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		
Mathematics for Engineering	MES1.61.2102	Study Program Compulsory Courses / Basic sciences	2	0	2	1
Responsible	Primawati, S.Si., M.Si., Dr. Ir. Mulianti, MT.,		Signature _____			

INFORMATION	**Dean**	**Head of Department**	Coordinator of study program
	Dr. Fahmi Rizal, M.Pd., MT NIP. 195912041985031004	Drs. Purwantono, M.Pd NIP. 196308041986031002	Drs. Purwantono, M.Pd NIP. 196308041986031002

Learning Outcomes of Graduates	**Study Program Graduate Learning Outcomes (PLO):**
	1. Possess a good ability to apply the basic science (mathematics and natural sciences) and other disciplines in profesional jobs / projects (Knowledge-understanding) 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 ***(Engineering analysis, 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	**Couse Learning Outcomes (CLO)**

<table>
<tr><td>Outcomes</td><td colspan="2"><table>
<tr><th>CLO</th><th>PLO</th></tr>
<tr><td>1. Be able to define calculus concepts</td><td>1.1</td></tr>
<tr><td>2. Be able to formulate differential equations</td><td>1.1</td></tr>
<tr><td>3. Able to evaluate critical points based on increasing and decreasing functions</td><td>1.1</td></tr>
<tr><td>4. Able determine the minimum and maximum value of a function</td><td>1.1</td></tr>
<tr><td>5. Able use differential equations to solve optimizations in Mechanical Engineering</td><td>1.1; 2.1, 2.2</td></tr>
<tr><td>6. Be able to formulate integral equations</td><td>1.1; 2.1, 2.2</td></tr>
<tr><td>7. Be able to apply the basic theorems of calculus in determining area</td><td>1.1</td></tr>
<tr><td>8. Able to apply integral equations in determining area</td><td>1.1</td></tr>
<tr><td>9. Be able to determine the volume of rotating objects</td><td>1.1</td></tr>
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<tr><td>Course descriptions</td><td colspan="2">This course is intended to complement students' abilities so that they can use advanced Mathematical concepts in identifying, solving and optimizing Mechanical Engineering problems.</td></tr>
<tr><td rowspan="4">References</td><td colspan="2">Main references (RU):</td></tr>
<tr><td colspan="2">1. Kastroud. Edition 5. 2003, "Mathematics for Engineering", Jakarta: Publisher Erlangga
2. Bill Cox (2001), “Understanding Engineering Mathematics”, Great Britain, MPG Books Ltd. Bodmin, Cornwall</td></tr>
<tr><td colspan="2">Additional references (RP)</td></tr>
<tr><td colspan="2">1. Sutarman. E. 2013. Engineering Mathematics. Yogyakarta: Andi</td></tr>
<tr><td rowspan="2">Learning Media</td><td>Software:</td><td>Hardware:</td></tr>
<tr><td></td><td>Computer, LCD Projector and Whiteboard and peripherals</td></tr>
<tr><td>Team Teaching</td><td colspan="2">Primawati, S.Si., M.Si., Dr. Ir. Mulianti, MT.,</td></tr>
<tr><td>Assessment</td><td colspan="2">UTS, UAS, Assignments</td></tr>
<tr><td>Requirements Subject</td><td colspan="2"></td></tr>
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COURSE SUBJECTS

Week	Expected competencies	Topics	Method and strategy for leraning	Assignment	Criterion / Assessment indicattor	References
(1)	**CLO-1,** Students are able to define the concept of calculus	Definition of calculus, brief history and why calculus	Material explanation **[60 ']** Question and answer **[1x40 ']**	• Make a summary and description of the material presented in the resume book	Able to define calculus, brief history and why calculus	RU-1, RU-2, RP-1
(2)	**CLO-2:** Students are able to formulate differential equations.	Definition of differential, the basic formula in differential	Material explanation **[60 ']** Question and answer **[1x10 ']** exercises **[1x30 ']**	• Make a summary and description of the material presented in the resume book • exercises	Be able to form differential equations	RU-1, RU-2, RP-1
(3)	**CLO-2:** Students are able to complete the differential.	Rules for division and inner multiplication differential	Material explanation **[60 ']** Question and answer **[1x10 ']** exercises **[1x30 ']**	• Make a summary and description of the material presented in the resume book • exercises	Able to complete derivative operations containing multiplication and division.	RU-1, RU-2, RP-1
(4)	**CLO-3** Students are able to evaluate critical points based on rising and falling functions	Critical point concepts, critical point examples	Material explanation **[60 ']** Question and answer **[1x10 ']** exercises **[1x30 ']**	• Make a summary and description of the material presented in the resume book	Be able to define critical points	RU-1, RU-2, RP-1
(5)	**CLO-3** Students are able to evaluate critical points based on rising and falling functions	Up function and down function	Material review by students **[1x10 ']** Material explanation **[60 ']** Question and answer **[1x10 ']**	• Make a summary and description of the material presented in the resume book	Able to evaluate critical points based on increasing and decreasing functions	RU-1, RU-2, RP-1

Week	Expected competencies	Topics	Method and strategy for leraning	Assignment	Criterion / Assessment indicattor	References
			Group discussion through practice questions **[1x20 ']**	• group discussion		
(6)	**CLO-4** Students are able to determine the maximum and minimum value of a function	maximum value and minimum value,	Material explanation **[60 ']** Question and answer **[1x10 ']** Group discussion through practice questions **[1x30 ']**	• Make a summary and description of the material presented in the resume book • group discussion	Able determine the minimum value and maximum value of a function	RU-1, RU-2, RP-1
7	**CLO-5** Students are able to use differential equations to solve optimizations in Mechanical Engineering	Definition of optimization, optimization using critical points and extreme values	Material explanation **[60 ']** Question and answer **[1x10 ']** Group discussion through practice questions **[1x30 ']**	• Make a summary and description of the material presented in the resume book • group discussion	Able use critical points and extreme values to optimize problems in Mechanical Engineering	RU-1, RU-2, RP-1
(8)	**MID EXAM (UTS)**					
(9)	**CLO-6** Students are able to formulate integral equations	Indeterminate Integral Equations with the usual technique	Material explanation **[60 ']** Question and answer **[1x10 ']** exercises **[1x30 ']**	• Make a summary and description of the material presented in the resume book • exercises	Able to formulate pindeterminate Integral Equation with the usual technique	RU-1, RU-2, RP-1
(10)	**CLO-6** Students are able to formulate integral equations	Indefinite Integral Equations with trigonometric and exponential functions	Material explanation **[60 ']** Question and answer **[1x10 ']** exercises **[1x30 ']**	• Make a summary and description of the material presented in the resume book • exercises	Able to formulate pindefinite Integral equations with trigonometric and exponential functions	RU-1, RU-2, RP-1
(11)	**CLO-6**	Indeterminate integral	Material explanation **[60 ']**	• Make a summary	Able to formulate	RU-1, RU-2,

Week	Expected competencies	Topics	Method and strategy for leraning	Assignment	Criterion / Assessment indicattor	References
	Students are able to formulate integral equations	by substitution technique	Question and answer **[1x10 ']** Group discussion with practice questions **[1x30 ']**	and description of the material presented in the resume book • group discussion	pindeterminate integral equations by substitution technique	RP-1
(12)	**CLO-7** Students are able to apply the basic theorem of calculus in determining area area	The area of one curve and the area of two curves	Material explanation **[60 ']** Question and answer **[1x10 ']** Group discussion through practice questions **[1x30 ']**	• Make a summary and description of the material presented in the resume book • group discussion	Be able to apply the basic theorems of calculus in determining area	RU-1, RU-2, RP-1
(13)	**CLO-8** Students are able to apply integral equations in determining area size	Integral equation of course, the area of a curve based on the integral equation	Material explanation **[60 ']** Question and answer **[1x10 ']** Group discussion through practice questions **[1x30 ']**	• Make a summary and description of the material presented in the resume book • group discussion	Be able to apply integral equations of course in determining area	RU-1, RU-2, RP-1
(14)	**CLO-8** Students are able to apply integral equations in determining area size	Area of two curves based on integral equations	Material explanation **[60 ']** Question and answer **[1x10 ']** Group discussion through practice questions **[1x30 ']**	• Make a summary and description of the material presented in the resume book • group discussion	Be able to apply integral equations of course in determining area	RU-1, RU-2, RP-1
(15)	**CLO-9** Students are able to determine the volume of rotating objects	The volume of the rotating object, the volume of the rotating object using the ring method, the volume of the rotary object using the cylinder method	Material explanation **[1x60 ']** Group discussion through question and answer **[1x10 ']** Iquestion practice **[1x30 ']**	• Make a summary and description of the material presented in the resume book • exercises	Being able to determine the volume of the rotary object using the ring method, the volume of the rotating object using the cylinder method	RU-1, RU-2, RP-1

Week	Expected competencies	Topics	Method and strategy for leraning	Assignment	Criterion / Assessment indicattor	References
(16)	**Final Exams (UAS)**					

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

MES1.61.2102	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	2.5	V																				
CLO-2	UTS 2a, UTS 2b	10	V																				
CLO-3	UTS 3	5	V																		V		
CLO-4	UTS 4	7.5	V																		V		
CLO-5	UTS 5	10	V																		V		
CLO-6	UAS 1a, UAS 1b	10	V																		V		
CLO-7	UAS 2	7.5	V																		V		
CLO-8	UAS 3	10	V																		V		
CLO-9	UAS 4	7.5	V																				
Duty		20																					
Presence		10																					
TOTAL		100																					

Assessment Components

Midterm exam (UTS)	: 35%
Final exams (UAS)	: 35%
Assignment	: 20%
Presence	: 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
ability to analyze	Able to analysize 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				