Emco Maier, (1990). EMCO VMC-200 Student's Handbook. Austria: Hallein		
4. Emco Maier, (1990). EMCO VMC-100 Student's Handbook. Austria: Hallein			
Additional references (RP)			
1. Emco Maier, (1990). Teacher's Handbook EMCO ET-120. Austria: Hallein			
2. Emco Maier, (1990). Teacher's Handbook EMCO ET-242. Austria: Hallein			
3. Emco Maier, (1990). Teacher's Handbook EMCO VMC-100. Austria: Hallein			
4. Emco Maier, (1990). Teacher's Handbook EMCO VMC-200. Austria: Hallein			
Learning Media	Software:	Hardware:	
		Computer, LCD Projector, PU CNC Machine 2A ET-120, ET-242 and CNC PU Machine 3A VMC-100, VMC-200, FEELER	
Team Teaching			
Assessment	UAS, Group Tasks, Work Results (Products)		

Requirements Subject	Machining Technology, Machine Tool Technology, CNC Programming
-----------------------------	--

COURSE SUBJECTS

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
(1)	CLO-1-2: (PLO-3.2, 3.3) Understand the characteristics and how to operate the PU-2A type ET-120 and ET-242 lathe. To determine the PSO and cutting tools	Characteristics and how to operate the PU-2A type ET-120 and ET-242 lathe.	Lecture, discussion, question and answer, observation	Determine machine characteristics, independent tasks, reports	Quizzes, report results, attitudes	RU-1, RU-2
(2)	CLO-2-3: [PLO-3.1,3.2,3.3, 3.4] Understand and apply G00, G01 programming for flat, graded and sleep turning. As well as the assignment of the G94 and G95 commands to determine the feeding speed in mm / rotation and mm / minute on	Programming code G00, G01 for flat, graded and sleep turning. As well as the assignment of the G94 and G95 commands to determine the feeding speed in mm / rotation	Self-study, group discussions, and simulations, practice	Program design, work results and reports	Work attitudes, program results, practice reports and workpieces	RU-1, RU-2

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
	CNC -PU-2A lathes.					
(3)	CLO-2-3: [PLO- 3.1, 3.2, 3.3, 3.4] Understand and apply the G84 commands for turning in longitudinal, transverse, multilevel and taper directions	Command code G84 for turning longitudinal, transverse flat, graded and tapered	Self-study, group discussions, and simulations, practice	Program design, work results and reports	Work attitudes, program results, practice reports and workpieces	RU-1, RU-2
(4)	CLO-2-3: [PLO-3.1, 3.2, 3.3, 3.4] Understand and apply the G02 command; G03 I and K as parameters for turning arcs 90° and <90	Command code G02; G03 I and K as parameters for turning arcs 90° and <90	Self-study, group discussions, and simulations, practice	Program design, work results and reports	Work attitudes, program results, practice reports and workpieces	RU-1, RU-2
(5)	CLO-2-3: [PLO-3.1, 3.2, 3.3, 3.4] Understand and apply G81 commands; G82; G83 and G87 for the drilling cycle on a CNC-PU-2A lathe Understand and apply the G25 pattern and instructions for the sub-routine on a CNC-PU-2A lathe machine	Command code G81; G82; G83 and G87 for the drilling cycle	Self-study, group discussions, and simulations, practice	Program design, work results and reports	Work attitudes, program results, practice reports and workpieces	RU-1, RU-2
(6)	CLO-2-3-4: [PLO-3.1, 3.2, 3.3, 3.4]	Command codes G33 and G85 for thread	Self-study, group discussions, and	Program design, work results and reports	Work attitudes, program results,	RU-1, RU-2

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
	Understand and apply the G33 and G85 commands for thread turning cycles on CNC-PU-2A machines	turning cycles	simulations, practice		practice reports and workpieces	
(7)	CLO-2-3-4: [CP-3.1, 3.2, 3.3, 3.4, 5.2] Understand and implement G86 commands and turning cycles on the PU-2A CNC machine Understand and implement the G96 and G97 commands to determine constant cutting speed or constant rotation	G86 command code and turning cycle on the PU-2A CNC machine Understand and implement G96 and G97 commands	Self-study, group discussions, and simulations, practice	Program design, work results and reports	Work attitudes, program results, practice reports and workpieces	RU-1, RU-2
(8)	Mid-Test					
(9)	CLO-1-4-: [PLO-3.2, 3.3] Understand the characteristics and apply the operational PU-3A CNC milling machine VMC-100, VMC-200 and FELLER MVP-4A types. Understand the concepts and ways to be able to	characteristics and applies the operational of the Pu-3A CNC milling machine, Type VMC-100, VMC-200 and FELLER MVP-4A	Lecture, discussion, question and answer, observation	Determine machine characteristics, standalone tasks and reports	Quizzes, report results, attitudes	RU-3, RU-4

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
	set the assignment and cancellation of possession PSO: G53; G54; G55; G56: G57; G58; G59 as well as cutting tool settings and storing cutting tool data					
(10)	CLO-4-5: [CP3.1, 3.2, 3.3, 3.4] Understand and apply machining process technology which includes; cutting speed, width and depth of cutting and speed of feeding / feeding G00 and G01 command assignments for incoming, nested and angled fields on the PU-3A VMC-100, VMC-200 and FELLER MVP-4A machines	Machining process technology which includes; cutting speed, width and depth of cutting and speed of feeding / feeding G00 and G01 command assignments to streamline incoming, nested and angled fields	Self-study, group discussions, and simulations, practice	Program design, report work results	Work attitudes, program results, practice reports and workpieces	RU-3 RP-4
(11)	CLO-4-5: [CP-3.1, 3.2, 3.3, 3.4] Application of the commands G02; G03 parameters I, J and K for milling arcs 90° and <90° Application of the G40 command; G41 and 41 for tools radius compensation	Command code G02; G03 parameters I, J and K for milling arcs 90° and <90° Application of the G40 command; G41 and 41 for tools radius compensation	Self-study, group discussions, and simulations, practice	Program design, report work results	Work attitudes, program results, practice reports and workpieces	RU-3, RU-4

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
	for tools radius compensation					
(12)	CLO-4-5: [CP-3.1, 3.2, 3.3, 3.4] Understand and can program G87 for square bag milling cycles and G88 for circle bags on the PU-3A VMC-100, VMC-200 and FELLER MVP-4A machines	Programming code G87 for rectangular bag milling cycle and G88 for circle pocket	Self-study, group discussions, and simulations, practice	Program design, report work results	Work attitudes, program results, practice reports and workpieces	RU-3, RU-4
(13)	CLO-4-5: [PLO-3.1, 3.2, 3.3, 3.4] Understand and apply the commands G81; G72; G83; and G86 for single drilling cycles, and G84 for tapping cycles on Freis CNC-PU3A VMC-100, VMC-200 and FELLER MVP-4A machines	Command code G81; G72; G83; and G86 for the single drilling cycle, and G84 for the tapping cycle	Self-study, group discussions, and simulations, practice	Program design, report work results	Work attitudes, program results, practice reports and workpieces	RU-3, RU-4
(14)	CLO-4-5: [PLO-3.1, 3.2, 3.3, 3.4] Understand and apply the G72 and G73 perinthes for parallel hole row drilling cycles on Freis CNC-PU3A VMC-100, VMC-200 and FELLER MVP-4A	Command codes G72 and G73 for parallel hole row drilling cycles	Self-study, group discussions, and simulations, practice	Program design, work results and reports	Work attitudes, program results, practice reports and workpieces	RU-3, RU-4

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
	machines					
(14)	CLO-4-5: [PLO-3.1, 3.2, 3.3, 3.4] Understand and be able to apply the G74 and G75 commands to circular hole row drilling cycles on Freis CNC-PU3A VMC-100, VMC-200 and FELLER MVP-4A machines	Command codes G74 and G75 for circular row hole drilling cycles	Self-study, group discussions, and simulations, practice	Program design, work results and reports	Work attitudes, program results, practice reports and workpieces	RU-3, RU-4
(15)	CLO-4-5: [PLO-3.1, 3.2, 3.3, 3.4, 5.2] Understand and apply the G89 command for angled width paths streamer cycles, on machines Freis CNC-PU3A VMC-100, VMC-200 and FELLER MVP-4A	Command code G89 for the angled width paths filling cycle	Self-study, group discussions, and simulations, practice	Program design, work results and reports	Work attitudes, program results, practice reports and workpieces	RU-3, RU-4
(16)	Final Test					

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

MSN1.62.4007	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	1	2	3	4	5
CLO-1	UTS. 1	5								v	v												
CLO-1-3-5	UTS. 2	5								v	v	v											
CLO-1-2-3	UTS. 3	20								v	v	v	v				v	v					
CLO-1	UAS. 1	5									v	v											
CLO-2-4	UAS. 2	5									v	v	v										
CLO-1-2-4	UAS. 3	5									v	v	v	v									
CLO-1-4-5	UAS. 4	20									v	v	v	v			v	v					
CLO-1-2-3	TASK 1	5									v	v	v	v			v	v					
CLO-1-2-3	TASK-2	5									v	v	v	v			v	v					
CLO-1-2-3	TASK-3	5									v	v	v	v			v	v					
CLO-1-2-3	TASK-4	5									v	v	v	v			v	v					
CLO-1-4-5	TASK-5	5									v	v	v	v			v	v					
CLO-1-4-5	TASK-6	5									v	v	v	v			v	v					
CLO-1-4-5	TASK-7	5									v	v	v	v			v	v					
CLO-1-4-5	TASK-8	5									v	v	v	v			v	v					
Presence		15																					
TOTAL		100																					

Assessment Component

Midterm exam (UTS)	: 20 %
Final exams (UAS)	: 25%
Task	: 40%
<u>Presence</u>	: 15 %
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
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

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				

