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		
Physics for Engineering	MES1.61.1103	Study Program Compulsory Courses	2	1	1	1

Responsible	Rifelino, S.Pd., MT, and Andre Kurniawan, MT	Signature

INFORMATION	**Dean**	**Dean 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

Program Learning Outcomes	**Program 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
Subject Learning	**Course Learning Outcomes (CLO)**

<table>
<tr><td>Outcomes</td><td>
<table>
<tr><th>CLO</th><th>PLO</th></tr>
<tr><td>1. Understand the basic concepts of electricity such as electric charge, Coulomb's law, Gauss, Kirchhoff's law, electrical properties of materials, potential energy, capacitors, direct current, alternating current, and electrical circuits.</td><td>1.2, 2.1, 2.2</td></tr>
<tr><td>2. Understand the basic concepts of magnets such as magnetic field, induction, emf induction, inductance</td><td>1.2, 2.1, 2.2</td></tr>
<tr><td>3. Understand the basic concepts of designing an RLC circuit</td><td>1.2, 2.1, 3.1, 3.3, 3.4</td></tr>
<tr><td>4. Understand the basic concepts of generators and transformers</td><td>1.2, 2.1, 3.1, 3.3, 3.4</td></tr>
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<tr><td>Course descriptions</td><td>This course provides knowledge of the basic concepts of physics related to Electricity and Magnetism at the undergraduate level of mechanical engineering which discusses the Coulomb Law, Electric Fields, Electric Potential, Capacitors, Electric Current and Resistance, Energy and Electric Power, Ohm's Law, Kirchoff I's Law. and II, Magnetic Field, Magnetic Induction, Lorentz Force, Ampere Law, Biot-Savart, Induction Emf, AC and DC Generators, Transformers, and RLC Circuits.</td></tr>
<tr><td rowspan="4">References</td><td>Main references (RU):</td></tr>
<tr><td>1. Searz Zemansky, "University Physics 2", 2014
2. Paul A. Tipler, "Physics: For Science and Engineering", Third Edition, Volume 2, Translated Dr. Bambang Soegijono, Erlangga Publisher, 1996.</td></tr>
<tr><td>Additional references (RP)</td></tr>
<tr><td>1. MN Avadhanulu, "A Textbook of Engineering Physics", 1992
2. Uma Mukherji, "Engineering physics", Publisher Alpha Sciences, 1998
3. Serway Jewett, “Physics for science and engineering”, 6th Edition, 2016</td></tr>
<tr><td rowspan="2">Learning Media</td><td>Software:</td><td>Hardware:</td></tr>
<tr><td></td><td>Computers, LCD projectors and whiteboards, electrical, magnetic, and wave practical equipment</td></tr>
<tr><td>Team Teaching</td><td colspan="2"></td></tr>
<tr><td>Assessment</td><td colspan="2">Mid-Term Exam, Final Exam, Practicum Report, Independent & group assignments, Group presentations</td></tr>
<tr><td>Requirements Subject</td><td colspan="2">There is no</td></tr>
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COURSE SUBJECTS

Week	Expected competencies	Topics	Method and strategy for leraning	Assignment	Criterion / Assessment indicattor	References
(1)	**CLO-1.1: (PLO-1.2, 2.1, 2.2)** Students are able to explain the basic concepts of discrete charge distribution electric fields	Definition and origin of electricity, electric charge, SI units of electric charge, Coulomb law, electric field discrete charge distribution, electric dipole, point charge motion in an electric field	Material description [1x70 '] Frequently asked questions [1x10 '] Group discussion [1x20 '] Introduction and socialization of electrical laboratory regulations **[1x100 ']**	Make a summary and description of the material presented in the resume book	Be able to explain the basic concepts of electric charge, electric field, and electric force caused by electric charge	RU-1 and RU-2
(2)	**CLO-1.2: [PLO-1.2, 2.1, 2.2]** Students are able to explain the basic concepts of continuous charge distribution electric fields	The basic concept of the electric field is continuous charge distribution	Material description [1x70 '] Frequently asked questions [1x10 '] Group discussion [1x20 '] Introduction to the material in the electrical laboratory [1x100 ']	• Make a summary and description of the material presented in the resume book • Task work on questions	Students are able to explain the basic concepts of the electric field of unlimited charge distribution	RU-1 and RU-2
(3)	**CLO-1.3: [PLO-1.2, 2.1, 2.2]** Students are able to explain the basic concepts of electric potential	Definition of electric potential, electric potential at point charge, electric potential on a charged conductor ball, electric potential on parallel plates, and electric potential energy	Material description [1x70 '] Frequently asked questions [1x10 '] Group discussion [1x20 '] Introduction to how to use a multimeter [1x100 ']	• Make a summary and description of the material presented in the resume book • Task work on questions • The task of working	Be able to explain basic concepts electric potential, electric potential at point charge, electric potential in charged conductor sphere, electric	RU-1 and RU-2

Week	Expected competencies	Topics	Method and strategy for leraning	Assignment	Criterion / Assessment indicattor	References
				on practicum reports	potential on parallel plates, and electric potential energy	
(4)	**CLO-1.4: [CP-1.2, 2.1, 2.2]** Students are able to explain capacitance, dielectric, and electrostatic energy	Explanation of capacitors and their benefits, capacitance of capacitors on parallel strips and on charged spheres, dielectric capacitors, arrangement of series and parallel capacitors, and energy stored in capacitors	Material description [1x70 '] Frequently asked questions [1x10 '] Group discussion [1x20 '] An introduction to identifying colors on resistors [1x100 ']	• Make a summary and description of the material presented in the resume book • Task work on questions • The task of working on practicum reports	Be able to explain capacitors and their benefits, capacitance of capacitors on parallel strips and in charged spheres, dielectric capacitors, series and parallel capacitor arrangements, and energy stored in capacitors	RU-1 and RU-2
(5)	**CLO-1.5: [CP-1.2, 2.1, 2.2]** Students are able to explain the basic concepts of direct current electricity	Basic concepts of electric current and resistance, ohms law, Kirchhoff I's law, energy and electric power	Material description [1x70 '] Frequently asked questions [1x10 '] Group discussion [1x20 '] Practicum [1x100 ']	• Make a summary and description of the material presented in the resume book • Task work on questions • The task of working on practicum reports	Be able to explain the basic concepts of electric current and resistance, ohms law, Kirchhoff I's law, energy and electrical power	RU-1 and RU-2
(6)	**CLO-1.6: [CP-1.2, 2.1, 2.2]** Students are able to	Basic concepts of energy and electric power, and direct current circuits	Material description [1x70 '] Frequently asked questions	• Make a summary and description of	Able to explain the basic concepts of energy and electric	RU-1 and RU-2

Week	Expected competencies	Topics	Method and strategy for leraning	Assignment	Criterion / Assessment indicattor	References
	explain the basic concepts of direct current circuits		[1x10 '] Group discussion [1x20 '] Practicum [1x100 ']	the material presented in the resume book • Task work on questions • The task of working on practicum reports	power, and direct current circuits	
(7)	**CLO-1.7: [CP-1.2, 2.1, 2.2]** Students are able to explain Kircchoff II's law in a closed circuit	Concept of Kircchoff II's law in closed circuits	Material description [1x70 '] Frequently asked questions [1x10 '] Group discussion [1x20 '] Practicum [1x100 ']	• Make a summary and description of the material presented in the resume book • Task work on questions • The task of working on practicum reports	Be able to explain Kircchoff II's law in closed circuit	RU-1 and RU-2
(8)	**Mid-Semester Evaluation through Mid-Semester Examination**					
(9)	**CLO-2.1: [CP-1.2, 2.1, 2.2]** Students are able to explain the basic concepts of magnetic fields	Basic concepts of the magnetic field, magnetic induction, Ampere's law, Biot-Savart law	Material description [1x70 '] Frequently asked questions [1x10 '] Group discussion [1x20 '] Practicum [1x100 ']	• Make a summary and description of the material presented in the resume book • Task work on questions • The task of working on practicum reports	Be able to explain basic concepts of the magnetic field, magnetic induction, Ampere's law, Biot-Savart law	RU-1 and RU-2 RP-1 and RP-2
(10)	**CLO-2.2: [CP-1.2, 2.1,**	The basic concept of	Material description [1x70	• Make a summary	Be able to explain	RU-1 and RU-2

Week	Expected competencies	Topics	Method and strategy for leraning	Assignment	Criterion / Assessment indicattor	References
	2.2] Students are able to explain the basic concepts of magnetic field sources	magnetic induction in straight wire, coiled wire, selenoids and toroid	'] Frequently asked questions [1x10 '] Group discussion [1x20 '] Practicum [1x100 ']	and description of the material presented in the resume book • Task work on questions • The task of working on practicum reports	basic concepts of magnetic induction in straight wire, coiled wire, selenoids and toroid	RP-1 and RP-2
(11)	**CLO-2.3: [CP-1.2, 2.1, 2.2]** Students are able to understand the basic concepts of magnetic induction	Basic concepts of Magnetic Flux, Faraday's Law, Lenz's Law, GGL Induction (Henry's Law)	Material description [1x70 '] Frequently asked questions [1x10 '] Group discussion [1x20 '] Practicum [1x100 ']	• Make a summary and description of the material presented in the resume book • Task work on questions • The task of working on practicum reports	Able to understand the basic concepts of magnetic induction,Magnetic Flux, Faraday's Law, Lenz's Law, Induction GGL (Henry's Law)	RU-1 and RU-2 RP-1
(12)	**CLO-2.4: [CP-1.2, 2.1, 2.2]** Students are able to understand the basic concepts of magnetism in the material	Basic concepts of how to make magnets, magnetic materials, and how to remove magnets	Material description [1x70 '] Frequently asked questions [1x10 '] Group discussion [1x20 '] Practicum [1x100 ']	• Make a summary and description of the material presented in the resume book • Task work on questions • The task of working on practicum reports	Able to master how to make magnets, magnetic materials, and how to remove magnets	RU-1 and RU-2
(13)	**CLO-2.5: [PLO-1.2, 2.1,**	The basic concept of	Material description [1x70	• Make a summary	Able to master the	RU-1 and RU-2

Week	Expected competencies	Topics	Method and strategy for leraning	Assignment	Criterion / Assessment indicattor	References
	2.2] Students are able to understand the basic concepts of Maxwell's equations	Maxwell's equations	'] Frequently asked questions [1x10 '] Group discussion [1x20 '] Practicum [1x100 ']	and description of the material presented in the resume book • The task of working on practicum reports	basic concepts of Maxwell's equations and solve problems related to the properties of electric and magnetic fields	RP-1
(14)	**CLO-3: [PLO-1.2, 2.1]** Students are able to understand and apply the concept of RLC circuits to alternating currents and voltages	The basic concept of the quantity of alternating current and voltage, alternating current circuits, series RLC circuits	Material description [1x70 '] Frequently asked questions [1x10 '] Group discussion [1x20 '] Practicum [1x100 ']	• Make a summary and description of the material presented in the resume book • The task of working on practicum reports	Able to master magnitude of alternating current and voltage, alternating current circuit, series RLC circuit	RU-1 and RU-2
(15)	**CLO-4: [PLO-1.2, 2.1]** Students are able to understand the concept of electromagnetic inductance in generators and transformers	Basic concepts of AC and DC generators, as well as transformers	Material description [1x70 '] Frequently asked questions [1x10 '] Group discussion [1x20 '] Practicum [1x100 ']	• Make a summary and description of the material presented in the resume book • The task of working on practicum reports	Able to explain the concept of electromagnetic inductance in generators and transformers	RU-1 and RU-2
(16)	**Final Semester Evaluation (Evaluation which is intended to determine the final achievement of student learning outcomes)**					

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)

Correlation 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-1.1	UTS.1.1	2.5		V		V	V																
CLO-1.2	UTS.1.2	2.5		V		V	V																
CLO-1.3	UTS. 2	5		V		V	V																
CLO-1.4	UTS. 3	5		V		V	V																
CLO-1.5	UTS.4.1	2.5		V		V	V																
CLO-1.6	UTS.4.2	2.5		V		V	V																
CLO-1.7	UTS. 5	5		V		V	V																
CLO-2.1	UAS. 1	5		V		V	V																
CLO-2.2	UAS. 2	5		V		V	V																
CLO-2.3	UAS. 3	5		V		V	V																
CLO-2.4	UAS. 4	5		V		V	V																
CLO-2.5	UAS. 5	5		V		V	V																
CLO-3	Presentation	20		V		V																	
Presence		10																					
TOTAL		100																					

Assessment Components

Midterm exam : 25%

Final exams : 25%

Practicum report : 20%

Duty : 10%

Presentation : 20%

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				