

SEMESTER COURSE PLAN

**FIELDS AND WAVES IN GEOPHYSICS COURSES
(23H06120203)**



TEACHING TEAM

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STUDI PROGRAM OF GEOPHYSICS - S1
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
HASANUDDIN UNIVERSITY
MAKASSAR
2025

**STUDY PROGRAM OF GEOFISIKA - S1
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
HASANUDDIN UNIVERSITY**

Vision

Become a program Reliable studies in the field of geophysics to produce superior graduates and mastering science, technology, arts and culture based on BMI in 2030.

Vision Strategy

Mission

Based on the Vision above, the Geophysics Study Program has a mission:

1. Improving the quality of education to produce graduates who are competitive, able to work independently and in groups in implementing and developing BMI science and technology;
2. Carrying out research to produce reliable and competitive scientific work oriented towards the scientific development of solid geophysics, marine geophysics, geoinformatics and hydro-meteorology;
3. Disseminate the results of applied research, action studies and appropriate technology packages in synergistic and accelerated productive activities to improve the quality of life of the community.

Graduate Profiles

Educators in the Field of Geophysics; meteorologist; geomaths; oceanographer; exploration geophysicist; seismologist ; geophysical entrepreneur.

PLO charged to courses

- CPL-4 (P1) - Mastering theoretical concepts of land, sea and geophysics atmosphere, principles of exploration, and design exploration necessary for identification and mapping natural resources and natural disaster mitigation;
- CPL-5 (P2) - Mastering Geophysical concepts and principles in applying applied mathematics in the field of Geophysics
- CPL-11 (KK1) - Able to apply the principles of mathematics and earth science, as well as the principles of Exploration and Mitigation to solve natural resource exploration and disaster mitigation problems (Exploration natural resources and natural disaster mitigation)

Course Learning Outcomes (CLO)

- CPMK-1: Able to understand the basic principles of fields (gravity, electricity, magnetism), potential (gravity, electricity, magnetism), Faraday's Law in integral and differential form and its applications and Ampere - Maxwell's Law in integral and differential form and its applications (CPL4, CPL5 dan CPL11)
- CPMK-2: Able to understand the general properties of waves and wave equations and their solutions, power and intensity of mechanical waves, 2-Dimensional (2-D) waves on the water surface, 3-Dimensional (3-D) waves in sound, properties of electromagnetic waves (EM), EM in conducting medium, reflection and transmission of EM waves (CPL4, CPL5 dan CPL11)

Sub-CLO

- Sub CPMK-1: Able to understand the gravitational field and gravitational potential, the gravitational field equation and upward continuation (Upward continuation) (CPMK-1)
- Sub CPMK-2: Able to understand electric fields and electric potential, integral & differential forms of electric fields, electric fields in the presence of dielectrics, conductivity, electric fields in conducting media (CPMK-1)

- Sub CPMK-3: Able to understand magnetic fields and magnetic potential, the equation of magnetic fields caused by conduction currents, magnetic field intensity, magnetic fields due to electric currents in the earth (CPMK-1)
- Sub CPMK-4: Able to understand Faraday's law in integral and differential form, induced electric field, application of Faraday's law (integral form), application of Faraday's law (differential form), charge conservation and charge distribution in a conducting medium (polarized medium) (CPMK-1)
- Sub CPMK-5: Able to understand the Ampere-Maxwell law in integral form, magnetic field circulation, vacuum permeability, application of the Ampere-Maxwell law in integral form, electric current density, shifting current density, application of the Ampere-Maxwell law in differential form (CPMK-1)
- Sub CPMK-6: Able to explain wave phenomena, wave equations and solutions as well as new wave forms resulting from wave superposition (CPMK-2)
- Sub CPMK-7: Able to calculate the rate of wave propagation in solids, reflection and transmission coefficients, energy, power and intensity of mechanical waves (CPMK-2)
- Sub CPMK-8: Able to calculate wave speed in shallow water and deep water as well as the dispersion relationship in water surface waves (2-D) (CPMK-2)
- Sub CPMK-9: Able to resolve impedance, intensity levels in sound waves (3-D) (CPMK-2)
- Sub CPMK-10: Able to explain the difference between mechanical waves and EM waves, the properties of EM waves, applications of EM waves and solutions to the EM wave equation (CPMK-2)
- Sub CPMK-11: Students are able to understand the propagation of EM waves in a linear medium, apply boundary conditions between different media, reflection and transmission of EM waves, the equation of EM waves in a conducting medium and penetration depth (skin depth). (CPMK-2)

Learning Analytics

Fields and Waves in Geophysics



Students are able to understand the propagation of EM waves in a linear medium, apply boundary conditions between different media, reflection and transmission of EM waves, the equation of EM waves in a conducting medium and penetration depth (skin depth). (CPMK-2)



Able to explain the difference between mechanical waves and EM waves, the properties of EM waves, applications of EM waves and solutions to the EM wave equation (CPMK-2)



Able to resolve impedance, intensity levels in sound waves (3-D) (CPMK-2)



Able to calculate wave speed in shallow water and deep water as well as the dispersion relationship in water surface waves (2-D) (CPMK-2)



Able to calculate the rate of wave propagation in solids, reflection and transmission coefficients, energy, power and intensity of mechanical waves (CPMK-2)



Able to explain wave phenomena, wave equations and solutions as well as new wave forms resulting from wave superposition (CPMK-2)



Able to understand the Ampere-Maxwell law in integral form, magnetic field circulation, vacuum permeability, application of the Ampere-Maxwell law in integral form, electric current density, shifting current density, application of the Ampere-Maxwell law in differential form (CPMK-1)



Able to understand Faraday's law in integral and differential form, induced electric field, application of Faraday's law (integral form), application of Faraday's law (differential form), charge conservation and charge distribution in a conducting medium (polarized medium) (CPMK-1)



Able to understand magnetic fields and magnetic potential, the equation of magnetic fields caused by conduction currents, magnetic field intensity, magnetic fields due to electric currents in the earth (CPMK-1)



Able to understand electric fields and electric potential, integral & differential forms of electric fields, electric fields in the presence of dielectrics, conductivity, electric fields in conducting media (CPMK-1)



Able to understand the gravitational field and gravitational potential, the gravitational field equation and upward continuation (Upward continuation) (CPMK-1)

Have passed the course Mathematical Geophysics I and Mathematical Geophysics II



HASANUDDIN UNIVERSITY

FAKULTY OF MATHEMATICS AND NATURAL SCIENCES

STUDY PROGRAM OF GEOPHYSICS - S1

SEMESTER LEARNING PLAN

Course		Code	Course Group	Credits	SEMESTER	Compilation Date
Fields and Waves in Geophysics		23H06120203		3	3	1 Juli 2025
AUTHORITY		SLP Developer Lecturer		Coordinator		Head of Study Program
		Dra. Maria, M.Si.		Dra. Maria, M.Si.		Dr. Muhammad Alimuddin, Eng.
Learning	SLOs that are imposed on the course					
	SLO-4:	Menguasai konsep teoritis Geofisika darat, laut dan atmosfer, prinsip-prinsip eksplorasi, dan perancangan eksplorasi yang diperlukan untuk identifikasi dan pemetaan SDA serta mitigasi bencana alam;				
	SLO-5:	Menguasai konsep Geofisika dan prinsip dalam mengaplikasikan matematika terapan dalam bidang Geofisika				
	SLO-11:	Mampu menerapkan prinsip-prinsip matematika dan sains kebumihan, serta prinsip Eksplorasi dan Mitigasi untuk menyelesaikan masalah eksplorasi SDA dan mitigasi bencana (Exploration natural resource and natural disaster mitigation)				
	SLO ⇒ Course Learning Outcomes					
	After completing this course, it is expected:					
	SLO-5	CLO-1: Able to understand the basic principles of fields (gravity, electricity, magnetism), potential (gravity, electricity, magnetism), Faraday's Law in integral and differential form and its applications and Ampere - Maxwell's Law in integral and differential form and its applications				
		CLO-2: Able to understand the general properties of waves and wave equations and their solutions, power and intensity of mechanical waves, 2-Dimensional (2-D) waves on the water surface, 3-Dimensional (3-D) waves in sound, properties of electromagnetic waves (EM), EM in conducting medium, reflection and transmission of EM waves				
	SLO-4	CLO-1: Able to understand the basic principles of fields (gravity, electricity, magnetism), potential (gravity, electricity, magnetism), Faraday's Law in integral and differential form and its applications and Ampere - Maxwell's Law in integral and differential form and its applications				
		CLO-2: Able to understand the general properties of waves and wave equations and their solutions, power and intensity of mechanical waves, 2-Dimensional (2-D) waves on the water surface, 3-Dimensional (3-D) waves in sound, properties of electromagnetic waves (EM), EM in conducting medium, reflection and transmission of EM waves				
	SLO-11	CLO-1: Able to understand the basic principles of fields (gravity, electricity, magnetism), potential (gravity, electricity, magnetism), Faraday's Law in integral and differential form and its applications and Ampere - Maxwell's Law in integral and differential form and its applications				
		CLO-2: Able to understand the general properties of waves and wave equations and their solutions, power and intensity of mechanical waves, 2-Dimensional (2-D) waves on the water surface, 3-Dimensional (3-D) waves in sound, properties of electromagnetic waves (EM), EM in conducting medium, reflection and transmission of EM waves				

Outcomes Course	CLO ⇒ Sub-CLO									
	CLO-1	Sub-CLO-1:Able to understand the gravitational field and gravitational potential, the gravitational field equation and upward continuation (Upward continuation)								
		Sub-CLO-2:Able to understand electric fields and electric potential, integral & differential forms of electric fields, electric fields in the presence of dielectrics, conductivity, electric fields in conducting media								
		Sub-CLO-3:Able to understand magnetic fields and magnetic potential, the equation of magnetic fields caused by conduction currents, magnetic field intensity, magnetic fields due to electric currents in the earth								
		Sub-CLO-4:Able to understand Faraday's law in integral and differential form, induced electric field, application of Faraday's law (integral form), application of Faraday's law (differential form), charge conservation and charge distribution in a conducting medium (polarized medium)								
		Sub-CLO-5:Able to understand the Ampere-Maxwell law in integral form, magnetic field circulation, vacuum permeability, application of the Ampere-Maxwell law in integral form, electric current density, shifting current density, application of the Ampere-Maxwell law in differential form								
	CLO-2	Sub-CLO-6:Able to explain wave phenomena, wave equations and solutions as well as new wave forms resulting from wave superposition								
		Sub-CLO-7:Able to calculate the rate of wave propagation in solids, reflection and transmission coefficients, energy, power and intensity of mechanical waves								
Sub-CLO-8:Able to calculate wave speed in shallow water and deep water as well as the dispersion relationship in water surface waves (2-D)										
Sub-CLO-9:Able to resolve impedance, intensity levels in sound waves (3-D)										
Sub-CLO-10:Able to explain the difference between mechanical waves and EM waves, the properties of EM waves, applications of EM waves and solutions to the EM wave equation										
Sub-CLO-11:Students are able to understand the propagation of EM waves in a linear medium, apply boundary conditions between different media, reflection and transmission of EM waves, the equation of EM waves in a conducting medium and penetration depth (skin depth).										
Correlation between SLOs/CLOs to Sub-CLOs										
SLOs that are charged on the Course	CPMK	SUB CPMK	Form of Assessment*				Weight	Value	Student Score	
			Formative	Sumative						
				Quiz	Project/Case Study	Summative Test				
SLO-11	CLO-1	SUB-CLO-1	Participation	2.5	0	0	2.5			
SLO-11	CLO-1	SUB-CLO-2	Participation	0	10	0	10			
SLO-11	CLO-1	SUB-CLO-3	Participation	2.5	0	0	2.5			
SLO-11	CLO-1	SUB-CLO-4	Participation	0	10	0	10			
SLO-11	CLO-1	SUB-CLO-5	Participation	0	10	15	25			

SLOs that are charged on the Course	CPMK	SUB CPMK	Form of Assessment*				Weight	Value	Student Score
			Formative	Sumative					
				Quiz	Project/Case Study	Summative Test			
SLO-11	CLO-2	SUB-CLO-6	Participation	2.5	0	0	2.5		
SLO-11	CLO-2	SUB-CLO-7	Participation	2.5	0	0	2.5		
SLO-11	CLO-2	SUB-CLO-8	Participation	0	8	0	8		
SLO-11	CLO-2	SUB-CLO-9	Participation	0	10	0	10		
SLO-11	CLO-2	SUB-CLO-10	Participation	0	5	0	5		
SLO-11	CLO-2	SUB-CLO-11	Participation	0	7	15	22		
				10	60	30	100		
Course Description	This course is offered in semesters ... with a weight of 3 credits. This course will discuss gravitational fields and gravitational potential, electric fields and electric potential, magnetic fields and magnetic potential, Faraday's law in integral and differential form and its applications, Ampere's – Maxwell's law; in integral form & differential, general properties and equations of mechanical waves, power and intensity of mechanical waves, waves in water surface waves (2-D), sound waves (3-D), electromagnetic waves and electromagnetic waves in a conducting medium. The learning method is Cooperative Learning								
Learning Materials/Subjects	1. Gravitational field and gravitational potential 2. Electric field and electric potential 3. Magnetic fields and magnetic potential 4. Faraday's law in integral and differential form and its applications 5. Ampère's Law – Maxwell in integral and differential form and their applications 6. General properties of waves and mechanical wave equations 7. Power and intensity of mechanical waves 8. 2 Dimensional and 3 Dimensional Waves 9. Electromagnetic Waves								
Reference	Main References								
	1. Alexander A. Kaufman, 1992, Geophysical Field Theory and Method Part A; Gravitational, Electric, and Magnetic Fields, Academic Press, Inc.								
	2. Alexander A. Kaufman, 1994, Geophysical Field Theory and Method Part B; Electromagnetic Fields I, Academic Press, Inc.								
	3. Daniel_Fleisch, A Student's Guide to Maxwell's Equation, Cambridge University Press.								
Reference	4. Afrimar, 2018, Waves in Geophysics, ITB Bandung.								
	5. Alonso-Fin 1992 “Fundamental University Physics II :Waves “ Addison Wesley								
	6. William CronkElmore, Mark A. Heald, 1985, Physics of Waves, Dover Edition, McgrawHill, New York.								
	Additional References								

		1. Michael S. Zhdanov, 2009, Geophysical Electromagnetic Theory and Methods, Elsevier. 2. Pain, H. J., 1989, The Physics of Vibration and Waves, John Wiley, London 3. M. O. Tjia 1994 "Wave" Dabara Publisher Solo					
Teaching Team		Dr. Muhammad Hamzah S., S.Si.,MT., Dra. Maria, M.Si., Muhammad Fawzy Ismullah Massinai, S.Si, M.T					
Course requirement		Mathematical Geophysics I, Mathematical Geophysics II					
Week	Sub CPMK (End-of-stage learning ability)	Penilaian (Assesment)		Learning Forms and Methods [time estimate]		Content	Weight of Assessment (%)
		Indicator	Techniques & Criteria	Offline	Online		
1	2	3	4	5	6	7	8
1	Able to understand the gravitational field and gravitational potential, the gravitational field equation and upward continuation (Upward continuation) (CPMK-1)	Formative: The accuracy of applying the concept of Newton's law of gravity, determining the gravitational field due to height, the Bouguer plate, the field and gravitational potential of object models 2 & 3 dimensions, integral and differential forms of the gravitational field equation(<i>Upward continuation</i>) Sumative: -	Formative Criteria: Participation dinilai dengan rubrik 1 Sumative Criteria: Quiz (2.5) dinilai dengan rubrik 1 Assessment Technique: Test and Non-Test	Studying: Cooperative learning (Cooperative learning) 1 x 3 x 50"	Other Forms: Self-Directed Learning - Reading Modules/PPTs at Sikola in Week 1 Learning Flow 1 x 3 x 60" Other Forms: Self-Directed Learning - Practice understanding examples of gravitational field cases in library 1 - Practice working on questions in the module 1 x 3 x 60"	1. Lecture contract 2. Gravitational field and gravitational potential	2.5

2	Able to understand electric fields and electric potential, integral & differential forms of electric fields, electric fields in the presence of dielectrics, conductivity, electric fields in conducting media (CPMK-1)	Formative: Precision in the application of Coulomb's law, electric fields by electric charges, conductors in vacuum & electric field, electric potential equation, integral form & differential electric field, electric field in the presence of a dielectric, conductivity, determination of the electric field in a conducting medium Sumative: -	Formative Criteria: Participation dinilai dengan rubrik 1 Sumative Criteria: Project/Case Study (10) dinilai dengan rubrik 1 Assessment Technique: Test and Non-Test	Studying: Collaborative learning (Collaborative Learning) 1 x 3 x 50"	Other Forms: Self-Directed Learning - Reading Modules/PPTs at Sikola in Week 2 Learning Flow 1 x 3 x 60" Other Forms: Self-Directed Learning - Practice understanding examples of electric field cases in library 1 - Practice working on questions in module 2 1 x 3 x 60"	Electric field and electric potential	10
3	Able to understand magnetic fields and magnetic potential, the equation of magnetic fields caused by conduction currents, magnetic field intensity, magnetic fields due to electric currents in the earth (CPMK-1)	Formative: Accuracy in the application of the Biot-Savart law, magnetic fields, magnetic potential, magnetic field equation caused by conduction current, magnetic field intensity, field magnetism due to electric currents in the earth Sumative: -	Formative Criteria: Participation dinilai dengan rubrik 1 Sumative Criteria: Quiz (2.5) dinilai dengan rubrik 1 Assessment Technique: Test and Non-Test	Studying: Collaborative learning (Collaborative Learning) 1 x 3 x 50"	Other Forms: Self-Directed Learning - Reading Modules/PPTs at Sikola in Week 3 Learning Flow 1 x 3 x 60" Other Forms: Self-Directed Learning - Practice understanding examples of magnetic field cases in library 1 - Practice working on questions in module 3 1 x 3 x 60"	Magnetic field and magnetic potential	2.5

4-5	Able to understand Faraday's law in integral and differential form, induced electric field, application of Faraday's law (integral form), application of Faraday's law (differential form), charge conservation and charge distribution in a conducting medium (polarized medium) (CPMK-1)	Formative: Accuracy in the application of Faraday's law in integral and differential form, induced electric fields, applications of Faraday's law (integral form), legal applications Faraday (differential form), charge conservation and charge distribution in a conducting medium (polarized medium) Sumative: -	Formative Criteria: Participation dinilai dengan rubrik 1 Sumative Criteria: Project/Case Study (10) dinilai dengan rubrik 1 Assessment Technique: Test and Non-Test	Studying: Collaborative learning (Collaborative Learning) 2 x 3 x 50"	Other Forms: Self-Directed Learning - Reading Modules/PPTs at Sikola in Week 4 Learning Flow 2 x 3 x 60" Other Forms: Self-Directed Learning - Practice understanding case examples in library 2 - Practice working on questions in module 4 2 x 3 x 60"	Faraday's law in integral and differential form and its applications	10
6-7	Able to understand the Ampere-Maxwell law in integral form, magnetic field circulation, vacuum permeability, application of the Ampere-Maxwell law in integral form, electric current density, shifting current density, application of the Ampere-Maxwell law in differential form (CPMK-1)	Formative: Precision in the application of laws Ampere – Maxwell in integral form, magnetic field circulation, vacuum permeability, applications Ampere's law - Maxwell's law in integral form, electric current density, shifting current density, application of Ampere's law - Maxwell's in differential form Sumative: -	Formative Criteria: Participation dinilai dengan rubrik 1 Sumative Criteria: Project/Case Study (10) dinilai dengan rubrik 1 Assessment Technique: Test and Non-Test	Studying: Collaborative learning (Collaborative Learning) 2 x 3 x 50"	Other Forms: Self-Directed Learning - Reading Modules/PPTs at Sikola in Week 6 Learning Flow 2 x 3 x 60" Other Forms: Self-Directed Learning - Practice understanding case examples in library 2 & 3 - Practice working on questions in module 5 2 x 3 x 60"	Ampère's Law – Maxwell in integral and differential form and their applications	10

8	Able to understand the Ampere-Maxwell law in integral form, magnetic field circulation, vacuum permeability, application of the Ampere-Maxwell law in integral form, electric current density, shifting current density, application of the Ampere-Maxwell law in differential form (CPMK-1)	Formative: - Sumative: -	Formative Criteria: Sumative Criteria: Summative Test (15) dinilai dengan rubrik 1 Assessment Technique: Test			-	15
9	Able to explain wave phenomena, wave equations and solutions as well as new wave forms resulting from wave superposition (CPMK-2)	Formative: Accuracy in describing wave phenomena, wave equations and their solutions as well as new wave forms resulting from superposition of waves Sumative: -	Formative Criteria: Participation dinilai dengan rubrik 1 Sumative Criteria: Quiz (2.5) dinilai dengan rubrik 1 Assessment Technique: Test and Non-Test	Studying: Collaborative learning (Collaborative Learning) 1 x 3 x 50"	Other Forms: Self-Directed Learning Reading Modules/PPTs at Sikola in Week 9 Learning Flow 1 x 3 x 60" Other Forms: Self-Directed Learning Create a resume and answer practice questions 1 x 3 x 60"	General properties of waves and wave mechanical equations	2.5
10	Able to calculate the rate of wave propagation in solids, reflection and transmission coefficients, energy, power and intensity of mechanical waves (CPMK-2)	Formative: Precision in calculating wave propagation rate in solids, reflection and transmission coefficients, energy, power and intensity of mechanical waves Sumative: -	Formative Criteria: Participation dinilai dengan rubrik 1 Sumative Criteria: Quiz (2.5) dinilai dengan rubrik 1 Assessment Technique: Test and Non-Test	Studying: Collaborative learning (Collaborative Learning) 1 x 3 x 50"	Other Forms: Self-Directed Learning - Reading Modules/PPTs at Sikola in Week 10 Learning Flow 1 x 3 x 60" Other Forms: Self-Directed Learning Create a resume and answer practice questions 1 x 3 x 60"	Power and intensity of mechanical waves	2.5

11-12	Able to calculate wave speed in shallow water and deep water as well as the dispersion relationship in water surface waves (2-D) (CPMK-2)	Formative: Precision in calculating wave speed in shallow water and deep water and the dispersion relationship in water surface waves (2-D). Sumative: -	Formative Criteria: Participation dinilai dengan rubrik 1 Sumative Criteria: Project/Case Study (8) dinilai dengan rubrik 1 Assessment Technique: Test and Non-Test	Studying: Collaborative learning (Collaborative Learning) 2 x 3 x 50"	Studying: Self-Directed Learning - Reading Modules/PPTs at Sikola in Week 11 Learning Flow 2 x 3 x 60" Other Forms: Self-Directed Learning Create a resume and answer practice questions 2 x 3 x 60"	2-Dimensional (2-D) waves on water surface waves	8
13	Able to resolve impedance, intensity levels in sound waves (3-D) (CPMK-2)	Formative: Accuracy in resolving impedance, intensity levels in sound waves (3-D). Sumative: -	Formative Criteria: Participation dinilai dengan rubrik 1 Sumative Criteria: Project/Case Study (10) dinilai dengan rubrik 1 Assessment Technique: Test and Non-Test	Studying: Collaborative learning (Collaborative Learning) 1 x 3 x 50"	Other Forms: Self-Directed Learning - Reading Modules/PPTs at Sikola in Week 13 Learning Flow 1 x 3 x 60" Other Forms: Self-Directed Learning Create a resume and answer practice questions 1 x 3 x 60"	3-Dimensional (3-D) waves in sound waves	10

14	Able to explain the difference between mechanical waves and EM waves, the properties of EM waves, applications of EM waves and solutions to the EM wave equation (CPMK-2)	Formative: Accuracy in explaining the differences between mechanical waves and EM waves, properties of EM waves, applications of EM waves and solutions to the EM wave equation Sumative: -	Formative Criteria: Participation dinilai dengan rubrik 1 Sumative Criteria: Project/Case Study (5) dinilai dengan rubrik 1 Assessment Technique: Test and Non-Test	Studying: Cooperative learning (Cooperative learning) 1 x 3 x 50"	Other Forms: Self-Directed Learning - Reading Modules/PPTs at Sikola in Week 14 Learning Flow 1 x 3 x 60" Other Forms: Self-Directed Learning Create a resume and answer practice questions 1 x 3 x 60"	Electromagnetic waves	5
15	Students are able to understand the propagation of EM waves in a linear medium, apply boundary conditions between different media, reflection and transmission of EM waves, the equation of EM waves in a conducting medium and penetration depth (skin depth). (CPMK-2)	Formative: Accuracy in understanding the propagation of EM waves in a linear medium, applying boundary conditions between different media, reflection and transmission of EM waves, the equation of EM waves in a medium conductor and penetration depth (skin depth). Sumative: -	Formative Criteria: Participation dinilai dengan rubrik 1 Sumative Criteria: Project/Case Study (7) dinilai dengan rubrik 1 Assessment Technique: Non Test	Studying: Collaborative learning (Collaborative Learning) 1 x 3 x 50"	Other Forms: Self-Directed Learning - Reading Modules/PPTs at Sikola in the 15th Week Learning Flow 1 x 3 x 60" Other Forms: Self-Directed Learning Create a resume and answer practice questions 1 x 3 x 60"	Electromagnetic waves in a conducting medium	7

16	Students are able to understand the propagation of EM waves in a linear medium, apply boundary conditions between different media, reflection and transmission of EM waves, the equation of EM waves in a conducting medium and penetration depth (skin depth). (CPMK-2)	Formative: - Sumative: -	Formative Criteria: Sumative Criteria: Summative Test (15) dinilai dengan rubrik 1 Assessment Technique: Test			-	15
							100

Matrix of SLO, CLO, and Assessment Method

SLO / CLO	CLO-1	CLO-2
CPL-4 (P1)	Quiz (Weight 2.5%) Project/Case Study (Weight 10%) Quiz (Weight 2.5%) Project/Case Study (Weight 10%) Project/Case Study (Weight 10%) Summative Test (Weight 15%)	Quiz (Weight 2.5%) Quiz (Weight 2.5%) Project/Case Study (Weight 8%) Project/Case Study (Weight 10%) Project/Case Study (Weight 5%) Project/Case Study (Weight 7%) Summative Test (Weight 15%)
CPL-5 (P2)	Quiz (Weight 2.5%) Project/Case Study (Weight 10%) Quiz (Weight 2.5%) Project/Case Study (Weight 10%) Project/Case Study (Weight 10%) Summative Test (Weight 15%)	Quiz (Weight 2.5%) Quiz (Weight 2.5%) Project/Case Study (Weight 8%) Project/Case Study (Weight 10%) Project/Case Study (Weight 5%) Project/Case Study (Weight 7%) Summative Test (Weight 15%)

SLO / CLO	CLO-1	CLO-2
CPL-11 (KK1)	Quiz (Weight 2.5%) Project/Case Study (Weight 10%) Quiz (Weight 2.5%) Project/Case Study (Weight 10%) Project/Case Study (Weight 10%) Summative Test (Weight 15%)	Quiz (Weight 2.5%) Quiz (Weight 2.5%) Project/Case Study (Weight 8%) Project/Case Study (Weight 10%) Project/Case Study (Weight 5%) Project/Case Study (Weight 7%) Summative Test (Weight 15%)

Evaluation Type and Assessment Weight

Type	Assessment Weight
Quiz	10
Project/Case Study	60
Summative Test	30
Total	100

Assessment and Evaluation of Student Achievement of CLOs

SLOs that are charged on the Course	CLO	SUB CLO	Form of Assessment*				Weight	Value	Student Score
			Formative	Sumative					
				Quiz	Project/Case Study	Summative Test			
SLO-11	CLO-1	SUB-CLO-1	Participation	2.5	0	0	2.5		
SLO-11	CLO-1	SUB-CLO-2	Participation	0	10	0	10		
SLO-11	CLO-1	SUB-CLO-3	Participation	2.5	0	0	2.5		
SLO-11	CLO-1	SUB-CLO-4	Participation	0	10	0	10		
SLO-11	CLO-1	SUB-CLO-5	Participation	0	10	15	25		
SLO-11	CLO-2	SUB-CLO-6	Participation	2.5	0	0	2.5		
SLO-11	CLO-2	SUB-CLO-7	Participation	2.5	0	0	2.5		
SLO-11	CLO-2	SUB-CLO-8	Participation	0	8	0	8		
SLO-11	CLO-2	SUB-CLO-9	Participation	0	10	0	10		
SLO-11	CLO-2	SUB-CLO-10	Participation	0	5	0	5		
SLO-11	CLO-2	SUB-CLO-11	Participation	0	7	15	22		
				10	60	30	100		

Lampiran Rubrik 1 | Rubrik Holistik

Tabel 6. 1 Rubrik Holistik		
Grade Capaian	Skor	Uraian
Sangat Baik	≥ 85	Memperlihatkan pemahaman yang lengkap tentang permasalahan. Semua metode dan persyaratan tentang tugas terdapat dalam jawaban
Baik	71 - 84	Memperlihatkan cukup pemahaman tentang permasalahan. Semua persyaratan tentang tugas terdapat dalam jawaban
Cukup Baik	61 - 70	Memperlihatkan hanya sebagian pemahaman tentang permasalahan. Kebanyakan persyaratan tentang tugas terdapat dalam jawaban
Kurang	51 - 60	Memperlihatkan sedikit pemahaman tentang permasalahan. Banyak persyaratan tugas yang tidak ada
Sangat kurang	< 51	Memperlihatkan tidak ada pemahaman tentang permasalahan