



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		
CNC	MES1.61.4106	Study Program Compulsory Courses	2	0	4	1
Responsible	Drs. H. Yufrizal A, M.Pd, Drs. Syahril, ST, M.Eng, Ph.D, Drs. Nofri Helmi, M.Kes, Rifeino, S.Pd., MT, Febri Prasetya, M.Pd.T, Budi Syahri, S.Pd., M.Pd.T			Signature		
<u>INFORMATION</u>	Dean of the Faculty of Engineering	Head of Mechanical Engineering Department	Responsible of MEVE			
	Dr. Fahmi Rizal, M.Pd., MT NIP. 195912041985031004	Drs. Purwantono, M.Pd NIP. 196308041986031002	Drs. Purwantono, M.Pd 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, investigations and assessment</i>): <ol style="list-style-type: none"> 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 (CLO)

Course Learning Outcomes	CLO		PLO
	1. Assessing and applying basic programming and operation of machine tools that are controlled numerically by computer (CNC machines)		2.1, 3.1, 3.2, 3.3, 3.4,5.2
	2. Designing and implementing command codes in the manufacture of simple machining components using a TU-2A (Turning) CNC lathe		3.1, 3.2, 3.3, 3.4,5.2
	3. Designing and implementing command codes in the manufacture of simple machining components using a TU-3A (Milling) CNC lathe		3.1, 3.2, 3.3, 3.4,5.2
Course descriptions	Provides knowledge of: Basic operation and programming of CNC machine tools, sprouting systems, tool offsets, reference points, standard miscellaneous functions, M codes and G codes for linear, circular interpolation, longitudinal, transverse, threading, groove, drill cycles , the cycle of milling bags, and making sub programs (sub routines)		
References	Main references (RU):		
	1. Emco Maier, (1990). EMCO TU-2A Student's Hand Book. Austria: 2. Emco Maier, (1990). EMCO TU-3A Student's Hand Book. Austria: Hallein .		
	Additional references (RP)		
	1. Nofri Helmi (1997). TU 3A Milling Machine. Padang. FT-UNP 2. Tjetep Samsuri, (1999). TU-3A Milling Machine: Programming and Operation Basics. Padang: FT. UNP 3. Syahril (1995). TU-2A CNC Lathe, Padang: FT. UNP 4. Yufrizal, (1999). Basics of CNC Machine Tool Technology. Padang: FT.UNP.		
Learning Media	Software:	Hardware:	
		Computer, LCD Projector, Whiteboard, OHP and Jobsheet	
Team Teaching			
Assessment	Mid-Term Exam, Final Exam, Practice, Practice Report, Group Project		
Requirements Subject	No		

COURSE SUBJECTS

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
(1)	CLO-1: (PLO-3.1, 3.2) Students understand the characteristics and working principles of the TU-2A CNC lathe	The characteristics and working principle of the TU-2A CNC lathe	Material explanation [1x80 ' Question and answer [1x10 ' Discussion [1x10 '	Examples of programming and machine operation, as well as assigning tasks (exercises)	Oral, written performance and work results	RU-1 and RU-2
(2)	CLO-2: [PLO- 3.3,3.3] Students are able to understand and apply the turning process technology and the basics of programming the TU2A CNC lathe	Technology turning process and the basics of programming the TU-2A CNC lathe. Application of G 00 and G 01 for flat and multilevel turning	Material explanation [1x100 ' Independent work[1x100 ' Practice[1x100 '	examples of programming and machine operation, as well as assigning tasks (exercises)	Oral, written performance and work results	RU-1, RU-2, RU-5
(3)	CLO-2: [PLO-3.2, 3.3,3.4] Students are able to design and apply circular interpolation programming G02 and G03 on the TU-2A CNC lathe	Circular interpolation programming on the TU-2A CNC lathe	Material explanation [1x100 ' Independent work [1x100 ' Practice [1x100 '	examples of programming and machine operation, as well as assigning tasks (exercises)	Oral, written performance and work results	RU-1 and RU-2
(4)	CLO-2: [CP3.2, 3.3,3.4] Students are able to design and apply M05, M06 programming for G00 tool change commands, G 01 for taper turning, G 86 outer	Programming of tool change commands, taper turning and outer grooves on the TU-2A CNC machine	Material explanation [1x100 ' Independent work [1x100 ' Practice [1x100 '	examples of programming and machine operation, as well as assigning tasks (exercises)	Oral, written performance and work results	RU-1, RU-2, RU-3

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
	groove turning on TU-2 CNC machines					
(5)	CLO-2: [3.2, 3.3,3.4] Students are able to design and apply G33 programming for one-way thread turning commands and G87 for turning cycles on TU-2A CNC lathes.	Programming of transverse direction turning orders and various drilling cycles on the TU-2A CNC lathe	Material explanation [1x100 ' Independent work [1x100 ' Practice [1x100 '	examples of programming and machine operation, as well as assigning tasks (exercises)	Oral, written performance and work results	RU-1, RU-3, RP-3
(6) & (7)	CLO-2: [CP-3.2, 3.3,3.4] Students are able to design and apply G88 programming for turning transverse directions G81: G82 and G83 for drilling cycles on TU-2A CNC lathes.	Programming of transverse direction turning orders and various drilling cycles on the TU-2A CNC lathe	Material explanation [1x100 ' Independent work [1x100 ' Practice [1x100 '	examples of programming and machine operation, as well as assigning tasks (exercises)	Oral, written performance and work results	RU-1, RU-3, RP-3
(8)	CLO-2: [3.2, 3.3,3.4] Students are able to design and apply the G01 and G84 command programs for flat and inner graded turning (inner lathe)	Drilling cycle programming of flat and inner graded lathes and turning	Material explanation [1x100 ' Independent work [1x100 ' Practice [1x100 '	examples of programming and machine operation, as well as assigning tasks (exercises)	Oral, written performance and work results	RU-1, RU-3, RU-5, RP-4
(9)	Mid-Test					

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
(10)	CLO-1: [CP-3.1, 3.2] Students are able to understand the characteristics and working principles of the TU-3A CNC friction machine and calculate the cutting parameters	The characteristics and working principle of the TU-3A CNC milling machine, the calculation of rotating speed (n), starting speed (Cs), cutting speed (F).	Material explanation [1x100 ' Independent work [1x100 ' Practice [1x100 '	examples of programming and machine operation, as well as assigning tasks (exercises)	Oral, written performance and work results	RU-1, RU-3, RU-5 RP-1
(11)	CLO-: [CP-3.2, 3.3,3.4] Students are able to understand and apply the milling process technology and the basics of programming the TU-3A CNC lathe. Application of G 00 for positioning motion, G 01 for single cutting motion for milling on TU-3A CNC milling machine	The milling process of flat and multilevel planes on the TU-3A CNC milling machine	Material explanation [1x100 ' Independent work [1x100 ' Practice [1x100 '	examples of programming and machine operation, as well as assigning tasks (exercises)	Oral, written performance and work results	RU-3 RP-4
(12)	CLO-3: [CP-3.2, 3.3,3.4] Students are able to understand and apply G 00 and G 01 programming for flat and multilevel milling on the TU-3A CNC milling machine.	Programming for milling flat and multilevel planes on the TU-3A CNC milling machine	Material explanation [1x100 ' Independent work [1x100 ' Practice [1x100 '	examples of programming and machine operation, as well as assigning tasks (exercises)	Oral, written performance and work results	RU-5 RP-4
(13 & 14)	CLO-4.8: [CP-3.2, 3.3,3.4] Students are able to understand and apply	Circular interpolation programming for milling circular arcs clockwise and	Material explanation [1x60 ' Question and answer [1x10 ' Discussion [1x30 '	giving examples and giving assignments	Oral, written performance and work results	RU-1, RP-4

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
	circular interpolation programming G02 and G03 on the TU-3A CNC milling machine	counterclockwise on TU-3A CNC milling machine		(training), practical work		
(15)	CLO-5.1: [PLO-3.2, 3.3,3.4] Students are capable understand and apply programming M05, M06 for tool change commands. G73 G81: G82 and G83 for drilling cycle on TU-3A CNC milling machine	Programming command change tool and drilling cycle of TU-3A CNC milling machine	Material explanation [1x60 '] Question and answer [1x10 '] Discussion [1x30 ']	questions and answers Discussion of giving examples and giving assignments (training), practical work	Oral, written performance and work results	RU-1, RU-2, RU-3, RU-4, RU-5
(16)	CLO-5.2: [PLO-3.2, 3.3,3.4] Students are capable understand and apply the milling process technology G 25, M 17 programming for sub-routine programming: G91 for absolute and incremental mixed programming mode and G72 for rectangular bag programming on TU-3A CNC milling machine	Absolute and incremental mixed program modes and	Material explanation [1x60 '] Question and answer [1x10 '] Discussion [1x30 ']	questions and answers Discussion of giving examples and giving assignments (training), practical work	Oral, written performance and work results	RU-1, RU-3 RU-5

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				

