



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		
Heat Transfer	MES1.61.5101	Compulsory course study program / basic science	2	0	5	1
Responsible	Dr. Arwizet KST, MT, Dr. Refdinal, MT, and Andre Kurniawan, MT			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	
Learning Outcome Program	The learning outcome program of Mechanical engineering vocational education: <ol style="list-style-type: none"> 1. Possess a good ability to apply the basic science (mathematics and natural sciences) and other disciplines in professional 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 physics 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 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 medium
- 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 soft skill and spirit of lifelong learning(**Transferable skills / soft skills**)
 - 6.1. possess a religious character
 - 6.2. possess a spirit of nationalism, 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

outcomes	CLO		PLO
	1. Understand the basic concepts and mechanisms of heat transfer in general which include conduction, convection, and radiation heat transfer.		1.2, 1.3, 2.1, 2.2, 2.3
	2. Understand the basic concept of conduction heat transfer mechanism along with certain cases that need to be deepened		1.2, 2.1, 2.2, 2.3
	3. Understand the basic concepts of the convection heat transfer mechanism along with certain cases that need to be deepened		1.2, 2.1, 2.2, 2.3
	4. Understand the basic concept of radiant heat transfer mechanism along with certain cases that need to be deepened		1.2, 2.1, 2.2, 2.3
	5. Understand the basic concepts of heat transfer equipment, overall heat transfer coefficient, types of heat exchangers, temperature distribution, physical and radiation properties of a material		1.2, 2.1, 2.2, 2.3, 5.2
Course description	This course provides deeper knowledge about thermodynamics which discusses heat transfer. The development of this branch of thermodynamics includes: the types of conduction, convection, and radiation heat transfer mechanisms, heat exchangers, and the physical properties and properties of radiation in several types of materials.		
References	Main References (RU):		
	1. FP Incropera, "Fundamentals Of Heat and Mass Transfer 7th", 2007		
	Additional References (RP)		
	1. Zemansky, MW, Dittman, RH (1986). Heat and Thermodynamics, Bandung: Publisher ITB. 2. Holman, JP Jasjfi, E. (1991). Transfer of Heat, sixth edition, Jakarta: Erlangga.		
Learning media	Software:	Hardware:	
		Computer, LCD Projector and whiteboards and other devices	
Teaching team			
Assessment	Mid Test, Final Test, Individual task & team, group discussion and presentation		
Prerequisite courses	Thermodynamics		

Course subjects

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
(1)	CLO-1.1: [PLO-1.2, 2.1-3] Students are able to explain the basic concepts of heat transfer	The concept of heat, related to heat transfer in thermodynamics, heat capacity and specific heat, sensible heat and latent heat and heat transfer mechanisms (conduction, convection, and radiation)	Material description [1x70 '] Frequently asked questions [1x10 '] Discussion [1x20 ']	Make a summary and description of the material presented in the resume book	Be able to explain the concept of heat, the relation of heat transfer in thermodynamics, heat capacity and specific heat, sensible heat and latent heat and heat transfer mechanisms (conduction, convection, and radiation).	RU-1
(2)	CLO-1.2: [PLO-1.2, 2.1-3] Students are able to explain the basic concepts of thermal resistance	Thermal resistance for each of the heat transfer mechanisms (conduction, convection and radiation), thermal resistance in parallel	Material description [1x60 '] Frequently asked questions [1x10 '] Group discussion about the questions given [1x30 ']	<ul style="list-style-type: none"> • Make a summary and description of the material presented in the resume book • Task work on questions 	Be able to explain thermal resistance for conduction, convection, and radiation heat transfer mechanisms, thermal resistance in parallel	RU-1
(3)	CLO-2.1: [PLO-1.2, 2.1-3, 5.2]	The concept of conduction heat transfer on flat walls,	Material description [1x60 ']	<ul style="list-style-type: none"> • Make a summary and description of 	Able to understand conduction heat	RU-1

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
	Students are able to understand 1-dimensional conduction heat transfer to simple objects	perforated cylinders, perforated balls	Frequently asked questions [1x10 '] Group discussion about the questions given [1x30 ']	the material presented in the resume book • Task work on questions	transfer concept on flat wall, perforated cylinder, perforated ball	
(4)	CLO-3.1: [CP-1.2, 2.1-3, 5.2] Students are able to understand heat transfer on an extended surface	Fin function in convection heat transfer, analysis of heat transfer in fins with uniform cross-section, fin efficiency	Material description [1x60 '] Frequently asked questions [1x10 '] Group discussion about the questions given [1x30 ']	• Make a summary and description of the material presented in the resume book • Task work on questions	Be able to explain fin function in convection heat transfer, analysis of heat transfer in fins with uniform cross-section, fin efficiency	RU-1
(5)	CLO-2.2: [CP-1.2, 2.1-3, 5.2] Students are able to understand unsteady conduction heat transfer	Combined heat capacity methods and their applications, transient heat flow, Biot numbers and Fourier numbers	Material description [1x60 '] Frequently asked questions [1x10 '] Group discussion about the questions given [1x30 ']	• Make a summary and description of the material presented in the resume book • Task work on questions	Able to understand the combined heat capacity method and its applications, transient heat flow, Biot number and Fourier number	RU-1
(6)	CLO-3.2: [CP-1.2, 2.1-3, 5.2] Students are able to understand forced convection heat transfer (forced convection heat transfer)	The basic concept of convection heat transfer with dimensionless parameters and layer speed limit, resistance coefficient, laminar flow over a flat plate	Material description [1x60 '] Frequently asked questions [1x10 '] Group discussion about the questions given [1x30 ']	• Make a summary and description of the material presented in the resume book • Task work on questions	Be able to explain basic concepts of convection heat transfer with dimensionless parameters and a layer of speed	RU-1

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
					limit, resistance coefficient, laminar flow over a flat plate	
(7)	CLO-3.3: [CP-1.2, 2.1-3, 5.2] Students are able to understand free convection heat transfer	The basic concept of free convection heat transfer, free convection on a flat plate	Material description [1x60'] Frequently asked questions [1x10'] Group discussion about the questions given [1x30']	<ul style="list-style-type: none"> Make a summary and description of the material presented in the resume book Task work on questions 	Able to understand k The basic concept of free convection heat transfer, free convection on a flat plate	RU-1
(8)	Mid-Semester Evaluation through Mid-Semester Examination					
(9)	CLO-4.1: [CP-1.2, 2.1-3, 5.2] Students are able to understand radiation heat transfer-I	Physical mechanism, radiation properties, radiation form factor, heat transfer between non-black bodies, radiation shielding	Material description [1x60'] Frequently asked questions [1x10'] Group discussion about the questions given [1x30']	<ul style="list-style-type: none"> Make a summary and description of the material presented in the resume book Task work on questions 	Be able to explain m Physical ecanism, radiation properties, radiation form factor, heat transfer between non-black bodies, radiation shielding	RU-1
(10)	CLO-4.2: [CP-1.2, 2.1-3, 5.2] Students are able to understand radiation-II heat transfer	Gas radiation, solar radiation, environmental radiation, the effect of radiation on temperature measurement	Material description [1x60'] Frequently asked questions [1x10'] Group discussion about the questions given [1x30']	<ul style="list-style-type: none"> Make a summary and description of the material presented in the resume book Task work on questions 	Be able to explain r gas adiation, solar radiation, environmental radiation, the effect of radiation on temperature measurement	RU-1

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
(11)	CLO-3.4: [CP-1.2, 2.1-3, 5.2] Students are able to understand the basic concept of boiling (boiling)	The basic concept of pool boiling and flow / forced convection boiling	Material description [1x60 '] Frequently asked questions [1x10 '] Group discussion about the questions given [1x30 ']	<ul style="list-style-type: none"> • Make a summary and description of the material presented in the resume book • Task work on questions 	Able to master basic concept of boiling in the vessel (pool boiling) and boiling in flow / forced convection boiling	RU-1
(12)	CLO-3.5: [CP-1.2, 2.1-3, 5.2] Students are able to understand the basic concepts of condensation	Film condensation and Dropwise condensation	Material description [1x60 '] Frequently asked questions [1x10 '] Group discussion about the questions given [1x30 ']	<ul style="list-style-type: none"> • Make a summary and description of the material presented in the resume book • Task work on questions 	Able to master the basic concept of film condensation and dropwise condensation	RU-1
(13)	CLO-5.1: [PLO-1.2, 2.1-3] Students are able to understand the basic concepts of heat exchangers (heat exchanger)	Overall heat transfer coefficient, types of heat exchangers, temperature distribution	Material description [1x60 '] Frequently asked questions [1x10 '] Group discussion about the questions given [1x30 ']	<ul style="list-style-type: none"> • Make a summary and description of the material presented in the resume book 	Able to master the concept of ko Overall heat transfer efficiency, types of heat exchangers, temperature distribution	RU-1
(14)	CLO-5.2: [PLO-1.2, 2.1-3] Students are able to understand the physical	Physical properties of several types of materials	Material description [1x60 '] Frequently asked questions	<ul style="list-style-type: none"> • Make a summary and description of 	Able to complyAnalyze a problem using a	RU-1

Week	Expected competencies	Topics	Method and strategy for learning	Assignment	Criterion / Assessment indicator	References
	properties of several types of materials		[1x10 '] Group discussion about the questions given [1x30 ']	the material presented in the resume book	table of physical properties of several types of materials	
(15)	CLO-5.3: [PLO-1.2, 2.1-3] Students are able to understand the radiation properties of several types of materials	Radiation properties of several types of materials	Material description [1x60 '] Frequently asked questions [1x10 '] Group discussion about the questions given [1x30 ']	<ul style="list-style-type: none"> Make a summary and description of the material presented in the resume book 	Able to comply Analyze a problem using a table of radiation properties of several types of materials	RU-1
(16)	Final Semester Evaluation (Evaluation which is intended to determine the final achievement of student learning outcomes)					

Remark :1 CU = (50 'TM + 60' BT + 60 'BM) / week

TM = Classical session

BT = Assignment.

BM = Individual session

PS = Simulation practice (160 minutes / week)

PL = Laboratory activities (160 minutes / week)

T = Theory (cognitive aspects)

P = Practicum (psychomotoric aspects)

The Linkage between CLO and PLO and assessment methods

MSN1.62.4007	Assessment	Quality (%)	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-1.1	UTS. 1	5		V		V	V	V															
CLO-1.2	UTS. 2	5		V		V	V	V															
CLO-2.1	UTS. 3.1	5		V		V	V	V															
CLO-3.1	UTS.3.2	5		V		V	V	V															
CLO-2.2	UTS. 4	5		V		V	V	V															
CLO-3.2	UTS.5.1	5		V		V	V	V															
CLO-3.3	UTS.5.2	5		V		V	V	V															
CLO-4.1	UAS. 1	5		V		V	V	V															
CLO-4.2	UAS. 2	5		V		V	V	V															
CLO-3.4	UAS. 3	5		V		V	V	V															
CLO-3.5	UAS. 4	5		V		V	V	V															
CLO-5.1	UAS. 5	5		V		V	V	V															
CLO-5.2	UAS. 6	5		V		V	V	V															
CLO-5.3	UAS. 7	5		V		V	V	V															
Presence		10																					
TOTAL		100																					

Assessment components

Mid test (UTS / Mid Semester Exam) :	35%
Final test (UAS / Semester End Examination):	35%
Students 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
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

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				

