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| **Program Study** | Geophysical Engineering Department |
| **Course** | Physical Geology |
| **Course Code** | RF184101 |
| **Semester** | I (One) |
| **Credit** | 3 (T:3) SKS |
| **Lecturer** | 1. Dr.Ir. Amien Widodo. 2. M.Haris MF,S.T.,M.Eng. |

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| **Study Materials** | Geology, mechanics | | |
| **Learning Outcome (LO)** | Attitude | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| General Skills | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| Knowledge | 3.2 | understanding geological knowledge that required to understand the geological process of a particular natural phenomena by its characteristics; |
| 3.3 | understanding the theoretical concept of statistics to define the process complexity of a particular natural phenomena; |
| 3.8 | understanding the principle and methods of mapping application that required in general geophysical engineering work; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.13 | understanding the insight of sustainable development in applied geophysical exploration methods and natural resource management in general; |
| Specific Skills | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented, and poured in the form of scientific papers. |
| **LO - Course** | [C4,P4,A4] Students are able to identify and describe geological objects as well as explain the diagenesis of geological phenomena found in the field. Students are able to hold the basic knowledge which includes the mechanical and chemical process on Earth. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | [C4,P4,A4]  Students are able to understand the basics of geophysical calculations from plate tectonics started from the concept of continental drift and seafloor spreading. | Introduction to geodynamics for geophysics, plate tectonics and mathematical equation for plate dynamics  [K9] : Introduction to geodynamics for geophysics.ppt | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  Assignment-K10 : Plate dynamics and isostasy practice | Get to know the general formula of plate dynamics | 10% |
| 2 | [C4,P4,A4]  Students are able to understand the basics of geophysical calculations from plate tectonics started from the concept of continental drift and seafloor spreading. | Introduction to geodynamics for geophysics, plate tectonics and mathematical equation for plate dynamics  [K9] : Introduction to geodynamics for geophysics.ppt | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  Assignment-K10 : Plate dynamics and isostasy practice | Get to know the general formula of plate dynamics | 10% |
| 3 | [C4,P4,A4]  Students are able to understand the basics of geophysical calculations from plate tectonics started from the concept of continental drift and seafloor spreading. | Introduction to geodynamics for geophysics, plate tectonics and mathematical equation for plate dynamics  [K9] : Introduction to geodynamics for geophysics.ppt | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  Assignment-K10 : Plate dynamics and isostasy practice | Get to know the general formula of plate dynamics | 10% |
| 4 | [C4,P4,A4]  Students are able to understand the basics of geophysical calculations from plate tectonics started from the concept of continental drift and seafloor spreading. | Introduction to geodynamics for geophysics, plate tectonics and mathematical equation for plate dynamics  [K9] : Introduction to geodynamics for geophysics.ppt | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  Assignment-K10 : Plate dynamics and isostasy practice | Get to know the general formula of plate dynamics | 10% |
| 5 | [C4,P4,A4]  Students are able to understand the basics of geophysical calculations from plate tectonics started from the concept of continental drift and seafloor spreading. | Introduction to geodynamics for geophysics, plate tectonics and mathematical equation for plate dynamics  [K9] : Introduction to geodynamics for geophysics.ppt | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  Assignment-K10 : Plate dynamics and isostasy practice | Get to know the general formula of plate dynamics | 10% |
| 6 | [C4,P4,A4]  Students are able to understand the basics of geophysical calculations from plate tectonics started from the concept of continental drift and sea floor spreading. | Introduction to geodynamics for geophysics, plate tectonics and mathematical equation for plate dynamics  [K9] : Introduction to geodynamics for geophysics.ppt | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  Assignment-K10 : Plate dynamics and isostasy practice | Get to know the general formula of plate dynamics | 10% |
| 7 | [C4,P4,A4]  Students are able to understand the basics of geophysical calculations from plate tectonics started from the concept of continental drift and seafloor spreading. | Introduction to geodynamics for geophysics, plate tectonics and mathematical equation for plate dynamics  [K9] : Introduction to geodynamics for geophysics.ppt | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  Assignment-K10 : Plate dynamics and isostasy practice | Get to know the general formula of plate dynamics | 10% |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | [C4,P4,A4]  Students are able to understand the basics of geophysical calculations from plate tectonics started from the concept of continental drift and seafloor spreading. | Introduction to geodynamics for geophysics, plate tectonics and mathematical equation for plate dynamics  [K9] : Introduction to geodynamics for geophysics.ppt | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  Assignment-K10 : Plate dynamics and isostasy practice | Get to know the general formula of plate dynamics |  |
| 10 | [C4,P4,A4]  Students are able to understand continental dynamics and deformation between plates with geophysics (gravity and isostasy) | Introduction to deformation, the basic concept of gravity and plate isostasy  [K10] : Introduction to gravity and isostasy.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  Assignment-K10 : Plate dynamics and isostasy practice | the accuracy of explaining | 5% |
| 11 | [C4,P4,A4]  Students are able to analyse stress and strain | The concept and measurement of stress and strain  [K11] : deformation, stress and strain.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of explaining and comparing |  |
| 12 | [C4,P4,A4]  Students are able to understand the basic rheology | The basic concept and measurement of rheology  [K12] : Introduction to reology.ppt | Direct Lecture, Discussion, Video; | TM: 1x(3x50”) | Discussion  Quiz-K12 :stress and strain | the accuracy of explaining | 5% |
| 13 | [C4,P4,A4]  Students are able to understand the concept of hotspot formation/volcanism and its relation to the plate movement, tectonic plume, fluid mechanics | The basic concept of fluid mechanics and volcanism  [K13] : Introduction to fluid mechanics and vulcanism.ppt | Direct Lecture, Discussion, Video; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion  Assignment-K13 : Practice in making a language program for flow simulation in the Earth | the accuracy of explaining | 10% |
| 14 | [C4,P4,A4]  Students are able to understand the principle of heat transfer occurrence/ whole mantle convection | Heat transfer concept  [K14] : Introduction to heat transfer.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of explaining |  |
| 15 | [C4,P4,A4]  Students are able to understand the study case of Geodynamics through Geophysics | Study case comprehension in geodynamics through geophysics  [K15] : Journal.ppt | Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion  Assignment-K15 :Presentation and resume study deodynamics in geophysics | the accuracy of explaining |  |
| 16 | End Semester Evaluation | | | | | | 30% |

**REFERENCES :**

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| 1. Hamblin, W.K., 1982; The Earth’s Dynamic Systems; 3rd Edition. Minesotta. 2. Thomson and Turk, 2007, Physical Geology, Sounders Golden series 3. Wilson, T. et al., “Physics and Geology”, McGraw-Hill, 1975 4. Dana’s Manual of Mineralogy, John Wiley and Sons, Inc., New York 5. Turcotte, D.L. and Schubert, G., 1982, Geodynamics : Applications of Continuum physics to geological problems, John Willey & Sons. Inc 6. Blatt, H., Tracy, R.J., Owens, B.R., 2006,Petrology: Igneous, Sedimentary, and Metamorphic,3 rd |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Introduction to Geophysical Engineering |
| **Course Code** | RF184102 |
| **Semester** | I (One) |
| **Credit** | 2 (T:2) SKS |
| **Lecturer** | Dr. Widya Utama, DEA |

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| **Study Materials** | Geology, Physics | | |
| **Learning Outcome (LO)** | Attitude | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| General Skills | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| Knowledge | 3.3 | understanding the principle and methods of applied geophysics engineering started from acquiring data, processing and modelling for problem solving in certain fields in deep; |
| Specific Skills | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| **LO - Course** | [C4,P3,A3] Students are able to recognise the physical characteristics of geological phenomena on Earth's surface through simple geophysical methods to acquire subsurface model and Earth's crust dynamics. By constructing and using simple model, students are able to understand its usefulness based on the exploration purpose | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | GEOPHYSICAL GENERAL REVIEW IN SCIENCE | 1. Geophysical status in geosciences  2. Investigation Geophysics  3. Applied geophysics in geosciences on a large-scale  *Widiyantoro (Bab I; Kearey & Vine Chapter 1* | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion | Explain geophysics existence in geosciences as well as its part in study the Earth | - |
| 2 | Theory of Earth's Formation | 1. Introduction *Widiyantoro (Bab I)* | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion, assignment | Explain the origin of human assumption on Earth's formation | 5% |
| 3 | SHAPE AND SIZE  OF THE EARTH | 1. Earth as a perfect spherics  2. Earth as a round ellipsoid  3. Earth as a triaxial ellipsoid  4. Earth's shape from satellite observation  *Tachyudin (Bab II)* | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion | Explain the invention of Earth's shape and size | - |
| 4 | EARTH’S INTERIOR AND  SEISMOLOGY | 1. Determination of Earth's mass, moment of inertia, and rotation  2. Determination of Earth's density value, constant and gravity acceleration  *Widiyantoro (Bab 2-4)* | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion, quiz | Explain the determination of Earth's physical parameters | 10% |
| 5 | EARTHQUAKE (1) | 1. Mechanism, source, location, parameters, and instrumentation of earthquake  *Fowler (Chapter 2-4)* | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion, assignment | Explain about earthquake and things related to it. | 5% |
| 6 | EARTHQUAKE (2) | 1. The theory of elastic wave, seismic wave characterization, seismic phase, and their relation to earthquake  *Fowler (Chapter 2-4)* | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion | Explain the seismic wave propagation and its relation to earthquake | - |
| 7 | EARTHQUAKE (3) | 1. The implication of seismology in Earth's interior structure  2. The implication of other geosciences in Earth's interior structure  *Fowler (Chapter 2-4)* | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion | Explain the implication of seismology in study the Earth's interior structure | - |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | GRAVITY | 1. Introduction  2. Basic concept of gravity  3. Earth’s potential and gravity acceleration  4. Earth’s gravity acceleration  *Fowler Chapter (5)* | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion | Explain the basic concept of gravity | - |
| 10 | GRAVITY | 1. Gravity acceleration measurement  2. Earth’s shape and illustration  3. Geoid and gravity anomaly | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion, assignment | Explain gravity measurement and its part in knowing Earth's shape and illustration | 5% |
| 11 | GRAVITY | 1. The concept and calculation of isostasy  2. Flexure litosfer and mantle viscosity | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion | Explain the concept of isostasy and flexure lithosphere to understand Earth's crust dynamics | - |
| 12 | EARTH MAGNETISM | 1. The concept and scope of basic geomagnetic  2. Measurement of magnetic field, prime field (properties and cause) and the theory of dynamo  *Tachyudin (Bab IV)* | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion, quiz | Explain the basic concept and measurement of geomagnetic field | 10% |
| 13 |  | 1. Secular variation and external magnetic field  2. Rock magnetism | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion, assignment | Explain the basic concept of paleomagnetic, external magnetic field and how to record a magnetism in a rock | 5% |
| 14 | HEAT FLOW ON EARTH | 1. Introduction  2. Conductive heat flow and  simple geothermal calculation  3. Heat flow on Earth  *Tachyudin (Bab VI)* | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion | Explain the mechanism of heat flow on Earth's surface | - |
| 15 | HEAT FLOW ON EARTH | 1. Adiabatic process, melting in  mantle, and convection on  mantle  2. Core thermal structure and forces that work on a plate | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion | Menjelaskan mekanisme aliran  panas di bagian dalam bumi.  Explain the mechanism of heat flow in Earth’s subsurface | - |
| 16 | End Semester Evaluation | | | | | | 30% |

**REFERENCES** :

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| * + - 1. Reynolds, John M., 1997, An Introduction to Applied and Environmental Geophysics, John Wiley & Sons, England.       2. Jones, E. J. , 1999, Marine Geophysics, John Wiley & Sons.       3. Turcotte, D.L. , 1982, Geodynamics Application of continue Physics to geological Problems, John Wiley & Sons       4. Fowler, C.M.R. , 1990, The Solid Earth. Cambridge University Press.       5. Fu, L., and Cazenave, A., satellite altimetry and Earth sciences, Academic Press, 2001. |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Geophysical Computing |
| **Cource Code** | RF184203 |
| **Semester** | II (Two) |
| **Credit** | 3 (Three) SKS |
| **Lecturer** | Dr. Dwa Desa Warnana, S.Si., M.Si. |

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| **Study materials** | Progamming, Mathematics | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysical engineering in depth; |
| 3.6 | understanding the complete operational knowledge related to the field of geophysical engineering technology; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.12 | understanding the concept, principle, workshop procedure, studio and laboratory activities, and Health and Safety Environment (HSE) in general; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| **LO – Course** | [C3,P3,A3] Students are able to apply the basics of programming, concepts, and application in geoscience field. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | Students can understand the basics of MATLAB programming. | MATLAB programming. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 2 | Students can solve a system of linear equations numerically (MATLAB) | Numerical linear equation solving (MATLAB) | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, task | Task result | 5% |
| 3 | Students can do numerical computations from inverse matices. | Numerical inverse matrix computation. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 4 | Students can do numerical computation using the decomposition method. | Numerical computation using the decomposition method. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, quiz | Quiz result | 10% |
| 5 | Students can do numerical computation using the iterative method. | Numerical computation using the iterative method | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, practicum | Practicum report | 5% |
| 6 | Students can do interpolation numerical computing. | Interpolation numerical computing | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, practicum | Practicum report | 5% |
| 7 | Students can do extrapolation numerical computing. | Extrapolation numerical computing | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 8 | Mid Semester Evaluation | | | | | | 25% |
| 9 | Students can do numerical curve fitting computing. | Numerical curve fitting computing. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 10 | Students can compute numerical nonlinear equations. | Numerical computation of nonlinear equations. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, task | Task result | 5% |
| 11 | Students can do differential numerical computing. | Differential numerical computing. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 12 | Students can do integral numerical computing. | Integral numerical computing. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, quiz | Quiz result | 10% |
| 13 | Students can understand numerical computing in the geophysics field. | Numerical computing in the geophysics field. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, practicum | Practicum report | 5% |
| 14 | Students can understand numerical computing in the geophysics field. | Numerical computing in the geophysics field. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, practicum | Practicum report | 5% |
| 15 | Students can understand numerical computing in the geophysics field. | Numerical computing in the geophysics field. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 16 | End Semester Evaluation | | | | | | 25% |

**REFERENCES :**

1. Yang , W.Y., Chung, W.T., Morris, J., "Applied Numerical Methods Using MATLAB"., John Wiley & Sons,200
2. Kiusalaas, J., “Numerical Methods in Engineering with MATLAB.”, cambridge university press, 2005

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Fundamental Electronics |
| **Course Code** | RF184304 |
| **Semester** | 3 (T:2, R:1) SKS |
| **Credit** | III (Three) |
| **Lecture** | Mariyanto |

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| **Study Materials** | | Electricity, Mathematics | | | | | | | | |
| **Learning Outcome (LO)** | | **Attitude** | | | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; | | | | |
| **General Skills** | | | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; | | | | |
| 2.2 | being able to show independent, quality, and measurable performance; | | | | |
| **Knowledge** | | | 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; | | | | |
| **Specific Skills** | | | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; | | | | |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; | | | | |
| **LO – Course** | | [C3,P3,A2] Students can explain and apply laws, basic theorems of electronics, the characteristics and way of working of the electronic components to solve electronic circuit problems. | | | | | | | | |
| **Week** | **The Expected of Sub LO - Course** | | **Learning Subject** | **Learning Methods** | | | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** | |
| **1** | **2** | | **3** | **4** | | | **5** | **6** | **7** | **8** | |
| 1 | Students are able to explain the basic of electrical circuits. | | Bacics concepts, charge, current, voltage | Direct Lecture  120 minute  Discussion  30 minute | | | 150 minute | Presentation, Discussion | Liveliness of interact | - | |
| 2 | Students are able to explain the law of conservation of energy, power, and circuit elements. | | The law of conservation energy, power, and circuit elements. | Direct Lecture  120 minute  Discussion  30 minute | | | 150 minute | Presentation, Discussion, Task | Task result | 5% | |
| 3 | Students are able to explain the basic laws of electronics and parts of the circuit. | | Ohm’s law, node, branch, loop, Kirchhhoff’s current law, Kirchhhoff’s voltage law. | Direct Lecture  120 minute  Discussion  30 minute | | | 150 minute | Presentation, Discussion | Liveliness of interact | - | |
| 4 | Students can use voltage and current divider methods to solve circuit problems. | | Resistor, voltage divider circuit, current divider circuit, wye-delta transformation. | Direct Lecture  120 minute  Discussion  30 minute | | | 150 minute | Presentation, Discussion, quiz | Quiz result | 10% | |
| 5 | Students are able to solve series problems using Node analysis method. | | Node analysis method. | Direct Lecture  120 minute  Discussion  30 minute | | | 150 minute | Presentation, Discussion,  Practicum | Practicum report | 5% | |
| 6 | Students are able to solve series problems using Mesh analysis method. | | Mesh analysis method. | Direct Lecture  120 minute  Discussion  30 minute | | | 150 minute | Presentation, Discussion,  Practicum | Practicum report | 5% | |
| 7 | Students are able to apply Node and Mesh analysis method for supernode and supermesh cases. | | Supernode, supermesh | Direct Lecture  120 minute  Discussion  30 minute | | | 150 minute | Presentation, Discussion | Liveliness of interact | - | |
| 8 | Mid Semester Evaluation | | | | | | | | | 25% | |
| 9 | Students are able to solve the diode and transistor circuit problems. | | Diode, transistor | Direct Lecture  120 minute  Discussion  30 minute | | | 150 minute | Presentation, Discussion | Liveliness of interact | - | |
| 10 | Students are able to understand the capacitor and inductor circuits. | | Capasitor and inductor circuits, the equivalent value of a series and parallel arrangement | Direct Lecture  120 minute  Discussion  30 minute | | | 150 minute | Presentation, Discussion, Task | Task result | 5% | |
| 11 | Students are able to solve the problems of the 1st orde series. | | RC and RL circuits are free source, RC and RL circuits with short responses. | Direct Lecture  120 minute  Discussion  30 minute | | | 150 minute | Presentation, Discussion | Liveliness of interact | - | |
| 12 | Students are able to solve the problems of the 2nd orde series. | | Source-free RLC circuit, RLC circuit with short response. | Direct Lecture  120 minute  Discussion  30 minute | | | 150 minute | Presentation, Discussion, quiz | Quiz result | 10% | |
| 13 | Students are able to understand sinusoid signals and phasor analysis. | | Sinusoid signals and phasor analysis. | Direct Lecture  120 minute  Discussion  30 minute | | | 150 minute | Presentation, Discussion,  Practicum | Practicum report | 5% | |
| 14 | Students are able to apply sinusoidal steady-state analysis. | | Sinusoidal steady-state analysis, superposition theorem, source transformation. | Direct Lecture  120 minute  Discussion  30 minute | | | 150 minute | Presentation, Discussion,  Practicum | Practicum report | 5% | |
| 15 | Students are able to apply AC electrical power analysis. | | AC electrical power analysis | Direct Lecture  120 minute  Discussion  30 minute | | | 150 minute | Presentation, Discussion | Liveliness of interact | - | |
| 16 | End Semester Evaluation | | | | | | | | | 25% | |

**REFERENCES :**

1. Alexander, CK., Sadiku, MNO., Fundamental of Electric Circuits, McGraw-Hill, New York
2. Johnson, David E, et al., Electric Circuit Analysis, Prentice-Hall Inetrnational Edition

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Rock Physics |
| **Course Code** | RF184305 |
| **Semester** | III (Three) |
| **Credit** | 4 (T:3,P:1) SKS |
| **Lecturer** | Anik Hilyah, S.Si., M.T. |

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| **Study Materials** | Intoduction: background and basic understanding of rock physics, rocks as part of the earth’s crust and soil as a result of chemical-physical weathering of rocks, rocks and soil as a constituent of tha earth’s crust.  Measurement and modeling of rock physics characteristics: design of acquisition and measurement of rock physics data at the laboratory scale and its development at the field scale.  Variables and parameters of rock characteristics: solid materials (matrix), pore space and fluid content in the pores that affect each other.  Application: relation of rock characteristics at various scales of rock phyics measurement and its application in geophysical exploration in the field. | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| **Specific Skills** | 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| **LO - Course** | [C4,P4,A4] Students can design simple measurement systems (tools and methodologies) to be followed up by measuring laboratory scale rock physics variables.  Students are able to understand the concepts and relationships between rock physical variables to extract important parameters of rocks for explorations purposes. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | Students are able to know what will be learned in the Rock Physics course and understand the classification and characteristics of each rock. | * Introduction of rock phyics * General classification and characteristics of igneous, sedimentary, and metamorphic rocks. | Direct lecture and discussion | 150 minute | Discussion and task | The ability to describe each rocks. | 1,8 % |
| 2 | Students are able to know various physical parameters of rock pore space. | * Porosity * Specific Internal Surface * Saturation * Permeability * Wettability * Capillary Pressure * Sandstone case study | Direct lecture and discussion | 150 minute | Presentation, discussion and task | Able to read simple log data shows the physical parameters of rocks. | 1,8 % |
| 3 | Students are able to understand NMR’s principles and their application in the log data. | * The principle of NMR measurement * Relaxation mechanism * Case Study | Direct lecture and discussion | 150 minute | Presentation, discussion and task | Able to explain the principle of NMR physically and numerically. | 1,8 % |
| 4 | Students are able to understand the concept of density and measurement method in laboratory. | * Definisi dan jenis densitas * Densitas berbagai batuan | Direct lecture and discussion | 150 minute | Presentation, discussion | Able to distinguish between types of density and taje laboratory scale measurements. | 1,8 % |
| 5 | First Quiz (Formative Evaluation – Evaluation which is intended to improve the learning process based on the assessment that has been done) | | | | | | 10 % |
| 6 | Students are able to understand application of radioactive method on formation evalution. | * The Concept of radioactive * Nature radioactivity * Gamma radiation * Netron raduation * Radioactive applications in formation * Sandstone case study | Direct lecture and discussion | 150 minute | Presentation, discussion and task | Able to understand the principle of radioactive measurement. | 1,8 % |
| 7 | Student are able to understand the elastic properties of rock and its application to seismic. | * Elasticity of rocks * Velocity of igneous, sedimentary, and metamorphic rocks. * Anisotrophy * Attenuation * Sandstone case study | Direct lecture and discussion | 150 minute | Presentation, discussion | Able to distinguish primary and secondary wave velocity. | 1,8 % |
| 8 | Mid Semester Evaluation (Formative Evaluation: Evaluation which is intended to improve the learning process based on the assessment that has been done) | | | | | | 20 % |
| 9 | Students are able to understand geomechanical concepts and its application to geotechnics. | * Basic concepts of geomechanics * Geomechanical processes * Correlation between static and dynamic modulus * Correlation between seismic velocity and rock strength | Direct lecture and discussion | 150 minute | Presentation, discussion and task | Able to understand stress, strain, and its application. | 1,8 % |
| 10 | Students are able to understand the electrical properties of rocks and its application in log data. | * Electrical properties of rocks * Resistivity of rocks * Clean rocks * Shaly rocks * Dielectric properties of rocks * Sandstone case study | Direct lecture and discussion | 150 minute | Presentation, discussion | Able to read resistivity value in the log data. | 1,8 % |
| 11 | Students are able to understand the electrical properties of rocks and its application in log data. | * Electrical properties of rocks * Resistivity of rocks * Clean rocks * Shaly rocks * Dielectric properties of rocks * Sandstone case study | Direct lecture and discussion | 150 minute | Presentation, discussion | Able to read resistivity value in the log data. | 1,8 % |
| 12 | Quiz 2 (Formative-Evaluation Evaluation intended to improve the learning process based on the assessment that has been done) | | | | | | 10 % |
| 13 | Students are able to understand the thermal concepts of rocks. | * Thermal properties in minerals and pore fillers * Thermal properties of rock * Models | Direct lecture and discussion | 150 minute | Presentation, discussion and task | Able to understand the thermal processes in rocks. | 1,8 % |
| 14 | Students are able to understand the magnetic properties of rocks. | * The basic concept of magnetic * Magnetic properties of rocks. | Direct lecture and discussion | 150 minute | Presentation, discussion and task | Able to distinguish various types of magnetic properties of the rocks. | 1,8 % |
| 15 | Correlation between physical parameters. | * Log interprestation for determining porosity and mineral composition * Correlation between thermal conductivity and elastic wave velocity | Direct lecture and discussion | 150 minute | Presentation, discussion | Able to know the correlation between the properties of rock physics. | 1,8 % |
| 16 | End of Semester Evaluation | | | | | | 20 % |

**REFERENCES :**

1. Schoon, J.H., 1998, Physical Properties of Rocks: Fundamental and Principles Of Petrophysics, Pergamon.

2. Bowless J E, 1979, Physical and Geotechnical Properties of Soils, Mc Graw hill Co, Tokyo.

3. Mavko, Gary., et al, 2009, The Rock Physics Handbook, Cambridge University Press, UK.

4. Terzghy K, dkk, 1997, Soil Mechanics in Enginering Practise, Prantice Hall, NY.

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Mathematical Geophysics |
| **Course Code** | RF184306 |
| **Semester** | 4 (T:3,R:1) SKS |
| **Credit** | III (Three) |
| **Lecturer** | 1. Dr. Ayi Syaeful Bahri, S.Si., M.T. 2. Mariyanto, S.Si., M.T. 3. M. Singgih Purwanto, S.Si., M.T. |

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| **Study Materials** | Physics, Mathematics | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| **LO - Course** | [C3,P3,A3] Students are able to apply the basic concepts of Geophysical Mathematics and apply them in the Geophysics problems. Students are able to solve vector problems, SPL, matrices, series, complex numers, integrals, Ordinary Differential problems, Partial Differential Equations, Fourier, and other special functions. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | Students are able to understand the importance of mathematics to solving geophysical problems. | Introduction, the bacis concepts of mathematic in Geophysics. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 2 | Students are able to solve the convergence test. | Series, convergent series, divergent series, convergent test, rank series | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, task | Task result | 5% |
| 3 | Students are able to solve complex algebra problems. | Complex numbers, complex fields, complex algebra. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 4 | Students are able to do calculation with Euler’s formula. | Infinite series, complex rank, euler formula, rank and root of complex numbers. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, quiz | Quiz resut | 10% |
| 5 | Students are able to solve trigonometric, exponential, logarithmic, hyperbolic function equations. | Trigonometric functions, exponential functions, logarithmic functions, hyperbolic function. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, task | Task result | 5% |
| 6 | Students are able to solve linear algebra problems. | Linear algebra, matrice, determinats, cramer rules. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 7 | Students are able to solve matrix operations. | Vector, line, area, matrix operation. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | Students are able to solve partial derivative problems. | Partial derivatives, chain rules, implicit derivatives. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 10 | Students are able to solve partial derivative application problems. | Partial derivative application for minimum maximum cases, Lagrange multiplers, Leibniz rules. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, task | Task result | 5% |
| 11 | Students are able to do fold integral calculations. | Fold integrals, double integrals, triple integrals. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 12 | Students are able to solve integral application problems. | Jacobian, surface integrals, application integrals. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, quiz | Quiz resut | 10% |
| 13 | Students are able to solve vector problems. | Vector analysis, vector multiplication, vectir derivation, terrain, gradient. | Kuliah  120 menit  Diskusi  30 menit | 150 minute | Presentation, discussion, task | Task result | 5% |
| 14 | Students are able to do vector operations. | Integral lines, green theorem, divergence, curl, stokes theorem. | Kuliah  120 menit  Diskusi  30 menit | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 15 | Students are able to solve partial differential equations. | Persamaan diferensial parsial, persamaan laplace, persamaan poisson | Kuliah  120 menit  Diskusi  30 menit | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 16 | End Semester Evaluation | | | | | | 30% |

**REFERENCES :**

1. Hubral, P., Mathematical Methods for Geophysics, University of Karlsruhe Press, 2001.
2. Michael S. Zhdanov, Geophysical Inverse Theory and Regularization Problems, Elsevier, 2002.
3. Boas, ML, Mathematical Method in Physical Sciences, Jhon Wiley and Sons 3rd edition, 2006.
4. Kreyzig, Erwin, advance Engineering Mathematics, Jhon Wiley and Sons 9th edition, 2006

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Structural Geology |
| **Course Code** | RF184307 |
| **Semester** | III (Three) |
| **Credit** | 3 (T:2, P:1) SKS |
| **Lecturer** | Dr. Ir. Amien Widodo, M.S. |

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| **Study Materials** | Geology, Mechanics, Deformation, Petrology | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.2 | understanding geological knowledge that required to understand the geological process of a particular natural phenomena by its characteristics; |
| 3.8 | understanding the principle and methods of mapping application that required in general geophysical engineering work; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.13 | understanding the insight of sustainable development in applied geophysical exploration methods and natural resource management in general; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| **LO - Course** | [C4,P4,A4] Students are able to identify the elements of geological structure, able to describe and analyse as well as explain a geological structure event. Students are able to define the correlation between tectonic and geological structure event. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4]  Students are able to understand structural geology and Earth's constituent components(Earth Structure) | Introduction to Earth Structure  [K1] : Earth Structure.ppt | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion (Comprehension of Earth’s components from the core to the crust and its relation to structural geology) | the accuracy of explaining |  |
| 2 | [C4,P4,A4] Students are able to understand crust deformations (Divergent, Convergent, and Transform) | Introduction to Crust Deformation  [K2] : Tectonic Deformation Part 1.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (types of tectonic crust movement);  **Assignment-K2 : Resume on divergent, convergent, and transform process** | Get to know of plate movements |  |
| 3 | [C4,P4,A4] Students are able to explain the difference of Brittle and Ductile | Introduction to Sedimentary Stratigraphy on sedimentary depositional environment  [K3] : Brittle and Ductile.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (sedimentary depositional environment);  **Assignment-K10 :depositional environment through rock components exercises** | Get to know of sedimentary depositional environment |  |
| 4 | [C4,P4,A4] Students are able to classified sedimentary rock through its component and its depositional environment | The concept of sedimentary stratigraphy on various depositional environment [K4] : Introduction to sedimentary depositional environment.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (sedimentary depositional environment);  **Assignment-K4 : Make a sedimentary rocks classification table** | Get to know clearly of sedimentary rock classification |  |
| 5 | [C4,P4,A4] Students are able to understand carbonate sedimentary rock | The concept of sedimentary stratigraphy on carbonate sedimentary rock  [K5] : Introduction to carbonate sedimentary rock.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (carbonate sedimentary rock);  **Quiz-K5 : Clastic Rock and Carbonate Rocks (components)** | Get to know of carbonate rocks component |  |
| 6 | [C4,P4,A4] Students are able to understand the genesis of carbonate rocks (differences in clastic rocks genesis) | The concept of sedimentary stratigraphy on carbonate sedimentary rock  [K5] : Introduction to carbonate rocks genesis.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  **Assignment-K6 : carbonate rocks genesis exercises** | Get to know of carbonate rocks genesis |  |
| 7 | [C4,P4,A4] Students are able to understand the genesis of sedimentary rocks, the components, textures, structures, minerals, as well as explain the depositional environment and its classification | The concept of sedimentary stratigraphy on clastic and non-clastic rocks  [K7] : Resume of sedimentary stratigraphy on clastic and non-clastic rocks.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (clastic and non-clastic rocks);  **Assignment-K7 : differences between clastic and non-clastic rocks exercise** | Get to know the differences between clastic and non-clastic rocks |  |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | [C4,P4,A4] Students are able to understand about stratigraphy and the laws of stratigraphy | Introduction to sedimentary stratigraphy, the principle of stratigraphy  [K9] : Introduction to the principle of stratigraphy.ppt | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion (the principle of stratigraphy); | Get to know the laws of stratigraphy |  |
| 10 | [C4,P4,A4] Students are able to understand the differences in stratigraphic science (lithostratigraphy, chronostratigraphy, biostratigraphy) | Introduction to lithostratigraphy, chronostratigraphy, and biostratigraphy  [K10] : Introduction to advanced stratigraphy.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (comprehensive knowledge in stratigraphy);  **Assignment-K10 : lithostratigraphy, chronostratigraphy, and biostratigraphy exercises** | the accuracy of explaining | 5% |
| 11 | [C4,P4,A4]  Students are able to analyse the correlation of rocks | The basic concept of sedimentary rocks correlations (understand datum/keybed)  [K11] : rocks correlation.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of comparing and explaining |  |
| 12 | [C4,P4,A4]  Students are able to analyse the correlation of rocks (lithocorrelation, chronocorrelation, and biocorrelation) | Comprehension of the differences in lithocorrelation, chronocorrelation, and biocorrelation  [K12] : lithocorrelation, chronocorrelation, and biocorrelation.ppt | Direct Lecture, Discussion, Video; | TM: 1x(3x50”) | Discussion  **Quiz-K12 : Stratigraphy and Correlation** | the accuracy of explaining | 5% |
| 13 | [C4,P4,A4]  Students are able to read a regional stratigraphy and its use | The basic concept of regional stratigraphy reading  [K13] :Regional geology map.ppt | Direct Lecture, Discussion, Video; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion  **Assignment -K13 : Practice on simulating the flow in the earth with program language** | the accuracy of explaining | 10% |
| 14 | [C4,P4,A4] Students are able to understand the sequence stratigraphy | The concept of sequence stratigraphy  [K14] : Introduction to Sequence Stratigraphy.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of explaining |  |
| 15 | [C4,P4,A4] Students are able to understand a stratigraphy, correlation, and sequence of rocks | Comprehensive understanding of sedimentary stratigraphy  [K15] : Journal.ppt | Discussion | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion  **Assignment-K15 : Presentation and resume about sedimentary stratigraphy** | the accuracy of explaining |  |
| 16 | End Semester Evaluation | | | | | | 30% |

**REFERENCES :**

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| * + - 1. "Billings, M.P., 1982, Structural Geology, Prentice Hall, New Delhi.       2. Ragan, D. R., Structural Geology, Geometrical Technique, 1979, John Willey       3. Davis,G.H.,Reynolds,S.J.,and Kluth,C.F.,2012,Structural Geology of Rock and Regions: 3rd edition, John and Wiley and Sons,Inc.,835p.       4. Fossen,H.,2010,Structural Geology,Cambridge University Press.,463p.       5. Modul Praktikum Geologi Struktur Departemen Teknik Geofisika ITS       6. Twiss, R. J. and Moore, E. M., 1992, Structural Geology: W. H. Freeman and Company, 532 p.       7. Suppe, J., 1985, Principles of Structural Geology: Prentice-Hall, Inc., 537p." |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Sedimentology and Stratigraphy |
| **Course Code** | RF184308 |
| **Semester** | III (Three) |
| **Credit** | 3 (T:3) SKS |
| **Lecturer** | Dr. Ir. Amien Widodo, M.S. |

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| **Study Materials** | Geology, Mechanics, Sediments, Stratigraphy | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.2 | understanding geological knowledge that required to understand the geological process of a particular natural phenomena by its characteristics; |
| 3.8 | understanding the principle and methods of mapping application that required in general geophysical engineering work; |
| 3.10 | understanding the concepts and principles of environmental preservation in general from geophysical engineering activities; |
| 3.13 | understanding the insight of sustainable development in applied geophysical exploration methods and natural resource management in general; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference between land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| **CP – Mata Kuliah** | [C4,P4,A4] Students are able to understand sedimentary rock genesis and its relation in time and space. Both definitions are used to understand the geometry of sedimentary rock layers that use to interpret the distribution and properties of the rock, along with its interpretation and calculation of economic values in the sedimentary rocks. Students are able to identify various types of sedimentary rocks and recognize it physically in the laboratory. Students are able to apply the stratigraphy correlations for stratigraphic mapping. Students are also able to understand the economic value of sedimentary rock and able to read and serve stratigraphic map for exploration and development purposes. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4] Students are able to understand the component and genesis of sedimentary rocks | Introduction to Sedimentary Stratigraphy on mineral composition of sedimentary rock and its genesis  [K1] : Component and Genesis of Sedimentary Rocks.ppt | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion (Review on sedimentary rocks component and mineral composition | the accuracy of explaining |  |
| 2 | [C4,P4,A4] Students are able to understand the texture and structure of sedimentary rocks | Introduction to Sedimentary Stratigraphy of depositions including the texture and structure formed simultaneously with syn-deposition or post-deposition  [K2] : Introduction to the Texture and Structure of Sedimentary Rocks.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (textures and structures of sedimentary rocks);  **Assignment-K2 : Resume on Component and Genesis of Sedimentary Rocks** | Get to know of Sedimentary Rocks in general |  |
| 3 | [C4,P4,A4] Students are able to explain the sedimentary rocks deposition environment reviewed from its components including its textures, structures, and minerals. | Introduction to Sedimentary Stratigraphy, sedimentary rock depositional environment  [K3] : Introduction to Sedimentary Stratigraphy depositional environment.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (sedimentary rock depositional environment);  **Assignment-K3:Exercise depositional system comprehension through rocks component** | Get to know of sedimentary rock depositional environment |  |
| 4 | [C4,P4,A4] Students are able to classified sedimentary rock through its components and depositional environment | The concept of sedimentary stratigraphy on a depositional environment [K4] : Introduction to Sedimentary rock depositional environment.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (sedimentary rock depositional environment );  **Assignment-K4 : Make a sedimentary rock classification table** | Get to know of sedimentary rock classification clearly |  |
| 5 | [C4,P4,A4] Students are able to understand carbonate sedimentary rock | The concept of sedimentary stratigraphy on carbonate sedimentary rock  [K5] : Introduction to carbonate sedimentary rock.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (carbonate sedimentary rock);  **Quiz-K5 : Clastic Rock and Carbonate Rocks (components)** | Get to know of carbonate rocks component |  |
| 6 | [C4,P4,A4] Students are able to understand the genesis of carbonate rocks (differences in clastic rocks genesis) | The concept of sedimentary stratigraphy on carbonate sedimentary rock  [K5] : Introduction to carbonate rocks genesis.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  **Assignment-K6 : carbonate rocks genesis exercises** | Get to know the genesis of carbonate rocks |  |
| 7 | [C4,P4,A4] Students are able to understand the genesis of sedimentary rocks, the components, textures, structures, minerals, as well as explain the depositional environment and its classification | The concept of sedimentary stratigraphy on clastic and non-clastic rocks  [K7] : Resume of sedimentary stratigraphy on clastic and non-clastic rocks.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (clastic and non-clastic rocks);  **Assignment-K7 : differences between clastic and non-clastic rocks exercise** | Get to know the differences between clastic and non-clastic rocks |  |
| 8 | Evaluasi Tengah Semester | | | | | | 30% |
| 9 | [C4,P4,A4] Students are able to understand about stratigraphy and the laws of stratigraphy | Introduction to sedimentary stratigraphy, the principle of stratigraphy  [K9] : Introduction to the principle of stratigraphy.ppt | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion (the principle of stratigraphy); | Get to know the laws of stratigraphy |  |
| 10 | [C4,P4,A4] Students are able to understand the differences in stratigraphic science (lithostratigraphy, chronostratigraphy, biostratigraphy) | Introduction to lithostratigraphy, chronostratigraphy, and biostratigraphy  [K10] : Introduction to advanced stratigraphy.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (comprehensive knowledge in stratigraphy);  **Assignment-K10 : lithostratigraphy, chronostratigraphy, and biostratigraphy exercises** | the accuracy of explaining | 5% |
| 11 | [C4,P4,A4]  Students are able to analyse the correlation of rocks | The basic concept of sedimentary rocks correlations (understand datum/keybed)  [K11] : rocks correlation.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of comparing and explaining |  |
| 12 | [C4,P4,A4]  Students are able to analyse the correlation of rocks (lithocorrelation, chronocorrelation, and biocorrelation) | Comprehension of the differences in lithocorrelation, chronocorrelation, and biocorrelation  [K12] : lithocorrelation, chronocorrelation, and biocorrelation.ppt | Direct Lecture, Discussion, Video; | TM: 1x(3x50”) | Discussion  **Quiz-K12 : Stratigraphy and Correlation** | the accuracy of explaining | 5% |
| 13 | [C4,P4,A4]  Students are able to read a regional stratigraphy and its use | The basic concept of regional stratigraphy reading  [K13] :Regional geology map.ppt | Direct Lecture, Discussion, Video; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion  **Assignment -K13 : Practice on simulating the flow in the earth with program language** | the accuracy of explaining | 10% |
| 14 | [C4,P4,A4] Students are able to understand the sequence stratigraphy | The concept of sequence stratigraphy  [K14] : Introduction to Sequence Stratigraphy.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of explaining |  |
| 15 | [C4,P4,A4] Students are able to understand a stratigraphy, correlation, and sequence of rocks | Comprehensive understanding of sedimentary stratigraphy  [K15] : Journal.ppt | Discussion | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion  **Assignment-K15 : Presentation and resume about sedimentary stratigraphy** | the accuracy of explaining |  |
| 16 | End Semester Evaluation | | | | | | 30% |

**REFERENCES :**

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| 1. Dunbar,C.O and Rodgers,J (157),Principal Of Stratigraphy  2. Schoch,R.M, (1989), Stratigraphy : Principal and Methods  3. Martodjojo, S dan Djuhaeni, (1996), Sandi Stratigrafi Indonesia  4. Mc Lane,M.,1995,Sedimentology,Oxford University Press Inc.,423 hal.  5. Collinson,JD.,Thompson,DB.,1982,Sedimentary Structures 2nd Ed.,London Unwin Hyman,207 hal. |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Seismology |
| **Cource Code** | RF184309 |
| **Semester** | III (Three) |
| **Credit** | 3 (P:2,R:1) SKS |
| **Lecturer** | Firman Syaifuddin, S.Si., M.T. |

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| **Study materials** | Wave, Physics | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.2 | understanding geological knowledge that required to understand the geological process of a particular natural phenomena by its characteristics; |
| 3.3 | understanding the theoretical concept of statistics to define the process complexity of a particular natural phenomena; |
| 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.7 | understanding the factual insights and technology application methods; codes and national/international standards as well as the regulations in force in his/her work area to carry out geophysical engineering technology work in depth; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference between land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented, and poured in the form of scientific papers. |
| **LO – Course** | [C3,P3,A3] Students can understand phenomena related to earthquake vibrations and are able to explain the concept of earthquake wave propagation. Students are able to determine the location of the earthquake source, the type of the earthquake, and analyze the mechanism of the earthquake. Students can understand the principles and application of the earthquake monitoring equipment. Students can understand the basic concepts of seismology used in exploration. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C3, P3,A3]  Understand what will be learned in this lecture, understand the basic fundamental of seismology. | 1. Introduction to lecture:  * Semester learning plans * College contracts * Scoring system  1. Review wave course | Introductory lectures, lecture contract and brainstorm, sharing opinion. | TM: 1x(3x50”) | Discussion;  Make a summary | Understanding what will be learned in this lecture  Able to explain the basic seismology | "5%  task" |
| 2 | [C3, P3,A3]  Understand the concepts of stress and strain that form the basis of the mechanical wave equation. | Stress and strain, | Direct lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concepts of stress and strain.  Able to explain the types of forces on continuous medium. | "5%  task " |
| 3 | [C3, P3,A3]  Understand wave equations and being able to derive general wave mechanics formulas, | The seismic wave equation, | Direct lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain wave equations.  Able to derive the general formula pf mechanical wave. | "5%  task " |
| 4 | [C3, P3,A3]  Knowing the concepts of travel times approached by the principle of wave rays. | Ray theory: Travel times, | Direct lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  **Quiz-01** | Able to explain the concept of travel times approached by the principle of wave rays. | "5%  task "  **15%  Quiz** |
| 5 | [C3, P3,A3]  Able to do inversion of travel time data with the wave ray approach. | Ray theory: Inversion of travel time data, | Direct lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to do inversion of travel time data with the wave ray approach. | "5%  task " |
| 6 | [C3, P3,A3]    Knowing the amplitude and phase which approached by the principle of wave light. | Ray theory:Amplitude and phase, | Direct lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the amplitude and phase which approached by the principle of wave light. | "5%  task " |
| 7 | [C3, P3,A3]    Knowing the concept of reflection that us used in the field of seismology. | Reflection seismology, | Direct lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concept of reflection used in the field of seismology. | "5%  task " |
| 8 | Mid Semester Evaluation (Formative Evaluation-Evaluation that is intended to improve the learning process based on the assessment that has been done) | | | | | | 40% |
| 9 | **[C3, P3,A3]**  Knowing the concept of surface waves and normal modes. | Surface waves and normal modes, | Direct lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concept of surface waves and normal modes. | "5%  task " |
| 10 | **[C3, P3,A3]**  Knowing the concept of earthquakes and source theory. | Earthquakes and source theory | Direct lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concepts of earthquake and source theory. | "5%  task " |
| 11 | [C3, P3,A3]  Knowing the concepts of earthquake prediction. | Earthquake prediction, | Direct lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the earthquake prediction. | "5%  task " |
| 12 | [C3, P3,A3]  Knowing the concept of earthquake instruments. | Earthquake  Instruments | Direct lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  **Quiz-02** | Able to explain the concept of earthquake instruments. | "5%  task " |
| 13 | [C3, P3,A3]  Knowing the concept of noise and anisotropy. | noise, and anisotropy | Direct lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concept of noise and anisotropy. | "5%  task " |
| 14 | [C3, P3,A3]  Knowing the concept of volcanic seismology. | Volcanic Seismology | Direct lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concept of volcanic seismology. | "5%  task " |
| 15 | [C3, P3,A3]  Able to analysis seismology data. | Case study.  Study literature from various source. | Group paper presentations; Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to analysis seismology data.  Being able to present papers on the result of literature studies.  Able to conduct scientific discussions with a question and answer mechanism. | "5%  task " |
| 16 | Final Semester Evaluation (Evaluation intended to find out the final achievement of student learning outcomes) | | | | | | 40% |

**REFERENCES :**

1. Shearer, P. M., 2009, Introduction to Seismology, Cambridge University Press, Cambridge, UK.
2. Zobin, V. M., 2012, Introduction to Volcanic Seismology, Elsevier, London, UK.
3. Jens Havskov, Gerardo Alguacil (auth.)-Instrumentation in Earthquake Seismology-Springer International Publishing (2016)
4. Barbara Romanowicz, Adam Dziewonski-Seismology and Structure of the Earth\_ Treatise on Geophysics-Elsevier (2009)
5. Agustin Udías-Principles of Seismology-Cambridge University Press (2000).
6. Thorne Lay, Terry C. Wallace-Modern Global Seismology, Vol. 58-Academic Press (1995
7. V. I. Keilis-Borok (auth.), V. I. Keilis-Borok, Edward A. Flinn (eds.)-Computational Seismology-Springer US (1995)

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Digital Data Analysis |
| **Cource Code** | RF184410 |
| **Semester** | 4 (T:3, R:1) SKS |
| **Credit** | IV (Empat) |
| **Lecturer** | 1. Dr. Ayi Syaeful Bahri, S.Si., M.T. 2. Mariyanto, S.Si., M.T. |

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| **Study materials** | Mathematics, Progamming, Domain Transformation | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.3 | Able to study the implications of the development or implementation of technological science that applies the value of the humanities according to their expertise based on scientific rules, procedures and ethics in order to produce solutions, ideas, designs or art criticisms, compile scientific descriptions of the results of their studies in the form of thesis or final project report , and upload it on the college page; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysical engineering in depth; |
| 3.9 | Able to master the principles of quality assurance in general in geophysical engineering work; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| **LO – Course** | [C4,P4.A3] Students are able to analyze the basic concepts of digital signal data in geophysics which includes all the substances in it to support data processing and be able to apply to geophysical data processing, Able to be responsible for the achievement of group work and to supervise and evaluate the completion of work assigned to workers under its responsibilities. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | Students are able to explain the concept of signal analysis. | The bacis concepts of signal analysis, signals and system in geophysics, data terminology, information and analysis in geophysics. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 2 | Students are able to explain the various type of signals. | Signals classification:  Analog signal  Digital signal  Odd function signal  Even function signal  Continuous signal  Discrete signal  Periodic signal  Aperiodic signal | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, task | Task result | 2,5% |
| 3 | Students are able to do periodic signal analysis in a fourier series. | Periodic signals, Fourier series | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 4 | Students are able to do aperiodic signal analysis using Fourier integrals. | Fourier analysis, Aperiodic signal, Fourier integral. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, quiz | Quiz result | 5% |
| 5 | Students are able to do discrete Fourier data transformation manually. | Discrete fourier data transformation. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, task | Task result | 2,5% |
| 6 | Students are able to do fourier data transformation by programming. | Algorithm in Fourier Transform, Fast Fourier Trasnform (FFT) | Kuliah  120 menit  Diskusi  30 menit | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 7 | Students are able understand and apply the Fourier transforms on geophysical data. |  | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | Students are able to understand the relationship between interval sampling with nyquist frequency and cut off. | Sampling function, nyquist theorem, nyquist frequency and cut off, aliasing | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 10 | Students are able to convolution data manually. | The physical meaning of convolution, convolution integral, convolution in the time and frequency domains. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, task | Task result | 2,5% |
| 11 | Students are able to convolution data by programming. | Convolution properties, convolution programming. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 12 | Students are able to correlate data manually. | Integral correlation, cross correlation, autocorrelation. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, quiz | Quiz result | 5% |
| 13 | Students are able to convolution data by programming. | correlation characteristics, correlation programming. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, task | Task result | 2,5% |
| 14 | Students are able to understand about data filters. | Filter classification, linear filter, nonlinear filter, low pass filter, band pass filter, high pass filter | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion, demo | Presentation and demo result | 20% |
| 15 | Students are able to filter data. | Correlation for suppressing noise (match filter), programming the data filter. | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, discussion | Liveliness of interact | - |
| 16 | End of Semester Evaluation | | | | | | 30% |

**REFERENCES :**

1. Clearbout, J.F.; Fundamentals of Geophysical Data Processing With Applications to Petroleum Prospecting. Mc. Graw-Hill Book Co., New York, 1976.
2. Sheriff, R.E., and Geldart, L.P.; Exploration Seismology Vol.2 : Data Processing and Interpretation. Cambridge University Press, 1983.
3. Oram Brigham B.: The Fast Fourier Transform and It’s Applications. Prentice-Hall Inc., 1988.

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| **Program Study** | Geophysical Engineering |
| **Course** | Mineral Deposits |
| **Code** | RF184412 |
| **Semester** | IV (Four) |
| **Credit** | 3 (T:3) SKS |
| **Lecturer** | Dr. Ir. Amien Widodo, M.S. |

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| **Study Materials** | Geology, Mechanics, Minerals | | |
| **Learning Outcome (LO)** | Attitude | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| General Skills | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| Knowledge | 3.2 | understanding geological knowledge that required to understand the geological process of a particular natural phenomena by its characteristics; |
| 3.10 | understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering; |
| 3.13 | understanding the insight of sustainable development in applied geophysical exploration methods and natural resource management in general; |
| Specific Skills | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| **LO– Course** | [C4,P4,A4] Students are able to understand various explorable and exploitable natural resources related to mineral deposits for economic purpose. Understand types of mineral deposits which has economic value and knowing its whereabouts that related to tectonic condition of a geology environment. Understand the process of mineral deposits formed in a certain zones and prediction of its whereabouts in the field (mineral deposits genesis). | | |

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| **Week** | **The Expected of Sub LO-Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience\*** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4]  Students are able to understand structural geology and Earth's constituent components(Earth Structure) | Introduction to Earth Structure  [K1] : Earth Structure.ppt | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion (Comprehension of Earth’s components from the core to the crust and its relation to structural geology) | the accuracy of explaining |  |
| 2 | [C4,P4,A4] Students are able to understand crust deformations (Divergent, Convergent, and Transform) | Introduction to Crust Deformation  [K2] : Tectonic Deformation Part 1.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (types of tectonic crust movement);  **Assignment-K2 : Resume on divergent, convergent, and transform process** | Get to know of plate movements |  |
| 3 | [C4,P4,A4] Students are able to explain the difference of Brittle and Ductile | Introduction to Brittle and Ductile on plate crust  [K3] : Brittle and Ductile.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (Brittle and Ductile);  **Assignment-K3 :Latihan soal Brittle and Ductile Exercises, the difference of divergent, convergent, and transform** | Get to know the difference of Brittle and Ductile and the outcome structures from both |  |
| 4 | [C4,P4,A4] Students are able to analyse the kinematics and dynamics of plate movement | The concept of kinematics and dynamics in structural geology  [K4] : Force Kinematics.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (Dynamics of Tectonic Plate);  **Assignment-K4 : Resume of Plate Movement Kinematics** | Get to know the various types of plate movement from the dynamics of its kinematic force |  |
| 5 | [C4,P4,A4] Students are able to understand carbonate sedimentary rock | The concept of sedimentary stratigraphy on carbonate sedimentary rock  [K5] : Introduction to carbonate sedimentary rock.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (carbonate sedimentary rock);  **Quiz-K5 : Clastic Rock and Carbonate Rocks (components)** | Get to know of carbonate rocks component |  |
| 6 | [C4,P4,A4] Students are able to understand the genesis of carbonate rocks (differences in clastic rocks genesis) | The concept of sedimentary stratigraphy on carbonate sedimentary rock  [K5] : Introduction to carbonate rocks genesis.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  **Assignment-K6 : carbonate rocks genesis exercises** | Get to know the genesis of carbonate rocks |  |
| 7 | [C4,P4,A4] Students are able to understand the genesis of sedimentary rocks, the components, textures, structures, minerals, as well as explain the depositional environment and its classification | The concept of sedimentary stratigraphy on clastic and non-clastic rocks  [K7] : Resume of sedimentary stratigraphy on clastic and non-clastic rocks.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (clastic and non-clastic rocks);  **Assignment-K7 : differences between clastic and non-clastic rocks exercise** | Get to know the differences between clastic and non-clastic rocks |  |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | [C4,P4,A4] Students are able to understand about stratigraphy and the laws of stratigraphy | Introduction to sedimentary stratigraphy, the principle of stratigraphy  [K9] : Introduction to the principle of stratigraphy.ppt | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion (the principle of stratigraphy); | Get to know the laws of stratigraphy |  |
| 10 | [C4,P4,A4] Students are able to understand the differences in stratigraphic science (lithostratigraphy, chronostratigraphy, biostratigraphy) | Introduction to lithostratigraphy, chronostratigraphy, and biostratigraphy  [K10] : Introduction to advanced stratigraphy.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (comprehensive knowledge in stratigraphy);  **Assignment-K10 : lithostratigraphy, chronostratigraphy, and biostratigraphy exercises** | the accuracy of explaining | 5% |
| 11 | [C4,P4,A4]  Students are able to analyse the correlation of rocks | The basic concept of sedimentary rocks correlations (understand datum/keybed)  [K11] : rocks correlation.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of comparing and explaining |  |
| 12 | [C4,P4,A4]  Students are able to analyse the correlation of rocks (lithocorrelation, chronocorrelation, and biocorrelation) | Comprehension of the differences in lithocorrelation, chronocorrelation, and biocorrelation  [K12] : lithocorrelation, chronocorrelation, and biocorrelation.ppt | Direct Lecture, Discussion, Video; | TM: 1x(3x50”) | Discussion  **Quiz-K12 : Stratigraphy and Correlation** | the accuracy of explaining | 5% |
| 13 | [C4,P4,A4]  Students are able to read a regional stratigraphy and its use | The basic concept of regional stratigraphy reading  [K13] :Regional geology map.ppt | Direct Lecture, Discussion, Video; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion  **Assignment -K13 : Practice on simulating the flow in the earth with program language** | the accuracy of explaining | 10% |
| 14 | [C4,P4,A4] Students are able to understand the sequence stratigraphy | The concept of sequence stratigraphy  [K14] : Introduction to Sequence Stratigraphy.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of explaining |  |
| 15 | [C4,P4,A4] Students are able to understand a stratigraphy, correlation, and sequence of rocks | Comprehensive understanding of sedimentary stratigraphy  [K15] : Journal.ppt | Discussion | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion  **Assignment-K15 : Presentation and resume about sedimentary stratigraphy** | the accuracy of explaining |  |
| 16 | End Semester Evaluation | | | | | | 30% |

**REFERENCES :**

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| * + - 1. Pirajno, F, (1990), Hydothermal Mineral Deposits, Springer Verlag.       2. Pirajno, F, 2009. Hydrothermal Processes and Mineral Systems. Springer Verlag, 1250 p.       3. Roberts, RG & Sheahan, PA, (1988), Ore Deposit Models, Geological Association of Canada.       4. Guilbert, JM & Park, Jr. CF., (1986) The Geology of Ore Deposits, Freeman, NY. |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Geostatistics |
| **Course Code** | RF184413 |
| **Semester** | IV (Four) |
| **Credit** | 3 SKS |
| **Lecturer** | 1. Anik Hilyah, S.Si., M.T. 2. M.Singgih Purwanto, S.Si., M.T. |

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| **Study Materials** | Basic statistical theory, conventional and unconventional geostatistical methods, analysis and modeling of variograms, variogram shapes, dispersion variances, estimation variances, krigging, reserve estimation, reservoir characterization and practicum using geostatistical software. | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.3 | understanding the theoretical concept of statistics to define the process complexity of a particular natural phenomena; |
| 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysical engineering in depth; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| **LO - Course** | [C4,P3,A3] Students are able to estimate the volume deviation and reservoir characterization using the geostatistical method. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | Able to know the geostatistical application. | * Introduction to geostatistics * Geostatistical applications in mining and reservoir characterization * Univariate Statistics | Direct Lecture and  Discussion | 150 minute | Discussion | Students are able to know the application of geostatistics in data processing and interpretation. |  |
| 2 | Able to know conventional backup calculation methods. | * Polygon Method * Nearest point method * Block method | Direct Lecture and  Discussion | 150 minute | Discussion | Students are able to apply various conventional backup calculation methods. |  |
| 3 | Able to understand geostatistical reserve calculation methods. | * Normal distribution * Data stationarity | Direct Lecture and  Discussion | 150 minute | Discussion | Students are able to apply various geostatistical reserve calculation methods. |  |
| 4 | Quiz 1 (Formative Evaluation-Evaluation which is intended to improve the learning process based on the assessment that has been done) | | | | | | 15% |  | 150 minute |
| 5 | Able to understand semivariograms. | * Sill, nuggets and range * Theoretical Variogram * Experimental variogram | Direct Lecture and  Discussion | 150 minute | Presentation, discussion, task | Students are able to make semivariograms, theoretical and experimental variograms. | 10% |
| 6 | Able to understand the variogram model. | * Variogram behavior near the starting point * Variogram model | Direct Lecture and  Discussion | 150 minute | Presentation, discussion | Students are able to analyze the variogram shape. |  |
| 7 | Able to understand geometry support. | * Pengaruh support geometri * Anisotropi | Direct Lecture and  Discussion | 150 minute | Presentation, discussion, Practicum | Students are able to determine the geometry support according to the data. | 20% |
| 8 | Mid Semester Evaluation (Formative Evaluation-Evaluation which is intended to improve the learning process based on the assessment that has been done) | | | | | | 20% |
| 9 | Able to understand extension variance. | * Calculation of variance extension * Application variance extension | Direct Lecture and  Discussion | 150 minute | Presentation, discussion | Students are able to apply extension variance. |  |
| 10 | Able to understand the estimated variance. | * Calculation of estimated variance * Application of estimation variance | Direct Lecture and  Discussion | 150 minute | Presentation, discussion | Students are able to apply the estimated variance. |  |
| 11 | Able to understand Kriging variance. | * Calculation of Kriging variance * Kriging variance application | Direct Lecture and  Discussion | 150 minute | Presentation, discussion | Students are able to calculate the Kriging variance. |  |
| 12 | Able to understand reserve estimates. | * Calculation of estimated reserves | Direct Lecture and  Discussion | 150 minute | Presentation, discussion | Students are able to calculate reserve estimates. |  |
| 13 | Quiz 2 (Formative Evaluation-Evaluation which is intended to improve the learning process based on the assessment that has been done)proses pembelajaran berdasarkan assessment yang telah dilakukan | | | 150 minute |  |  | 15% |
| 14 | Able to understand geostatistical case studies for reserve calculations. | Geostatistical case studies on mining. | Direct Lecture and  Discussion | 150 minute | Presentation, discussion, task | Students are able to solve geostatistical problems in mining. |  |
| 15 | Able to understand geostatistical case studies for reservoir characterization | Geostatistical case study on reservoirs | Direct Lecture and  Discussion | 150 minute | Presentation, discussion | Students are able to solve geostatistical problems in reservoir characterization. |  |
| 16 | End of Semester Evaluation (Formative Evaluation-Evaluation which is intended to improve the learning process based on the assessment that has been done) | | | | | | 20% |

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1. David, M., “Geostatistical Ore Reserve Estimation, Developments in Geomathematics 2”, Elsevier Scientific Publishing Co., Amsterdam, Oxford-New York, 1980 Matheron, G., “Principles of Geostatistics”, Economic Geology vol.58, 1963
2. Annels, Alwyn E., “Mineral Deposit Evaluation”, A practical approach, Chapman dan Hall, London, 1991.
3. Wellmer, Friedrich, Statistical Evaluations in Exploration for Mineral Deposits, Springer, Germany, 1998
4. Journel, A.G. dan C. Huijbregts, “Mining Geostatistics”, Academic Press, 1978
5. Rendu, J.M., “An Introduction to Geostatistical Methods of Mineral Evaluation”, Monograph of the South African Inst. Min. Metall., 1978

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Geodynamics |
| **Course Code** | RF184414 |
| **Semester** | IV (Four) |
| **Credit** | 3 (T:3) SKS |
| **Lecturer** | 1. Wien Lestari, S.T., M.T. 2. Nita Aryanti, S.T., M.Eng. |

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| **Study Materials** | Geology, Mechanics | | |
| **Learning Outcome (LO)** | Attitude | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| General Skills | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| Knowledge | 3.2 | understanding geological knowledge that required to understand the geological process of a particular natural phenomena by its characteristics; |
| 3.3 | understanding the theoretical concept of statistics to define the process complexity of a particular natural phenomena; |
| 3.8 | understanding the principle and methods of mapping application that required in general geophysical engineering work; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.13 | understanding the insight of sustainable development in applied geophysical exploration methods and natural resource management in general; |
| Specific Skills | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented and poured in the form of scientific papers. |
| **LO - Course** | [C4,P4,A4] Students are able to apply physics law into plate dynamics which includes the process and the products among others are earthquake, landslide, mountain formation, and the change in coastal line. Students are able to understand the basics of Brittle and Ductile from lithosphere, able to explain the relation between the events and appearance which is revealed in the field, also able to understand the geophysics calculations on the basis of continental or oceanic crust emergence and Earth dynamics. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4] Students are able to understand the basics of plate crust which includes the brittle (rigid) and ductile (non-rigid) | Introduction to geodynamics on the basics of the Earth's plate crust consists of the rigid part and non-rigid part along with its movement  [K1] : Introduction to Geodynamics of Plate Crust.ppt | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”) | Discussion (Review on the basics of plate crust and its movement); | The accuracy of explaining | 5% |
| 2 | [C4,P4,A4] Students are able to understand the basics of geophysical calculations from plate tectonics started from the concept of continental drift and seafloor spreading. | Introduction to geodynamics for geophysics, plate tectonic, and mathematical equation for plate dynamics  [K9] : Introduction to geodynamics for geophysics.ppt | Introductory Lecture, brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  **Assignment-K10 : Plate dynamics and isostasy exercises** | Get to know the general formula of plate dynamics | 10% |
| 3 | [C4,P4,A4] Students are able to understand the basics of geophysical calculations from plate tectonics started from the concept of continental drift and seafloor spreading. | Introduction to geodynamics for geophysics, plate tectonic, and mathematical equation for plate dynamics  [K9] : Introduction to geodynamics for geophysics.ppt | Introductory Lecture, brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  **Assignment-K10 : Plate dynamics and isostasy exercises** | Get to know the general formula of plate dynamics | 10% |
| 4 | [C4,P4,A4] Students are able to understand the basics of geophysical calculations from plate tectonics started from the concept of continental drift and seafloor spreading. | Introduction to geodynamics for geophysics, plate tectonic, and mathematical equation for plate dynamics  [K9] : Introduction to geodynamics for geophysics.ppt | Introductory Lecture, brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  **Assignment-K10 : Plate dynamics and isostasy exercises** | Get to know the general formula of plate dynamics | 10% |
| 5 | [C4,P4,A4] Students are able to understand the basics of geophysical calculations from plate tectonics started from the concept of continental drift and seafloor spreading. | Introduction to geodynamics for geophysics, plate tectonic, and mathematical equation for plate dynamics  [K9] : Introduction to geodynamics for geophysics.ppt | Introductory Lecture, brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  **Assignment-K10 : Plate dynamics and isostasy exercises** | Get to know the general formula of plate dynamics | 10% |
| 6 | [C4,P4,A4] Students are able to understand the basics of geophysical calculations from plate tectonics started from the concept of continental drift and seafloor spreading. | Introduction to geodynamics for geophysics, plate tectonic, and mathematical equation for plate dynamics  [K9] : Introduction to geodynamics for geophysics.ppt | Introductory Lecture, brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  **Assignment-K10 : Plate dynamics and isostasy exercises** | Get to know the general formula of plate dynamics | 10% |
| 7 | [C4,P4,A4] Students are able to understand the basics of geophysical calculations from plate tectonics started from the concept of continental drift and seafloor spreading. | Introduction to geodynamics for geophysics, plate tectonic, and mathematical equation for plate dynamics  [K9] : Introduction to geodynamics for geophysics.ppt | Introductory Lecture, brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  **Assignment-K10 : Plate dynamics and isostasy exercises** | Get to know the general formula of plate dynamics | 10% |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | [C4,P4,A4] Students are able to understand the basics of geophysical calculations from plate tectonics started from the concept of continental drift and seafloor spreading. | Introduction to geodynamics for geophysics, plate tectonic, and mathematical equation for plate dynamics  [K9] : Introduction to geodynamics for geophysics.ppt | Introductory Lecture, brainstorming | TM: 1x(3x50”) | Discussion (plate dynamics in geophysics);  **Assignment-K10 : Plate dynamics and isostasy exercises** | Get to know the general formula of plate dynamics |  |
| 10 | [C4,P4,A4]  Students are able to understand continental dynamics and deformation between plates with geophysics (gravity and isostasy) | Introduction to deformation, the basic concept of gravity and plate isostasy  [K10] : Introduction to gravity and isostasy.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  **Assignment-K10 : Plate dynamics and isostasy practice** | the accuracy of explaining | 5% |
| 11 | [C4,P4,A4]  Students are able to analyse stress and strain | The concept and measurement of stress and strain  [K11] : deformation, stress and strain.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of explaining and comparing |  |
| 12 | [C4,P4,A4]  Students are able to understand the basic rheology | The basic concept and measurement of rheology  [K12] : Introduction to rheology.ppt | Direct Lecture, Discussion, Video; | TM: 1x(3x50”) | Discussion  **Quiz-K12 :stress and strain** | the accuracy of explaining | 5% |
| 13 | [C4,P4,A4]  Students are able to understand the concept of hotspot formation/volcanism and its relation to the plate movement, tectonic plume, fluid mechanics | The basic concept of fluid mechanics and volcanism  [K13] : Introduction to fluid mechanics and volcanism.ppt | Direct Lecture, Discussion, Video; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion  **Assignment-K13 : Practice in making a language program for flow simulation in the Earth** | the accuracy of explaining | 10% |
| 14 | [C4,P4,A4]  Students are able to understand the principle of heat transfer occurrence/ whole mantle convection | Heat transfer concept  [K14] : Introduction to heat transfer.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of explaining |  |
| 15 | [C4,P4,A4]  Students are able to understand the study case of Geodynamics through Geophysics | Study case comprehension in geodynamics through geophysics  [K15] : Journal.ppt | Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion  **Assignment-K15 :Presentation and resume study geodynamics in geophysics** | the accuracy of explaining |  |
| 16 | End Semester Evaluation | | | | | | 30% |

**REFERENCES :**

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| 1. Wilson, T. et al., “Physics and Geology”, McGraw-Hill, 1975 |
| 1. Dana’s Manual of Mineralogy, John Wiley and Sons, Inc., New York |
| 1. Turcotte, D.L. and Schubert, G., 1982, Geodynamics : Applications of Continuum physics to geological problems, John Willey & Sons. Inc |
| 1. Blatt, H., Tracy, R.J., Owens, B.R., 2006,Petrology: Igneous, Sedimentary, and Metamorphic,3 rd |
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| **Program Study** | Geophysical Engineering Department |
| **Course** | Rock Mechanics |
| **Cource Code** | RF184415 |
| **Semester** | IV (Four) |
| **Credit** | 3 (T:2,P:1) SKS |
| **Lecturer** | 1. Dr.Dwa Desa Warnana, M.Si. 2. Wien Lestari, S.T., M.T. |

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| **Study materials** | Geology, Mechanics | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.12 | understanding the concept, principle, workshop procedure, studio and laboratory activities, and Health and Safety Environment (HSE) in general; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| **LO – Course** | [C4,P4,A4] Students can explain the concept and solve the basic problems of rock mechanics systems in an integrated and comprehensive for engineering applications. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4] Students are able to understand the basics of rock and rock mechanics. | Rock and rock mechanics, scope and problems | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion; | Accuracy of explanation | 5% |
| 2 | [C4,P4,A4] Students are able to understand stress and strain analysis. | Introduction to stress and strain analysis | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  **: Exercises** | Accuracy of explanation | 10% |
| 3 | [C4,P4,A4] Students are able to understand the stress analysis in fields, Mohr circle | Strain analysis | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion **Task-K10 : Exercises** | Accuracy of explanation | 10% |
| 4 | [C4,P4,A4] Students are able to understand strain analysis. | Introduction to strain analysis | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion **Task-K10 : Exercises** | Accuracy of explanation | 10% |
| 5 | [C4,P4,A4] Students are able to understand the physical and mechanical properties of rocks in the laboratory. | Physical and mechanical properties of rocks | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion **Task-K10 : Exercises** | Accuracy of explanation | 10% |
| 6 | [C4,P4,A4] Students are able to understand the determination of mechanical properties in situ. Rock Behavior; Elastic, elastoplastic, rock creep, rock relaxation, stress and strain relations for linear and isotropic elastic behavior. | Determination of mechanical properties in situ. Rock Behavior; Elastic, elastoplastic, rock creep, rock relaxation, stress and strain relations for linear and isotropic elastic behavior. | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion **Task-K10 : Exercises** | Accuracy of explanation | 10% |
| 7 | [C4,P4,A4] Students are able to understand the basics of rock "Failure" Criteria; Mohr Theory, Mohr-Coulomb Criteria, Criteria for maximum tensile stress. | "Failure" criteria for rocks; Mohr Theory, Mohr-Coulomb Criteria, Criteria for maximum tensile stress. | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion **Task-K10 : Exercises** | Accuracy of explanation | 10% |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | [C4,P4,A4] Students are able to understand the maximum shear stress criteria. | Maximum shear stress criteria. | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion (plate dynamics in geophysics); | Get to know the general formula of plate dynamics |  |
| 10 | [C4,P4,A4] Students are able to understand in situ stress measurements in rock masses; | Measurement of in situ stresses in rock mass; | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics); **Task-K10 : Exercises about plate dynamics and isostation** | Accuracy of explanation | 5% |
| 11 | [C4,P4,A4] Students are able to analyze the Rosette deformation Method, | Concept and measurement of Rosette deformation method, [K11]: deformation, stress and strain.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | The accuracy of comparing and explaining |  |
| 12 | [C4,P4,A4] Students are able to understand the Flat Jack method, the over coring method, | Basic concepts and rheological calculations  [K12]: Introduction to rheology.ppt | Direct Lecture, Discussion, Video; | TM: 1x(3x50”) | Discussion **Quiz-K12 :stress and strain** | Accuracy of explanation | 5% |
| 13 | [C4,P4,A4] Students are able to understand Hydraulic fracturing. | Basic concepts of fluid mechanics and volcanism  [K13]: Introduction to fluid mechanics and volcanism. ppt | Direct Lecture, Discussion, Video | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion **Task-K13 : Exercises making the script of flow simulation in the earth** | Accuracy of explanation | 10% |
| 14 | [C4,P4,A4] Students are able to understand the technical classification of rock masses; | Technical classification of rock masses; | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | Accuracy of explanation |  |
| 15 | [C4,P4,A4] Students are able to understand the important factors in rock classification, rock mass properties, rock mass classification. | Understanding important factors in rock classification, rock mass properties, rock mass classification | Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion **Task-K15 :** **Presentation and resume of geodynamic studies in geophysics** | Accuracy of explanation |  |
| 16 | End Semester Evaluation | | | | | | 30% |

**REFERENCES :**

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| 1.Telford, W., Geldart, L.P., and Sheriff, R. E. (1976). Applied Geophysics.Cambridge Univ Press, Cambridge.  2. Goodman, R. E. (1980). Introduction to Rock Mechanics. J. Wiley and Sons, New York  3. Wiley, D. C. and Mah, C. W. (1980). Rock Slope Engineering  4. Derski, W., Izbicki, R., Kisiel, I., and Mroz, Z. (1989). Rock and Soil Mechanics. Elsevier  5. Jurnal Geofisika, Sedimentary, and Metamorphic,3 rd |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Geoelectrical Exploration |
| **Cource Code** | RF184516 |
| **Semester** | V (Five) |
| **Credit** | 4 (T:2,P:2) SKS |
| **Lecturer** | 1. Dr.Dwa Desa Warnana, S.Si., M.Si. 2. Wien Lestari, S.T.,M.T. |

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| **Study materials** | Electricity, Physics | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysical engineering in depth; |
| 3.6 | understanding the complete operational knowledge related to the field of geophysical engineering technology; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.12 | understanding the concept, principle, workshop procedure, studio and laboratory activities, and Health and Safety Environment (HSE) in general; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| 4.12 | mampu mengkritisi prosedur operasional lengkap dalam penyelesaian masalah teknologi rekayasa geofisika yang telah dan/atau sedang diterapkan, dan dituangkan dalam bentuk kertas kerja ilmiah. |
| **LO – Course** | [C4,P3,A3] Students are able to apply geophysical exploration methods, combine geophysical and geological data to produce accurate interpretations alaso have skills in geological and geophysical field surveys. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4] [Conceptual knowledge, Analyze] Students are able to understand the geoelectric method and its development | Introduction to the geoelectric method, the development of geoelectric methods and general applications  [K1]: Introduction to the Geoelectric Method.ppt | Introductory Lecture, contract and  brainstorming; | TM: 1x(4x50”) | Discussion **Task-K1 :** **Resume of the development of the Geoelectric method** | Get to know geoelectrical applications in general; | 5% |
| 2 | [C4,P4,A4][Conceptual knowledge, Analyze]: Able to explain the theoretical concepts of geoelectric methods and  relation to the equation  electric waves that spread in the earth, the nature of electricity  material and rock | Basic concepts and principles of the Geoelectric Method | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion | Accuracy of explanation |  |
| 3 | [C4,P4,A4][Conceptual knowledge, Analyze]: able to understand the concepts and principles of electrode configuration and the process of acquisition (data collection) in the Geoelectric Method | Electrode configuration and application | Direct Lecture, Discussion; | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Discussion | The accuracy of comparing and explaining |  |
| 4 | [C4,P4,A4][Conceptual knowledge, Analyze]: able to understand the concepts, modeling principles to solve geophysical engineering problems;  1D and 2D modeling | Concepts, 1D and 2D modeling principles | Direct Lecture, Discussion; | [TM: 1x(4x50”)] | Quiz-K4:  Basic geoelectric concepts, data processing stages and general modeling | Accuracy of explanation | 5% |
| 5 | [C4,P4,A4][Conceptual knowledge, Analyze]: Able to explain the theoretical concepts of resistivity methods, mastering data collection techniques (acquisition) | Concepts, principles and acquisition of resistivity methods | Direct Lecture, Discussion; audio video, *case study* | [TM: 1x(4x50”)] | Discussion | Understand the principle of resistivity data acquisition |  |
| 6 | [C4,P4,A4][Procedural knowledge, Analyze]:  Able to choose resources and utilize data design and analysis resistivity method based on information and computational technology appropriate in resistivity method data processing activities; | 1D and 2D resistivity data acquisition | Direct Lecture, Team discussion, Practicum | [TM: 1x(4x50”)] | Direct Lecture, Team discussion, Field Practicum | Understand how resistivity tools work |  |
| 7 | [C4,P4,A4][Procedural knowledge, Analyze]:  Able to improve the quality of resistivity data through analysis, interpretation of data following the procedures and standards of geophysical exploration activities by taking into the geological rules and exploration objectives; recognize differences in the characteristics of terrestrial and marine exploration fields that can affect the quality of measurement data; | 1D and 2D resistivity data processing | Direct Lecture, Team discussion, Practicum | [TM: 1x(4x50”)]  [BT+BM:2x(4x60”)] | Discussion **Task-K7:**  **1. Understand resistivity data processing software**  **2. Processing 1D and 2D resistivity data** | Able to apply software in 1D and 2D resistivity data and analyze the results of data processing. | 10% |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | [C4,P4,A4][Procedural knowledge, Analyze]: mastering the concepts, principles and techniques of 1D and 2D modeling in the resistivity method | The concept of 1D and 2D resistivity data modeling principles | Direct Lecture, Class discussion, Practicum | [TM: 1x(4x50”)]  [BT+BM:2x(4x60”)] | Discussion and Practicum **Task K-9;**  **1D and 2D modeling and interpretation** | Able to apply modeling data in resistivity | 20% |
| 10 | [C4,P4,A4][Conceptual knowledge, Analyze]: Able to explain the theoretical concepts of the Self Potential method, mastering data collection techniques (acquisition) | The concept of the principle of self potential method | Direct Lecture, Class discussion, | [TM: 1x(4x50”)] | Discussion | Accuracy of explanation |  |
| 11 | [C4,P4,A4][Procedural knowledge, Analyze]:  Able to choose resources and make use of the data potential design and analysis tools based on information technology and computation that are appropriate in the Self Potential method of data processing activities; | Acquisition data of self-potential methods, introduction of tools and software | Direct Lecture, Team discussion, Practicum | [TM: 1x(4x50”)] | Team discussion and Practicum | Able to understand the function of tools and software used in processing Self-Potential data |  |
| 12 | [C4,P4,A4][Procedural knowledge, Analyze]:  Able to improve the quality of Self Potential data through analysis, interpretation of data following the procedures and standards of geophysical exploration activities by taking into the geological rules and exploration objectives; recognize differences in the characteristics of terrestrial and marine exploration fields that can affect the quality of measurement data; | Processing and modeling of Self Potential data | Direct Lecture, Team discussion, Practicum | [TM: 1x(4x50”)]  [BT+BM:2x(4x60”)] | Team discussion and Practicum: **Self Potential data processing** | Understand how to process data and improve the quality of Self Potential data |  |
| 13 | [C4,P4,A4][Procedural knowledge, Analyze]:  Able to choose resources and utilize data design and analysis tools based on information and computational technology based on the Induced Polarization method; | Acquisition data of Induced Polarization method, introduction of tools and software | Direct Lecture, Team discussion, Practicum | [TM: 1x(4x50”)]  [BT+BM:2x(4x60”)] | Team discussion and Practicum | Able to understand the function of tools and software used in data processing Induced Polarization |  |
| 14 | [C4,P4,A4][Procedural knowledge, Analyze]:  Able to improve the quality of Induced Polarization data through analysis, interpretation of data following the procedures and standards of geophysical exploration activities by taking into the principles of geology and exploration objectives; | Induced Polarization data processing and modeling | Direct Lecture, Team discussion, Practicum | [TM: 1x(4x50”)]  [BT+BM:2x(4x60”)] | Team discussion and Practicum: **Induced Polarization data processing** | Understand how to process data and improve the quality of Induced Polarization data |  |
| 15 | [C4,P4,A4][Procedural knowledge, Analyze]: mastering the concepts, principles and modeling techniques of Self Potential and Induced Polarization methods | The conceptual principles of Self Potential and Induced Polarization data modeling | Direct Lecture, Team discussion, Practicum | [TM: 1x(4x50”)]  [BT+BM:2x(4x60”)] | Discussion and Practicum **Task K-15;**  **1D and 2D modeling and interpretation** | Modeling data in Self Potential and Induced Polarization |  |
| 16 | End Semester Evaluation | | | | | | 30% |

**REFERENCES :**

1. Telford, WM; Geldart, L.P; Sheriff, RE, 1998, Applied Geophysics, Cambridge Univ Press, Cambridge.
2. Zhdanov, M. S., Keller, G. V., The Geoelectrical Methods in Geophysical Exploration, Elsevier, 1994
3. Jurnal Geofisika

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Seismic Exploration |
| **Cource Code** | RF184517 |
| **Semester** | V (Five) |
| **Credit** | 4 (T:3, P:1) SKS |
| **Lecturer** | Firman Syaifuddin, S.Si., M.T. |

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| **Study materials** | Wave, Geology | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.2 | understanding geological knowledge that required to understand the geological process of a natural phenomenon by its characteristics; |
| 3.3 | understanding the theoretical concept of statistics to define the process complexity of a natural phenomenon; |
| 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysics engineering in deep; |
| 3.6 | understanding the complete operational knowledge related to the field of geophysical engineering technology; |
| 3.8 | understanding the principle and methods of mapping application that required in general geophysical engineering work; |
| 3.9 | mastering the principles of quality assurance in general in geophysics engineering work; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.11 | mastering factual knowledge of current principles and issues in economic, socio-cultural and ecological issues in general that have an influence on the field of geophysics engineering; |
| 3.14 | mastering general concepts, principles, and techniques of effective communication orally and in writing for specific purposes in general; and |
| 3.15 | mastering factual knowledge about the development of cutting-edge technology and advanced materials in the field of geophysical engineering in deep |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.3 | being able to conduct research that includes identification, formulation, and analysis of geophysical engineering problems; |
| 4.4 | being able to formulate alternative solutions to solve complex geophysical engineering problems by considering economic, health, public safety, cultural, social and environmental factors; |
| 4.5 | being able to design systems, processes, and components with an analytical approach and consider technical standards, aspects of performance, reliability, ease of application, sustainability and pay attention to economic, health and public safety, cultural, social and environmental factors; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| **LO – Course** | [C3,P3,A3] Students can understand the basic concepts of physics related to seismic wave propagation, Students must have knowledge of "seismic exploration", history, development and technology and terminology, students can understand the seismic refraction and reflection methods, students have an understanding of data processing techniques 2D seismic refraction and reflection. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4, P3,A3] [Conceptual  knowledge, Analyze]:  Able to understand the history of technological development of seismic methods in exploration activities, | "1. Introduction to Lecture:    • Semester Learning Plans    • College Contracts    • Scoring system  Introduction to Lecture  The history of seismic exploration  "Main literature - chapter 1 | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion;  Make a summary | * Understanding what will be learned in this course * Understanding the history of technological development of seismic methods in exploration activities | "5%  Task" |
| 2 | [C3, P3,A3]    Knowing the basic concepts of seismic wave mechanism and seismic wave propagation. Able to explain the wave equation. | "a) Stress and strain  b) The seismic wave equation  c) Basic wave propagation"    Supporting literature 1 - chapters 2 & 3  Supporting literature 2 - chapter 2  Practicum Module-01 " | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | * Knowing the basic concepts of seismic wave mechanism * Knowing the basic concepts of seismic wave propagation, * Able to explain the wave equation. | "5%  Task" |
| 3 | [C4, P3,A3]    Understanding the concept of ray theory, Understanding the concept of time of wave propagation, Able to reduce Snell's law equation in the boundary line, | "a) Ray theory & Travel times  b) Snell’s law & Asymptotic ray theory  c) Rays at an interface & Boundary conditions  d) Continuity of the ray equations    "Supporting literature 1 - chapter 4  Supporting literature 2 - chapters 5 & 6  Practicum Module-02 " | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | * Understanding the concept of ray theory, * Understanding the concept of the time of wave propagation, * Being able to reduce Snell's law equation in the boundary line and know the concepts of reflection and transmission of seismic waves, | "5%  Task" |
| 4 | [C3, P3,A3]  Knowing the concept of reflection and seismic wave transmission, Knowing the concept of acoustic wave propagation in Isotropic and Anisotropic media | e)Reflection/transmission coefficients & Free surface reflection coefficients  f) Fluid–solid reflection/transmission coefficients  g) Interface polarization conversions  h) Linearized coefficients & Geometrical Green dyadic with interfaces  "  "Supporting literature 1 - chapter 4  Supporting literature 2 - chapters 5 & 6  Practicum Module-02 " | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  **Quiz-01** | Knowing the concept of acoustic wave propagation in Isotropic and Anisotropic media | "5%  Task"  15%  Quiz |
| 5 | [C4, P3,A3]    Understanding the concept of seismic wave geometry both reflection and refraction, Understanding the vertical velocity gradient phenomenon. | "Seismic wave geometry   * Reflection path * Refraction path * Vertical velocity gradient   "Main literature - chapters 4, 5 & 6  Practicum Module-03” | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Understanding the concept of seismic wave geometry both reflection and refraction,  Understanding the vertical velocity gradient phenomenon. | "5%  Task" |
| 6 | [C4, P3,A3]    Understanding the concept of seismic wave velocity theoretically and be able to experiment with seismic wave velocity data, able to distinguish the types of seismic events and their characteristics. | Seismic wave velocity   * Seismic sedimentary rock models * Speed data experimentation * Application of the concept of speed * Speed measurement   Characteristics of seismic events   * Reflection * Events other than reflection * Resolution * Attenuation   "Main literature - chapters 4, 5 & 6  Practicum Module-03 " | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Understanding the concept of seismic wave velocity theoretically and be able to experiment with seismic wave velocity data  Being able to distinguish the types of seismic events and their characteristics. | "5%  Task" |
| 7 | [C3, P3,A3]    Understanding the basic concepts of the seismic refraction method. Able to make refraction seismic survey design, Able to do refraction seismic data processing, able to interpret refraction seismic data and make subsurface modeling based on refraction seismic data. | * The basic concept of the seismic refraction method * Survey design and measurement of seismic refraction methods * Refraction seismic data processing * Interpretation and modeling of seismic refraction * Geological interpretation of refraction seismic data   "Main literature - chapter 11  Practicum Module-04 " | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Understanding the basic concepts of the seismic refraction method.  Able to make a refractive seismic survey design, Able to do refraction seismic data processing  Able to interpret refraction seismic data and make subsurface modeling based on refraction seismic data | "5%  Task" |
| 8 | Mid Semester Evaluation | | | | | | 40% |
| 9 | **[C3, P3,A3]**    Understanding the basic concepts of the seismic reflection method. Being able to make a reflection seismic survey design, | " The basic concept of the seismic method of reflection;  Survey design and measurement of seismic reflection methods;  "Main literature - chapters 8 & 9  Supporting literature 1 - chapter 7  Practicum Module-05 " | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Understanding the basic concepts of the seismic reflection method. | "5%  Task" |
| 10 | **[C3, P3,A3]**    Being able to reflection seismic data processing. | Processing reflection seismic data;  Interpretation and modeling of seismic reflection  "Main literature - chapters 8 & 9  Supporting literature 1 - chapter 7  Practicum Module-05 " | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to make reflection seismic survey design, Able to do reflection seismic data processing | "5%  Task" |
| 11 | [C3, P3,A3]    Being able to interpret seismic reflection data | "Geological interpretation of reflection seismic data;  Basic geological concepts;  Interpretation Procedure  Geological features of seismic data  "Main literature - chapter 10  Practicum Module-06 " | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to interpret reflection seismic data and make subsurface modeling based on reflection seismic data | "5%  Task" |
| 12 | [C3, P3,A3]    Being able to make subsurface modeling based on seismic reflection data. | Subsurface modeling based on seismic reflection data  "Main literature - chapter 10  Practicum Module-06 " | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  **Quiz-02** | Being able to make subsurface modeling based on seismic reflection data | "5%  Task" |
| 13 | [C3, P3,A3]    Knowing the latest developments in seismic exploration methods | "3D seismik refleksi  Main literature - chapters 12, 13, 14 | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Knowing the development of the latest exploration seismic methods with special techniques | "5%  Task" |
| 14 | [C3, P3,A3]    Knowing the special techniques used in exploration activities using seismic methods | VSP survey  Borehole seismik survey"  Main literature - chapters 12, 13, 14 | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Knowing the development of the latest exploration seismic methods with special techniques | "5%  Task" |
| 15 | [C3, P3,A3]    Students are able understand and able to explain the basic concepts of the seismic exploration method and explain how to use the seismic method, both the refraction method and the reflection method in geophysical exploration activities | Case study  "Utilization  Seismic exploration methods "  Study of literature from various sources | Group paper presentations, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Being able to make a brief paper about the use of seismic methods  Being able to present papers on the results of literature studies made  Able to conduct scientific discussions with a question and answer mechanism | "5%  Task" |
| 16 | End Semester Evaluation | | | | | | 40% |

**REFERENCES :**

1. Shearer, P. M., 2009, Introduction to Seismology, Cambridge University Press, Cambridge, UK.
2. Zobin, V. M., 2012, Introduction to Volcanic Seismology, Elsevier, London, UK.
3. Jens Havskov, Gerardo Alguacil (auth.)-Instrumentation in Earthquake Seismology-Springer International Publishing (2016)
4. Barbara Romanowicz, Adam Dziewonski-Seismology and Structure of the Earth\_ Treatise on Geophysics-Elsevier (2009)
5. Agustin Udías-Principles of Seismology-Cambridge University Press (2000).
6. Thorne Lay, Terry C. Wallace-Modern Global Seismology, Vol. 58-Academic Press (1995
7. V. I. Keilis-Borok (auth.), V. I. Keilis-Borok, Edward A. Flinn (eds.)-Computational Seismology-Springer US (1995)

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Inversion Method |
| **Course Code** | RF184518 |
| **Semester** | V (Five) |
| **Credit** | 3 (Three) SKS |
| **Lecturer** | Juan Pandu Gya Nur Rochman, S.Si., M.T. |

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| **Study materials** | Mathematics, Programming | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysics engineering in deep; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented and poured in the form of scientific papers. |
| **LO - Course** | [C3,P3,A3] Students can apply the basic concept of inversion (inverse theorem) and inversion parameters of measured data to solve inversion problems in geophysics both linear and non-linear. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4, P3,A3] [Conceptual , knowledge, analyze]: Students can understand the basic concepts of inversion, data, error, probability and distribution methods | Introduction,  Data, errors, probability and distribution concepts | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Make a summary | Able to analyze data quality and error also distribution of data. Understand the concept of inversion method | 5%  Task |
| 2 | [C4, P3,A3] [Conceptual , knowledge, Analyze]:  Students can understand the basic concepts of linear systems in inversion methods | Linear systems | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Make a summary | Able to understand the basic concepts of Linear Systems | 5%  Task |
| 3 | [C4, P3,A3] [Conceptual , knowledge, Analyze]:  Mahasiswa memahami konsep dasar Vector norms dan mampu menyelesaikan kasus overdetermined problem | Vector norms, overdetermined problem | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Make a summary | Able to understand the basic concepts of Vector norms and be able to solve cases of overdetermined problems | 5%  Task |
| 4 | [C4, P3,A3] [Conceptual , knowledge, Analyze]:  Students can understand the basic concepts of Simple Least Square and are able to solve Simple Least Square cases | Simple least squares solution | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Make a summary  Quiz-01 | Able to understand the basic concepts of Simple Least Square and be able to solve Simple Least Square cases | 5%  Task  20%  Quiz |
| 5 | [C4, P3,A3] [Conceptual , knowledge, Analyze]:  Students understand the basic concepts of Mixed problems, damped least squares and are able to solve cases of underdetermined problems | Mixed problems, damped least squares dan underdetermined problems | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Make a summary | Able to understand the basic concepts of Mixed problems, damped least squares and able to solve cases of underdetermined problems | 5%  Task |
| 6 | [C4, P3,A3] [Conceptual , knowledge, Analyze]:  Students can understand the basic concepts of the Weighted least square method | Weighted least squares | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Make a summary | Able to understand the basic concepts of Weighted least squares | 5%  Task |
| 7 | [C4, P3,A3] [Conceptual , knowledge, Analyze]:  Students can understand the basic concepts of Resolution | Resolution: data and model | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Make a summary | Able to understand the basic concepts of Resolution | 5%  Task |
| 8 | Mid Semester Evaluation | | | | | | 40% |
| 9 | [C4, P3,A3] [Conceptual , knowledge, Analyze]:  Students can understand the basic concepts of covariance | Covariance: data and model | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Make a summary | Able to understand the basic concepts of covariance | 5%  Task |
| 10 | [C4, P3,A3] [Conceptual , knowledge, Analyze]:  Students can understand the basic concepts of non-linear inversion methods using Newton's approach and Gradient methods | Nonlinear problems: Newton and Gradient methods | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Make a summary | Able to solve non-linear problem using Newton and Gradient methods | 5%  Task |
| 11 | [C4, P3,A3] [Conceptual , knowledge, Analyze]:  Students can understand the basic concept of non-linear inversion method using Grid and Monte Carlo searches approach | Nonlinear problems: Grid and Monte Carlo searches | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Make a summary | Able to solve non-linear problems using Grid and Monte Carlo searches | 5%  Task |
| 12 | [C4, P3,A3] [Conceptual , knowledge, Analyze]:  Students can understand the basic concepts of non-linear inversion method using simulated anealing approach | Nonlinear problems: Simulated Annealing | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Make a summary  Quiz-02 | Able to solve non-linear problem using Simulated annealing method | 5%  Task  20%  Quiz-02 |
| 13 | [C4, P3,A3] [Conceptual , knowledge, Analyze]:  Students can understand the basic concepts of model based seismic data inversion methods | Seismic inversions: Recursive (Bandlimited) and Model Based (Blocky) | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Make a summary | Able to seismic data inversion using model based methods | 5%  Task |
| 14 | [C4, P3,A3] [Conceptual , knowledge, Analyze]:  Students can understand the basic concept of the Sparse Spike seismic data inversion method | Seismic inversion: Sparse Spike | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Make a summary | Able to seismic data inversion using the Sparse Spike method | 5%  Task |
| 15 | [C4, P3,A3] [Conceptual , knowledge, Analyze]:  Students can analyze the application of inversion methods in geophysics. | Case Study Reference Paper | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation & Review Paper | Able to review paper | 5%  Task |
| 16 | End Semester Evaluation | | | | | |  |

**REFERENCES :**

1. Menke, W., Geophysical Data Analysis: Discrete Inverse Theory, Academic Press, 1989.
2. Tarantola, A., Inverse Problem Theory: Methods for Data Fitting and Model Parameter Estimation, Elsevier, 1987.
3. Sen, M.K., Stoffa, P.L., Global Optimization Methods in Geophysical Inversion, Elsevier, 1995
4. Grandis, H., Pengantar Inversi Geofisika, HAGI, 2009.

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Geological Disaster Mitigation |
| **Course Code** | RF184519 |
| **Semester** | V (Five) |
| **Credit** | 3 (Three) SKS |
| **Lecturer** | Dr. Ir. Amien Widodo, M.S. |

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| **Study Materials** | Geology, natural disaster | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.8 | understanding the principle and methods of mapping application that required in general geophysical engineering work; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| **Specific Skills** | 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented and poured in the form of scientific papers. |
| **LO - Course** | [C4,P3,A3] Students are able to apply geophysics exploration methods, combine geophysical and geological data to produce accurate interpretations, also competent in geological and geophysical field survey. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | Students are able to understand the purpose of the course, lecture rules, teaching scope, definition of vulnerability, hazard and risk | Course purpose, class rules, teaching scope, definition of vulnerability, hazard and risk | Brainstorming (20 minutes), Introductory lecture (100 minutes), Discussion (30 minutes) | Brainstorming (20 minutes), Introductory lecture (100 minutes), Discussion (30 minutes) | Discussion | Learning process agreement, Definition of vulnerability, hazard and risk |  |
| 2 | Students are able to understand the purpose of the course, lecture rules, teaching scope, definition of vulnerability, hazard and risk | Course purpose, class rules, teaching scope, definition of vulnerability, hazard and risk | Brainstorming (20 minutes), Introductory lecture (100 minutes), Discussion (30 minutes) | **.** Brainstorming (20 minutes), Introductory lecture (100 minutes), Discussion (30 minutes) | Discussion | Learning process agreement, Definition of vulnerability, hazard and risk |  |
| 3 | Students are able to understand the meaning of landslide disaster, landslide occurrence controller factors, landslide occurrence trigger factors, landslide mechanism, landslide management methods, study case of landslide in Indonesia. | the meaning of landslide disaster, landslide occurrence controller factors, landslide occurrence trigger factors, landslide mechanism.  Lee,E.M and Jones, D. K. C,2004, landslide risk assessment, Thomas Telford | self-learning and simple paper making and group presentation about land movement disaster. | Direct Lecture(30 minutes), group presentation(40 minutes) Group discussion(30 minutes), (Assignment-2: Problem & Solving), | Discussion | The accuracy of understanding the meaning of landslide disaster, landslide occurrence controller factors, landslide occurrence trigger factors, landslide mechanism, landslide management methods |  |
| 4 | Students are able to understand the meaning of landslide disaster, landslide occurrence controller factors, landslide occurrence trigger factors, landslide mechanism, landslide management methods, study case of landslide in Indonesia. | Landslide management meethods.  Lee,E.M and Jones, D. K. C,2004, landslide risk assessment, Thomas Telford | self-learning and simple paper making and group presentation about land movement disaster. | Direct Lecture(30 minutes), group presentation(40 minutes) Group discussion(30 minutes), (Assignment-2: Problem & Solving), | Presentation | The accuracy of understanding the meaning of landslide disaster, landslide occurrence controller factors, landslide occurrence trigger factors, landslide mechanism, landslide management methods | 10% |
| 5 | Students are able to understand the meaning of earthquake, types of earthquake wave, earthquake occurrence mechanism, earthquake management methods, study case of earthquake in Indonesia. | the meaning of earthquake, types of earthquake wave, earthquake occurrence mechanism, David, D.,2003,Earth quake risk reduction, John Wiley and Son | self-learning and simple paper making and group presentation about land movement disaster. | Direct lecutre (60 minutes), rock observation in megascopic(30 minutes), group discussion(50 minutes), quiz(10 minutes) | Discussion | the accuracy of understanding the meaning of earthquake, types of earthquake wave, earthquake occurrence mechanism, earthquake management methods, study case of earthquake in Indonesia. |  |
| 6 | Students are able to understand the meaning of earthquake, types of earthquake wave, earthquake occurrence mechanism, earthquake management methods, study case of earthquake in Indonesia. | earthquake management methods, study case of earthquake in Indonesia. David, D.,2003,Earth quake risk reduction, John Wiley and Son | self-learning and simple paper making and group presentation about land movement disaster. | Direct lecutre (60 minutes), rock observation in megascopic(30 minutes), group discussion(50 minutes), quiz(10 minutes) | Presentation | the accuracy of understanding the meaning of earthquake, types of earthquake wave, earthquake occurrence mechanism, earthquake management methods, study case of earthquake in Indonesia. | 10% |
| 7 | Students are able to understand the meaning of flood, flood occurrence mechanism, flood management methods, study case of flood in Indonesia. | the meaning of flood, flood occurrence mechanism | self-learning and simple paper making and group presentation about flood disaster. | Direct lecutre (60 minutes), rock observation in megascopic(30 minutes), group discussion(50 minutes), quiz(10 minutes) | Presentation | the accuracy of understanding the meaning of flood, flood occurrence mechanism, flood management methods, study case of flood in Indonesia. |  |
| 8 | Mid Semester Evalution | | | | | | 20% |
| 9 | Students are able to understand the meaning of flood, flood occurrence mechanism, flood management methods, study case of flood in Indonesia. | flood management methods, study case of flood in Indonesia. | self-learning and simple paper making and group presentation about flood disaster. | Direct lecutre (60 minutes), rock observation in megascopic(30 minutes), group discussion(50 minutes), quiz(10 minutes) | Presentation | the accuracy of understanding the meaning of flood, flood occurrence mechanism, flood management methods, study case of flood in Indonesia. | 10% |
| 10 | Students are able to understand the meaning of tsunami disaster. | the meaning of tsunami disaster, types of earthquake wave, earthquake occurrence mechanism, | self-learning and simple paper making and group presentation about tsunami disaster. | Direct lecutre (60 minutes), rock observation in megascopic(30 minutes), group discussion(50 minutes), quiz(10 minutes) | Presentation | the meaning of tsunami disaster |  |
| 11 | Students are able to understand the meaning of tsunami disaster. | tsunami management methods, study case of tsunami in Indonesia. | self-learning and simple paper making and group presentation about tsunami disaster. | Direct lecutre (60 minutes), rock observation in megascopic(30 minutes), group discussion(50 minutes), quiz(10 minutes) | Presentation | tsunami management methods | 10% |
| 12 | Students are able to understand the meaning of volcanic eruption disaster. | the meaning of volcanic eruption disaster. | self-learning and simple paper making and group presentation about volcanic eruption disaster. | Direct lecutre (60 minutes), rock observation in megascopic(30 minutes), group discussion(50 minutes), quiz(10 minutes) | Discussion | the meaning of volcanic eruption disaster |  |
| 13 | Students are able to understand the meaning of volcanic eruption disaster. | volcanic eruption management methods, study case of volcanic eruption in Indonesia. | self-learning and simple paper making and group presentation about volcanic eruption disaster. | Direct lecutre (60 minutes), rock observation in megascopic(30 minutes), group discussion(50 minutes), quiz(10 minutes) | Presentation | the meaning of volcanic eruption disaster | 10% |
| 14 | Government Policies | Policies on Disaster mitigation unit, Government policies on disaster mitigation and anticipation. | Self-learning | Direct Lecture (60 minutes)  Discussion (60 minutes) | Discussion | understand the government policies on disaster mitigation |  |
| 15 | Hazard estimation level using geographic information system | hazard mapping on study case disaster in Indonesia | Self-learning | Direct Lecture (60 minutes)  Discussion (60 minutes) | Presentation and discussion | understand the disaster hazard mapping | 10% |
| 16 | End Semester Evaluation | | | | | | 20% |

**REFERENCES :**

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| * + - 1. Hamblin, W.K., 1982; The Earth’s Dynamic Systems; 3rd Edition. Minesotta.       2. http://www.tulane.edu/~sanelson/Natural\_Disasters/oinformatic for Disasters ://nidm.gov.in/PDF/modules/geo.pdf       3. <ftp://ftp.itc.nl/pub/westen/Multi_hazard_risk_course/Powerpoints/Background%20paper%20Spatial%20data%20for%20hazard%20and%20risk%20assessment.pdf>       4. <https://www.bnpb.go.id/home/get_publikasi/12/buku>       5. <https://www.bnpb.go.id/home/get_publikasi/13/jurnal>       6. <https://www.marshall.edu/cegas/geohazards/2015pdf/Session1/03_GeobruggCanopyPP.pdf>       7. https://www.bnpb.go.id/home/aplikasi |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Thermodynamics |
| **Course Code** | RF184520 |
| **Semester** | V (Five) |
| **Credit** | 3 (Three) SKS |
| **Lecturer** | Juan Pandu Gya Nur Rochman, S.Si., M.T. |

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| **Study Materials** | Temperature, Dynamics | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| **Specific Skills** | 4.12 | being able to criticise the complete operational procedure in solving geophysical engineering technology problems which has been and / or is being implemented, and set forth in the form of scientific work papers. |
| **LO - Course** | [C4,P3,A3] Students are able to analyse thermodynamics system, thermodynamics law, empirical relation of thermodynamic variables, imaging technique of thermodynamics variable components, and geoscience interpretation, also the application of thermodynamics in geoscience. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Assessment** | | |
| **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| KONSEP TERMODINAMIKA, SISTEM,SUHU,PANAS,ENERGI, DAN KERJA, HK 1&2 TERMODINAMIK | | | | | | | |
| (1,2) | [C3,P3,A2][Conceptual knowledge, Application] : Students are able to explain the basic concept of Thermodynamics | The concept of Thermodynamics  [1]:K1\_Introduction  K2\_Study Case/Application | Introductory Lecture, lecture contract and brainstorming  (Assignment-1: Review on Thermodynamics and its applications 4x50”) | [TM: 2x(4x50”)] | Oral Quiz | The accuracy of explaining the basic concept of thermodynamics, and its scope | 10% |
| 3 | [C3,P3,A2][Conceptual knowledge, Application] : Students are able to explain the thermodynamics system, temperature, and energy | Thermodynamics system  Temperature, Energy, and Works | Direct Lecture, Group Discussion;  (Assignment-2: Problem & Solving) [BT+BM:2x(4x50”)] | [TM: 1x(4x50”)] | Oral Quiz | The accuracy of explaining thermodynamics system  The accuracy of explaining temperature, energy, and works | 10% |
| (4,5) | [C3,P3,A2][Conceptual knowledge, Application] : Students are able to explain first thermodynamics law and its application, heat, and enthalpy | First thermodynamics law | Direct Lecture, Group Discussion; | [TM: 1x(4x50”)] | Written Quiz-1 | The accuracy of explaining First thermodynamics law | 10% |
| Heat and Enthalpy | (Assignment-3: First thermodynamics law exercises [BT+BM:2x(4x60”)] | The accuracy of applying First thermodynamics law |
| Solving Thermodynamics Law 1 Problems |
| 6 | [C3,P3,A2][Conceptual knowledge, Application] :  Students are able to explain second thermodynamics law and its application | Second thermodynamics law | Direct Lecture, Group Discussion; | [TM: 2x(4x50”)] | Written Quiz-1 | The accuracy of explaining First thermodynamics law | 10% |
| The concept of Entropy | Group Presentation | The accuracy of solving problems |
| Reversible - Irreversible | (Assignment -4: Exercises (BT+BM:2x(4x60”)] | The accuracy of explaining the concept of reversible and irreversible |
| 7 | [C3,P3,A2][Conceptual knowledge, Application] :  Students are able to explain and solve the Gibbs-Helmholtz equation and Maxwell equation in thermodynamics | Gibbs-Helmholtz equation | Direct Lecture, Group Discussion; | [TM: 2x(4x50”)] | Written Quiz-1 | The accuracy of explaining and solving Gibbs-Helmholtz equation | 10% |
| Maxwell equation | Assignment: Exercises | The accuracy of explaining and solving Maxwell equation |
| 8 | Mid Test Evaluation | | | | | |  |
| PHASE DIAGRAM, THERMODYNAMICS APPLICATION ON GEOLOGY< GEOTHERMAL, FLUID FLOW | | | | | | | |
| (9, 10) | [C3,P3,A2][Conceptual knowledge, Application] :  Students are able to explain clapericon and phase diagram | Phase Diagram | Direct Lecture, Group Discussion; | [TM: 2x(4x50”)] | Written Quiz-1 | The accuracy of explaining phase diagram, and solving problems | 10% |
| Clapericon relations | The accuracy of explaining Clapericon relations and solving problems |
| (11, 12) | [C3,P3,A2][Conceptual knowledge, Application] :  Students are able to explain the application of thermodynamics in geology and geothermal | Thermodynamics on minerals | Group Discussion; | [TM: 2x(4x50”)] | Group Assignment: Study Case | The accuracy of explaining the application of thermodynamics in Geology | 10% |
| Thermodynamics on Geothermals  [2] : 145-197 | Assignment: Review on Application in Geothermal and Geology | The accuracy of explaining the application of thermodynamics in Geothermals |
| (13, 14) | [C3,P3,A2][Conceptual knowledge, Application] :  Students are able to explain fluids and fluid dynamics | Fluids | Direct Lecture and brainstorming, Group Discussion; | [TM: 2x(4x50”)] | Group Assignment: Study Case | The accuracy of explaining fluids and solving problems | 15% |
| Fluid dynamics: Newtonian, non-newtonian, Bernoulli, and Viscosity  [2] : 145-197 | The accuracy of explaining fluid dynamics and solving problems |
| 15 | [C3,P3,A2][Conceptual knowledge, Application] :  Students are able to explain the empirical fluids | viscous flow : Empirical Parameter : Reynold, Releigh, Prandtl, Peclet | Study Case & Group Discussion | [TM: 1x(4x50”)] | Written Quiz-1 | The accuracy of explaining empirical fluids and problems example | 15% |
| (Assignment -5 : Exercises [BT+BM:2x(4x60”)] | Group Assignment : study case |
| 16 | End Semester Evaluation | | | | | |  |

**REFERENCES :**

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| Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey, Fundamentals Of Engineering Thermodynamics, John Wiley & Sons, 2014  Anderson, G.M.,Thermodynamics of Natural Systems (2nd edition),Cambridge University Press, 2009 |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Capita Selecta |
| **Course Code** | RF184521 |
| **Semester** | V (Five) |
| **Credit** | 2 (T:2) SKS |
| **Lecturer** | 1. Dr. Ayi Syaeful Bahri, S.Si., M.T. 2. Dr. Ir. Amien Widodo, M.S. |

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| **Study Materials** | Topics adapted to the latest developments or / and at the request of the Stakeholder | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysical engineering in depth; |
| 3.6 | understanding the complete operational knowledge related to the field of geophysical engineering technology; |
| 3.7 | understanding the factual insights and technology application methods; codes and national/international standards as well as the regulations in force in his/her work area to carry out geophysical engineering technology work in depth; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| **LO - Course** | [C2,P2,A2] Students are able to understand the development in exploration technology in the context of utilization of natural resources, environment and energy as well as specific topics relevant to the latest developments. | | |

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| **Week** | **The Expected of Sub LO-Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience\*** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4] [Conceptual knowledge, Analyze]  Students are able to understand and master the current conditions of a given topic | Introduction to current developments of a given topic | Introductory Lecture, Brainstorming;  **(Assignment : Write a Resume on current developments of a given topic)** | TM: (2x50”) | Discussion (application and development of a given topic); **Assignment : Fundamentals of a given topic’s concept** | Get to know the basic theoretical concept of current developments of a given topic in general |  |
| 2 | [C4,P4,A4] [Conceptual knowledge, Analyze]  Students are able to understand the basic concept of a given topic | The concept and basic principle of a given topic (subject - 1) | Direct Lecture, Discussion ; | TM: (2x50”) | Discussion (The concept and basic principle of a given topic );  **Assignment : Study Case of a given topic’s problem analysis** | The accuracy of explaining |  |
| 3 | [C4,P4,A4] [Conceptual knowledge, Analyze]  Students are able to understand the basic concept of a given topic | The concept and basic principle of a given topic (subject - 2) | Direct Lecture, Discussion ; | TM: (2x50”) | Discussion (The concept and basic principle of a given topic ); | The accuracy of explaining |  |
| 4 | [C4,P4,A4] [Conceptual knowledge, Analyze]  Students are able to understand the basic concept of a given topic | The concept and basic principle of a given topic (subject - 3) | Direct Lecture, Discussion ; | TM: (2x50”) | Discussion (The concept and basic principle of a given topic ); | The accuracy of explaining |  |
| 5 | [C4,P4,A4] [Conceptual knowledge, Analyze]  Students are able to understand and analyse the basic concept of a given topic | The concept and basic principle of a given topic (subject - 4) | Direct Lecture, Discussion ; | TM: (2x50”) | Discussion (The concept and basic principle of a given topic ); | The accuracy of explaining |  |
| 6 | [C4,P4,A4] [Conceptual knowledge, Analyze]  Students are able to understand and analyse the basic concept of a given topic | The concept and basic principle of a given topic (subject - 5) | Direct Lecture, Discussion ; | TM: (2x50”) | Discussion (The concept and basic principle of a given topic ); | The accuracy of explaining |  |
| 7 | [C4,P4,A4] [Conceptual knowledge, Analyze]  Students are able to understand and analyse the basic concept of a given topic | The concept and basic principle of a given topic (subject - 6) | Direct Lecture, Discussion ; | TM: (2x50”) | Discussion (The concept and basic principle of a given topic ); | The accuracy of explaining |  |
| 8 | Mid Semester Evaluation | | | | | | 20% |
| 9 | [C4,P4,A4] [Conceptual knowledge, Analyze]  Students are able to understand, analyse, and apply the basic concept of a given topic | The concept and basic principle and applications of a given topic subject - 7 (Study case 1) | Direct Lecture, Discussion ; | TM: (2x50”) | Discussion (The concept and basic principle of a given topic );  **Assignment : Analysing and Applying in study case, presented per small group (2-3 ppl)** | The accuracy of explaining |  |
| 10 | [C4,P4,A4] [Conceptual knowledge, Analyze]  Students are able to understand, analyse, and apply the basic concept of a given topic | The concept and basic principle and applications of a given topic subject - 8 (Study case 1) | Direct Lecture, Discussion ; | TM: (2x50”) | Discussion (The concept and basic principle of a given topic );  **Assignment : Analysing and Applying in study case, presented per small group (2-3 ppl)** | The accuracy of explaining |  |
| 11 | [C4,P4,A4] [Conceptual knowledge, Analyze]  Students are able to understand, analyse, and apply the basic concept of a given topic | The concept and basic principle and applications of a given topic subject - 9 (Study case 1) | Direct Lecture, Discussion ; | TM: (2x50”) | Discussion (The concept and basic principle of a given topic );  **Assignment : Analysing and Applying in study case, presented per small group (2-3 ppl)** | The accuracy of explaining |  |
| 12 | [C4,P4,A4] [Conceptual knowledge, Analyze]  Students are able to understand, analyse, and apply the basic concept of a given topic | The concept and basic principle and applications of a given topic subject - 10 (Study case 1) | Direct Lecture, Discussion ; | TM: (2x50”) | Discussion (The concept and basic principle of a given topic );  **Assignment : Analysing and Applying in study case, presented per small group (2-3 ppl)** | The accuracy of explaining | 20% |
| 13 | [C4,P4,A4] [Conceptual knowledge, Analyze]  Students are able to understand, analyse, and apply the basic concept of a given topic in a project/ a research | The concept and basic principle and applications of a given topic in self-project subject - 11 (Study case 1) | Direct Lecture, Discussion ; | TM: (2x50”) | Discussion (The concept and basic principle of a given topic );  **Assignment : Analysing and Applying in study case, in self-project, presented per small group (2-3 ppl)** | The accuracy of explaining |  |
| 14 | [C4,P4,A4] [Conceptual knowledge, Analyze]  Students are able to understand, analyse, and apply the basic concept of a given topic in a project/ a research | The concept and basic principle and applications of a given topic in self-project subject - 12 (Study case 1) | Direct Lecture, Discussion ; | TM: (2x50”) | Discussion (The concept and basic principle of a given topic );  **Assignment : Analysing and Applying in study case, in self-project, presented per small group (2-3 ppl)** | The accuracy of explaining |  |
| 15 | [C4,P4,A4] [Conceptual knowledge, Analyze]  Students are able to understand, analyse, and apply the basic concept of a given topic in a project/ a research | The concept and basic principle and applications of a given topic in self-project subject - 12 (Study case 1) | Direct Lecture, Discussion ; | TM: (2x50”) | Discussion (The concept and basic principle of a given topic );  **Assignment : Analysing and Applying in study case, in self-project, presented per person (Tugas Besar)** | The accuracy of explaining | 20% |
| 16 | End Semester Evaluation | | | | | | 20% |

**REFERENCES :**

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| * + - 1. Telford, WM; Geldart, L.P; Sheriff, RE, 1998, Applied Geophysics, Cambridge Univ Press, Cambridge.       2. Geophysics Journal and Near-Surface Geophysics Journal       3. Geothermal Journal       4. SPE Journal |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Data Analysis Well Log |
| **Cource Code** | RF184622 |
| **Semester** | VI (Six) |
| **Credit** | 4 SKS (T:3, P:1) |
| **Lecturer** | Firman Syaifuddin, S.Si., M.T. |

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| **Study materials** | Seismic, Logging | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.2 | understanding geological knowledge that required to understand the geological process of a natural phenomenon by its characteristics; |
| 3.3 | understanding the theoretical concept of statistics to define the process complexity of a natural phenomenon; |
| 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysics engineering in deep; |
| 3.6 | understanding the complete operational knowledge related to the field of geophysical engineering technology; |
| 3.8 | understanding the principle and methods of mapping application that required in general geophysical engineering work; |
| 3.9 | mastering the principles of quality assurance in general in geophysics engineering work; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.11 | mastering factual knowledge of current principles and issues in economic, socio-cultural and ecological issues in general that have an influence on the field of geophysics engineering; |
| 3.14 | mastering general concepts, principles, and techniques of effective communication orally and in writing for specific purposes in general; and |
| 3.15 | mastering factual knowledge about the development of cutting-edge technology and advanced materials in the field of geophysical engineering in deep |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.3 | being able to conduct research that includes identification, formulation, and analysis of geophysical engineering problems; |
| 4.4 | being able to formulate alternative solutions to solve complex geophysical engineering problems by considering economic, health, public safety, cultural, social and environmental factors; |
| 4.5 | being able to design systems, processes, and components with an analytical approach and consider technical standards, aspects of performance, reliability, ease of application, sustainability and pay attention to economic, health and public safety, cultural, social and environmental factors; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| **LO – Course** | [C3,P3,A3] Students can understand the basic concepts of formation evaluation, wellbore environment, working principles and measurement of well logging, understanding theories about well log including interpreting well log data, being able to apply the concept of well log for evaluation of formation. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C3, P3,A3]  Students can understand what will be learned in this lecture, understanding the fundamentals of rock physics parameters | 1. Introduction to Lecture:    • Semester Learning Plans    • College Contracts    • Scoring system  2. Review of rock physics courses (physical parameters of rocks) | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion;  Make a summary | Understanding what will be learned in this lecture  Understanding the basic parameters of rock physics | "5%  Task" |
| 2 | [C3, P3,A3]  Students can understand the terms in well log, understanding well log data types, understanding terms in the borehole environment, knowing well log data collection tools, know how to collect well log data | • Terminology in well log  • Well log data types  • Borehole enviroment  • Well log measurement equipment  • Acquisition of well log data  Main Book 1 chapter-01 | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Being able to explain the terms used in well log  Understanding the types of well log data types  Understanding the terms in borehole environment  Knowing well log data equipment, know how to collect well log data | "5%  Task" |
| 3 | [C3, P3,A3]  Students can understand the basic equations, rock types, physical properties of rocks in analyzing well log data | The basic equation in analyzing well log data  Rock and fluid properties  • Rock classification  • Porosity  • Saturation  • Permeability  • Capillary pressure  • Fluid property  • Salinity  • Temperature formation  Main Book 2 chapter-01 | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Understanding the basic equations used in well logging data analysis  Being able to explain the types of rock types based on physical properties  Understanding rock types, physical properties in well log data | "5%  Task" |
| 4 | [C3, P3,A3]  Knowing the characteristic of the potential self-log data, gamma ray and resistivity, Understanding the information contained in each well logging data | • Log self-potential  • Log Gamma ray  • Log Resistivitas  Main Book 2  chapter -02,03 & 05 | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  **Quiz-01** | Knowing the characteristic of the potential self-log data, gamma ray and resistivity  Understanding the information in each well logging data | "5%  Task"  **15%  Quiz** |
| 5 | [C3, P3,A3]    Knowing the characteristic of the density, sonic, neutron and porosity log data, Understanding the information in each well logging data | "• Log densitas  • Log sonic  • Log neutron  • Log Porositas  "    Main Book 2  chapter -04 | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Knowing the characteristic of density, sonic, neutron and porosity log data  Understanding the information in each well log data | "5%  Task" |
| 6 | [C3, P3,A3]    Knowing the characteristic of the data log Magnetic resonance imaging (NMR) and Borehole imaging, Understanding the information in each data well log | "• Log Magnetic resonance imaging (NMR)  • Borehole imaging  "  Main Book 2  chapter -06 & 09 | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Knowing the characteristic of the magnetic resonance imaging (NMR) and Borehole imaging log data  Understanding the information in each well log data | "5%  Task" |
| 7 | [C3, P3,A3]    Knowing how to evaluate data quality, understanding how to define reservoir layers, understanding how to calculate reservoir parameters | "Quicklook Log Interpretation  • Evaluation of the quality of well log data  • Identify reservoir layers  • Identification of types and limits of fluid contact  • Calculation of porosity  • Calculation of hydrocarbon saturation  • Calculation of permeability  "  Main Book 1 chapter-02 | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Being able to evaluate the quality of well log data  Being able to determine the reservoir layer  Being able to calculate reservoir parameters | "5%  Task" |
| 8 | Mid Semester Evaluation | | | | | | 40% |
| 9 | [C3, P3,A3]    Understanding how to interpret well log data by utilizing all available information, determine effective reservoir parameters | "Full Interpretation  • Defining net sand  • Calculation of effective porosity  • Archie saturation calculation  • Calculation of effective permeability  "  Main Book 1 chapter-03 | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Understanding how to interpret well log data by utilizing all available information  Being able to determine effective reservoir parameters | "5%  Task" |
| 10 | [C3, P3,A3]    Understanding some advanced interpretation techniques for well log data | "Advanced Log Interpretation Techniques  • Shaly sand analysis  • Carbonates  • Multi mineral analysis  • Thin bed analysis  • Borehole correction  "  Main Book 1  chapter -05 | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Knowing the advanced interpretation techniques of well log data  Being able to interpret well log data | "5%  Task" |
| 11 | [C3, P3,A3]    Knowing how to integrate well log data with seismic data, understanding the concept of mechanical rock | "Integration with Seismic  • Synthetic Seismograms  • Fluid Replacement Modeling  • Acoustic/Elastic Impedance Modeling  Rock Mechanics  "    Main Book 1  chapter -06 & 07 | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to integrate seismic data and well log data  Knowing the concept of mechanical rock | "5%  Task" |
| 12 | [C3, P3,A3]    Knowing the economic terms from the results of interpretation of well log data | "Value of Information  • Capital expenses  • Operating expenses  • Net present value  Equitydeterminations  • Gross bulk volume  • Net pore volume  • Hydrocarbon pore volume  • Barrels of oil equivalent  • Reserves.  "  Main Book1  chapter -08 & 09 | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  Quiz-02 | Able to explain economic terms from the results of well log data interpretation  "able to do calculations  • Gross bulk volume  • Net pore volume  • Hydrocarbon pore volume  • Barrels of oil equivalent  • Reserves.  " | "5%  Task" |
| 13 | [C3, P3,A3]    Knowing the basics of geological concepts in integrating the results of well log data interpretation, Knowing the terms reservoir engineering | "Production Geology Issues  • Understanding Geological Maps  • Basic Geological Concepts  Reservoir Engineering Issues  • Behavior of Gases  • Behavior of Oil/Wet Gas Reservoirs  • Material Balance  • Darcy’s Law  • Well Testing  "  Main Book1  chapter -10 & 11 | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Knowing the basics of geological concepts used in integrating the results of well logging data interpretation  Able to explain the terms reservoir engineering | "5%  Task" |
| 14 | [C3, P3,A3]  Knowing several terms in well drilling, understanding the physical properties of wellbore | "• Well Deviation  • Surveying  • Geosteering  "  Main Book1  chapter -13 | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain several terms in well drilling  Understanding the characteristic of the wellbore | "5%  Task" |
| 15 | [C3, P3,A3]  Being able to integrate well log data analysis | Case study | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to be integrated well log data analysis | "5%  Task" |
| 16 | End Semester Evaluation | | | | | | 40% |

**REFERENCES :**

1. Darling, T., “Well Logging and Formation Evaluation”, Elsevier Inc., 2005.Zobin, V. M., 2012, Introduction to Volcanic Seismology, Elsevier, London, UK.
2. Tiab, D. and Donaldson, E.C., “Petrophysics 2nd.”, Elsevier, 2004.
3. Asquith, G. B. And Krygowski, D., “Basic Well Log Analysis, 2nd”, American Association of Petroleoum Geologist, 2004.
4. Rider, M., “The Geological Interpretation of Well Logs, 2nd”, Rider-French Consulting Ltd., 2002.
5. Asquith, G.B. And Gibson, C.R., “Basic Well Log Analysis for Geologist”, American Association of Petroleoum Geologist, 1982.

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| **Program Study** | Geophysical Engineering |
| **Course** | Electromagnetic Exploration |
| **Code** | RF184623 |
| **Semester** | VI (Six) |
| **Credit** | 4 (T:2,P:2) SKS |
| **Lecturer** | Wien Lestari, S.T., M.T. |

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| **Study Materials** | Waves, Mathematics, Geology | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skill** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.4 | understanding the theoretical concepts of engineering science (engineering sciences), engineering principles and engineering design methods that required for the analysis and design of systems, processes, products or components in the field of deep geophysical engineering; |
| 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysical engineering in depth; |
| 3.6 | understanding the complete operational knowledge related to the field of geophysical engineering technology; |
| 3.10 | understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering; |
| 3.12 | understanding the concept, principles, workshop procedures, studio and laboratory activities and implementation of safety, occupational health and environment (K3L) in general; |
| **Specific Skill** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented, and poured in the form of scientific papers. |
| **LO– Course** | [C4,P4,A4] Students are able to hold the concepts, principles and techniques of system design, process or components of the Electromagnetic Method (GPR, VLF, and MT) application and carry them out procedurally starting from data collection, processing, analyzing the results of interpretation with subsurface geological conditions and modeling to complete deep surface geophysical engineering issues deeply in mine exploration, hydrogeology, geotechnical engineering and the environment as well as being responsible for the results of one's own work and groups through scientific reports and presentations. | | |

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| **Week** | **The Expected of Sub LO-Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience\*** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4] Students are able to understand the electromagnetic method (EM) and its development | Introduction to the EM Method, the development of the EM method and general applications  L1: introduction to EM methods and their development | Direct Lecture | DL: 2x(4x50”) | Discussion | Get to know EM applications in general |  |
| 2 | [C4,P4,A4]  Students are able to explain the concept of EM methods | Basic principles  EM methods, Maxwell's Equation  L2: Electric Field Equation, Magnetic Field and Maxwell Equation | Direct Lecture | DL: 1x(4x50”); | Discussion | Accuracy explained |  |
| 3 | [C4,P4,A4]  Students are able to explain the concept of EM methods | L3 : Introduction to the magnetotelluric method, skin depth | Direct Lecture | DL: 1x(4x50”); | Discussion | Accuracy explained |  |
| 4 | [C4,P4,A4]  Students are able to explain the processing of the Magnetotelluric method | L4: Introduction to the data processing stages of the MT method | Direct Lecture | DL: 1x(4x50”); | Discussion | Accuracy explained |  |
| 5 | [C4,P4,A4]  Students are able to apply Magnetotelluric method processing | L5: Case study, data processing | Direct Lecture | DL: 1x(4x50”);  [SL+Self-Learning:2x(4x60”)] | Practicum | The accuracy of applying a good filter to improve data quality | 10% |
| 6 | [C4,P4,A4]  Students are able to explain the concept of CSAMT-AMT and apply Magnetotelurik processing methods | L6: Case study, pengolahan data | Direct Lecture | DL: 1x(4x50”) | Discussion | Accuracy in explaining and comparing | 10% |
| 7 | [C4,P4,A4]  Students are able to explain the concept of CSAMT-AMT and apply Magnetotelurik processing methods | L7 : CSAMT and AMT data processing | Direct Lecture | DL: 1x(4x50”);  [SL+Self-Learning:2x(4x60”)] | make resume paper with CSAMT and AMT-Practicum methods | The accuracy of applying a good filter to improve data quality | 10% |
| 8 | Semester Middle Evaluation | | | | | | 30% |
| 9 | [C4,P4,A4]  Students are able to explain the concept of Very Low Frequency | L9 : Introduction to the VLF method | Direct Lecture | DL: 1x(4x50”); | Discussion | Accuracy explained |  |
| 10 | [C4,P4,A4]  Students are able to explain the processing phase of Very Low Frequency | L10 : Introduction to the processing stages | Direct Lecture | DL: 1x(4x50”); | Discussion | Accuracy explained |  |
| 11 | [C4,P4,A4]  Students are able to explain the processing phase of Very Low Frequency | L11 : Introduction to the stages of modeling and development of the VLF method | Direct Lecture | DL: 1x(4x50”); | Discussion Resume | Accuracy explained | 10% |
| 12 | [C4,P4,A4]  Students are able to explain the concept of Ground Penetrating Radar | L12 : Introduction to the GPR method | Direct Lecture | DL: 1x(4x50”); | Discussion | Accuracy explained |  |
| 13 | [C4,P4,A4]  Students are able to explain the stages of GPR processing | L13 : Introduction to the processing stages | Direct Lecture | DL: 1x(4x50”); | Discussion Practicum | Accuracy explained |  |
| 14 | [C4,P4,A4]  Students are able to apply the EM VLF and GPR methods | L14 : Introduction to the processing stages | Practicum | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Discussion Practicum | Accuracy explained |  |
| 15 | [C4,P4,A4]  Students are able to apply the EM VLF and GPR methods | L15 : Introduction to the processing stages | Practicum | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Discussion Practicum | Accuracy explained |  |
| 16 | Semester Final Evaluation |  |  |  | Presentation  Report |  | 30% |

**REFERENCES :**

1.Telford, W., Geldart, L.P., Sheriff, R. E. (1976). Applied Geophysics.Cambridge Univ Press, Cambridge.

2. Griffiths, D. J. (1999). Introduction to Electrodynamics, 3rd ed., Prentice Hall.

3. Zhdanov, M. S. (2009). Geophysical Electromagnetic Theory and Methods. Elsevier.

4. Simpson, F. and Bahr, K. (2005). Practical Magnetotelluric. Cambridge.

5. Jurnal Geofisika

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Geotechnic |
| **Cource Code** | RF184624 |
| **Semester** | VI (Six) |
| **Credit** | 3 (T:3) SKS |
| **Lecturer** | Dr.Dwa Desa Warnana, S.Si., M.Si. |

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| **Study materials** | Geology, Geophysics | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyze and design system, process, product, or component in geophysics engineering in deep; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.12 | understanding the concept, principle, workshop procedure, studio and laboratory activities, and Health and Safety Environment (HSE) in general; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.10 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| **CP – Mata Kuliah** | [C4,P4,A4] Students are able to master the concepts, principles and techniques of system design, process or component application of geophysical methods for environmental problems and carry them out procedurally starting from data collection, processing, analyzing the results of interpretation with subsurface geological conditions and modeling to solve physical environmental problems and mitigation deeply and responsibly towards the results of their own work and groups through scientific reports and presentations. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4] Students are able to understand geotechnics concepts | Introduction | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion | the accuracy of explaining | 5% |
| 2 | [C4,P4,A4] Students are able to understand the meaning and role of geophysics methods to solve engineering problems, for example the case of engineering geophysics applications; physical parameters and engineering | Geophysics methods to solve engineering problems, for example the case of engineering geophysics applications; physical parameters and engineering | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  **:** **Exercises** | the accuracy of explaining | 10% |
| 3 | [C4,P4,A4] Students are able to understand the methodology, analysis and interpretation of technical geophysics; | Engineering geophysics methodology, analysis and interpretation; | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion **Task-K10 : Exercises** | the accuracy of explaining | 10% |
| 4 | [C4,P4,A4] Students are able to understand the methodology, analysis and interpretation of engineering geophysics; | Engineering geophysics methodology, analysis and interpretation; | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion **Task-K10 : Exercises** | the accuracy of explaining | 10% |
| 5 | [C4,P4,A4] Students are able to understand the application of geophysics methods to technical geology problems | Application of geophysics methods to technical geology problems | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion **Task-K10 : Exercises** | the accuracy of explaining | 10% |
| 6 | [C4,P4,A4] Students are able to understand the application of geophysics methods to technical geology problems | Application of geophysics methods to technical geology problems | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion **Task-K10 : Exercises** | the accuracy of explaining | 10% |
| 7 | [C4,P4,A4] Case study | Case study | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion **Task-K10 : Exercises** | the accuracy of explaining | 10% |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | [C4,P4,A4] Students are able to apply geophysics methods to geotechnics problems (determination of geotechnics parameters from geophysics measurements) | Geophysics methods for geotechnics problems | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion (plate dynamics in geophysics); | Get to know the general formula of plate dynamics |  |
| 10 | [C4,P4,A4] Students are able to apply geophysics methods to geotechnics problems (determination of geotechnics parameters from geophysics measurements) | Geophysics methods for geotechnics problems | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics); **Task-K10 : Exercises** | the accuracy of explaining | 5% |
| 11 | [C4,P4,A4] Students are able to analyze geotechnical evaluations of soil conditions: soil corrosion, | geotechnical evaluation of soil conditions: soil corrosion, | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of explaining and comparing |  |
| 12 | [C4,P4,A4] Students are able to analyze geotechnical evaluations of soil conditions: soil corrosion, | geotechnical evaluation of soil conditions: soil corrosion, | Direct Lecture, Discussion;Video | TM: 1x(3x50”) | Discussion **Quiz-K12 :stress dan strain** | Ketepatan menjelaskan | 5% |
| 13 | [C4,P4,A4] Students can understand the strength of the soil, the potential of liquefaction, etc., | Students are able to understand pollution in the marine environment | Direct Lecture, Discussion;Video | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion **Task-K13: practice of making a script program about flow simulation in the earth.** | the accuracy of explaining | 10% |
| 14 | [C4,P4,A4] construction materials, foundation structures, dams, etc.); | Case study | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of explaining |  |
| 15 | [C4,P4,A4] Case study. | Case study | Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion **Exercises: Presentation and resume of geodynamic studies in geophysics** | the accuracy of explaining |  |
| 16 | End Semester Evaluation | | | | | | 30% |

**REFERENCES :**

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| 1. Telford, W.M; Geldart, L.P; Sheriff, R.E., 1998. Applied Geophysics. Cambridge Univ Press, Cambridge. 2. Zhdanov, M. S. and Keller, G. V., 1994. The Geoelectrical Methods in Geophysical Exploration. Elsevier 3. Ward, S. H. (ed.), 1990. Geotechnical & Environmental Geophysics, Soc. Expl. Geophys., 1032 pp, 4. McDowell P Wet *al, 2002.* ***Geophysics in engineering investigations, ciria*** 5. Jurnal Geofisika |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Seismic Data Processing and Acquisition |
| **Cource Code** | RF184625 |
| **Semester** | VI (Six) |
| **Credit** | 3 (T:2, P:1) SKS |
| **Lecturer** | Firman Syaifuddin, S.Si., M.T. |

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| **Study materials** | Wave, Computation | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.2 | understanding geological knowledge that required to understand the geological process of a natural phenomenon by its characteristics; |
| 3.3 | understanding the theoretical concept of statistics to define the process complexity of a natural phenomenon; |
| 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysics engineering in deep; |
| 3.6 | understanding the complete operational knowledge related to the field of geophysical engineering technology; |
| 3.8 | understanding the principle and methods of mapping application that required in general geophysical engineering work; |
| 3.9 | mastering the principles of quality assurance in general in geophysics engineering work; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.11 | mastering factual knowledge of current principles and issues in economic, socio-cultural and ecological issues in general that have an influence on the field of geophysics engineering; |
| 3.14 | mastering general concepts, principles, and techniques of effective communication orally and in writing for specific purposes in general; and |
| 3.15 | mastering factual knowledge about the development of cutting-edge technology and advanced materials in the field of geophysical engineering in deep |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.3 | being able to conduct research that includes identification, formulation, and analysis of geophysical engineering problems; |
| 4.4 | being able to formulate alternative solutions to solve complex geophysical engineering problems by considering economic, health, public safety, cultural, social and environmental factors; |
| 4.5 | being able to design systems, processes, and components with an analytical approach and consider technical standards, aspects of performance, reliability, ease of application, sustainability and pay attention to economic, health and public safety, cultural, social and environmental factors; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| **LO – Course** | [C4,P4,A4] Students are able to make 2-dimensional and 3-dimensional seismic acquisition design, able to do seismic data processing (basic seismic processing) | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4, P3,A3]  Students are able to understand the concept of seismic exploration | 1. Introduction to Lecture:    • Semester Learning Plans    • College Contracts    • Scoring system  Seismic Exploration Method | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to understand of seismic exploration | "5%  Task" |
| 2 | [C3, P3,A3]  Students are able to understand the concept of 2-dimensional refraction and reflection seismic design and are able to make 2-dimensional refraction and reflection seismic acquisition designs | Design of 2-dimensional seismic refraction and reflection acquisition | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to create 2-dimensional seismic reflection and refraction acquisition designs | "5%  Task " |
| 3 | [C4, P3,A3]  Students are able to understand the concept of 3-dimensional reflection seismic design and are capable of making 3-dimensional reflection seismic acquisition design | 3-dimensional seismic acquisition design | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to make 3-dimensional reflection seismic acquisition design | "5%  Task " |
| 4 | [C3, P3,A3]  Students are able to understand the concepts of land seismic and sea seismic acquisition | Land and sea seismic acquisition | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  **Quiz-01** | Able to understand of seismic exploration both land and sea environments | "5%  Task "  **15%  Quiz** |
| 5 | [C4, P3,A3]  Students are able to understand the operational concepts of land seismic and sea seismic acquisition | Seismic operational data acquisition | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to plan seismic data acquisition operations | "5%  Task " |
| 6 | [C4, P3,A3]  Students are able to understand the concept of seismic data signal analysis and are able to do seismic data signal processing | Seismic data signal analysis | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Capable of analyzing seismic data signals | "5%  Task " |
| 7 | [C3, P3,A3]  Students are able to understand the concept of seismic data processing and are able to do it | Processing reflection seismic data | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to do 2-dimensional reflection seismic data processing | "5%  Task " |
| 8 | Mid Semester Evaluation | | | | | | 40% |
| 9 | **[C3, P3,A3]**  Students are able to understand the concept of pre-processing of seismic data and are able to analyze | Seismic data pre-processing | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to analyze data quality, perform geometric corrections and conduct seismic data conditioning before further processing | "5%  Task " |
| 10 | **[C3, P3,A3]**  Students are able to understand the concept of seismic data filtering and are able to do it | Filtering | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to filter seismic data | "5%  Task " |
| 11 | [C3, P3,A3]  Students are able to understand the concept of seismic data speed analysis and are able to do speed analysis and do the Normal Move Out correction | Velocity analysis | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to do seismic wave velocity analysis and Normal Move Out correction | "5%  Task " |
| 12 | [C3, P3,A3]  Students are able to understand the concept of seismic data migration and are able to process seismic data migration | Migrate seismic data | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  Quiz-02 | Able to migrate seismic data | "5%  Task " |
| 13 | [C3, P3,A3]  Students are able understand the latest developments in seismic data processing technology | The latest data acquisition and processing technology | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Understanding the development of the latest seismic data processing technology | "5%  Task" |
| 14 | [C3, P3,A3]  Students are able to understand the latest developments in seismic data processing technology | Case Study Reference Paper  Study of literature from various sources | Group paper presentations, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Students are able to conduct paper reviews and understand their contents and are able to present the contents of existing papers | "5%  Task " |
| 15 | [C3, P3,A3]  Students are able to understand the latest developments in seismic data processing technology | Case Study Reference Paper  Study of literature from various sources | Group paper presentations, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Students are able to conduct paper reviews and understand their contents and are able to present the contents of existing paper | "5%  Task " |
| 16 | End Semester Evaluation | | | | | | 40% |

**REFERENCES :**

1. Vermeer, G.J.O., “Fundamentals of 3-D seismic survey design.”, 2001
2. Costain, J. K. and Çoruh, C.,”Basic theory of exploration seismology.”, Elsevier, 2004.
3. Chapman, C.H., “Fundamentals of seismic wave propagation.”, Cambridge University Press, 2004.
4. Shearer, P.M. ,”Introduction to Seismology.”, Cambridge University Press,2009

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Digital Electronics |
| **Cource Code** | RF184626 |
| **Semester** | 3 (T:2,P:1) SKS |
| **Credit** | VI (Six) |
| **Lecturer** | Mariyanto, S.Si., M.T. |

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| **Study materials** | Electricity, Mathematics, Progamming | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.2 | being able to show independent, quality, and measurable performance; |
| **Knowledge** | 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| **LO – Course** | [C3,P3,A3] Students are able to know the theory of digital electronics also are able to demonstrate its application in the geophysics field. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | Students are able to understand the system of quantities and number systems and their conversions | Understanding the quantity system and the number system and its conversion | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, Discussion | Liveliness of interact | - |
| 2 | Students are able to understand the characteristic of logic gates | Characteristic of Logic Gates | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, Discussion, Task | Task result | 5% |
| 3 | Students are able to understand how logic gates work | How to work logic gates | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, Discussion | Liveliness of interact | - |
| 4 | Students are able to understand the Boolean algebra theorem | Boolean Algebra Theorem | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, Discussion,  quiz | Quiz result | 10% |
| 5 | Students are able to apply the simplification method with the Karnaugh map | Simplification Method with the Karnaugh Map | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, Discussion,  practicum | Practicum report | 5% |
| 6 | Students are able to apply digital arithmetic operations | Digital Arithmetic Operations | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, Discussion,  practicum | Practicum report | 5% |
| 7 | Students are able to design digital arithmetic circuits | Digital Arithmetic Circuits | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, Discussion | Liveliness of interact | - |
| 8 | Evaluasi Tengah Semester | | | | | | 25% |
| 9 | Students are able to understand the characteristic of flip-flops | The characteristic of flip-flops | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, Discussion | Liveliness of interact | - |
| 10 | Students are able to understand how to work flip-flops | How to work a flip-flop | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, Discussion, Task | Task result | 5% |
| 11 | Students are able to design a counter circuit | Counter Circuit | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, Discussion | Liveliness of interact | - |
| 12 | Students are able to design registrer circuits | Registrer Circuits | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, Discussion, quiz | Quiz result | 10% |
| 13 | Students are able to design decoder circuits | Decoder Circuits | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, Discussion,  practicum | Practicum report | 5% |
| 14 | Students are able to design encoder circuits | Encoder Circuits | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, Discussion,  practicum | Practicum report | 5% |
| 15 | Students are able to design a multiplexer circuit | Multiplexer Circuit | Direct Lecture  120 minute  Discussion  30 minute | 150 minute | Presentation, Discussion | Liveliness of interact | - |
| 16 | Evaluasi Akhir Semester | | | | | | 25% |

**REFERENCES :**

1. Ronald J. Tocci, Digital Systems Principles and Applications, Prentice-Hall int

2. M. Morris Mano, Digital Design, Prentice-Hall

3. Malvino Leach, Irwan Wijaya, Prinsip-Prinsip dan Penerapan Digital, Penerbit Erlangga

4. Roger L. Tokheim, Elektronika Digital, Penerbit Erlangga

5. Jurnal tentang elektronika digital

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Groundwater Exploration |
| **Cource Code** | RF184627 |
| **Semester** | VI (Six) |
| **Credit** | 3 (T:2 P:1) SKS |
| **Lecturer** | Dr. Dwa Desa Warnana, S.Si., M.Si. |

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| **Study materials** | Geoelectricity, Geology | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.2 | understanding geological knowledge that required to understand the geological process of a natural phenomenon by its characteristics; |
| 3.3 | understanding the theoretical concept of statistics to define the process complexity of a natural phenomenon; |
| 3.8 | understanding the principle and methods of mapping application that required in general geophysical engineering work; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.13 | understanding the insight of sustainable development in applied geophysical exploration methods and natural resource management in general; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented and poured in the form of scientific papers. |
| **LO – Course** | [C4,P4,A4] Students are able to know the concepts and scope of work in groundwater exploration and mapping, geological conditions that are important in the formation of aquifer systems, physical and chemical properties of ground water to determine its quality, the basics of groundwater exploration techniques, mapping methods and water modeling soil | | |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Oil and Gas Geology |
| **Course Code** | RF184628 |
| **Semester** | VI (Six) |
| **Credit** | 3 (T:3) SKS |
| **Lecturer** | Dr. Ir. Amien Widodo, M.S. |

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| **Study Materials** | Geology, Mechanics, Reservoir | | |
| **Learning Outcome (LO)** | Attitude | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| General Skills | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| Knowledge | 3.2 | understanding geological knowledge that required to understand the geological process of a particular natural phenomena by its characteristics; |
| 3.3 | understanding the theoretical concept of statistics to define the process complexity of a particular natural phenomena; |
| 3.8 | understanding the principle and methods of mapping application that required in general geophysical engineering work; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.13 | understanding the insight of sustainable development in applied geophysical exploration methods and natural resource management in general; |
| Specific Skills | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented and poured in the form of scientific papers. |
| **LO - Course** | [C4,P4,A4] Students are able to understand the fundamentals of oil and gas availability in the crust along with the principles of exploration. Students are able to understand the concept of oil and gas formation and accumulation, petroleum systems, oil and gas exploration methods, and the regulation of oil and gas trade in Indonesia. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4]  Students are able to understand structural geology and Earth's constituent components(Earth Structure) | Introduction to Earth Structure  [K1] : Earth Structure.ppt | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion (Comprehension of Earth’s components from the core to the crust and its relation to structural geology) | the accuracy of explaining |  |
| 2 | [C4,P4,A4] Students are able to understand crust deformations (Divergent, Convergent, and Transform) | Introduction to Crust Deformation  [K2] : Tectonic Deformation Part 1.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (types of tectonic crust movement);  **Assignment-K2 : Resume on divergent, convergent, and transform process** | Get to know of the plate movements |  |
| 3 | [C4,P4,A4] Students are able to explain the difference of Brittle and Ductile | Introduction to Brittle and Ductile on plate crust  [K3] : Brittle and Ductile.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (Brittle and Ductile);  **Assignment-K3 :Latihan soal Brittle and Ductile Exercises, the difference of divergent, convergent, and transform** | Get to know the difference of Brittle and Ductile and the outcome structures from both |  |
| 4 | [C4,P4,A4] Students are able to analyse the kinematics and dynamics of plate movement | The concept of kinematics and dynamics in structural geology  [K4] : Force Kinematics.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (Dynamics of Tectonic Plate);  **Assignment-K4 : Resume of Plate Movement Kinematics** | Get to know the various types of plate movement from the dynamics of its kinematic force |  |
| 5 | [C4,P4,A4] Students are able to understand carbonate sedimentary rock | The concept of sedimentary stratigraphy on carbonate sedimentary rock  [K5] : Introduction to carbonate sedimentary rock.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (carbonate sedimentary rock);  **Quiz-K5 : Clastic Rock and Carbonate Rocks (components)** | Get to know of carbonate rocks component |  |
| 6 | [C4,P4,A4] Students are able to understand the genesis of carbonate rocks (differences in clastic rocks genesis) | The concept of sedimentary stratigraphy on carbonate sedimentary rock  [K5] : Introduction to carbonate rocks genesis.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (plate dynamics in geophysics);  **Assignment-K6 : carbonate rocks genesis exercises** | Get to know the genesis of carbonate rocks |  |
| 7 | [C4,P4,A4] Students are able to understand the genesis of sedimentary rocks, the components, textures, structures, minerals, as well as explain the depositional environment and its classification | The concept of sedimentary stratigraphy on clastic and non-clastic rocks  [K7] : Resume of sedimentary stratigraphy on clastic and non-clastic rocks.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (clastic and non-clastic rocks);  **Assignment-K7 : differences between clastic and non-clastic rocks exercise** | Get to know the differences between clastic and non-clastic rocks |  |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | [C4,P4,A4] Students are able to understand about stratigraphy and the laws of stratigraphy | Introduction to sedimentary stratigraphy, the principle of stratigraphy  [K9] : Introduction to the principle of stratigraphy.ppt | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion (the principle of stratigraphy); | Get to know the laws of stratigraphy |  |
| 10 | [C4,P4,A4] Students are able to understand the differences in stratigraphic science (lithostratigraphy, chronostratigraphy, biostratigraphy) | Introduction to lithostratigraphy, chronostratigraphy, and biostratigraphy  [K10] : Introduction to advanced stratigraphy.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion (comprehensive knowledge in stratigraphy);  **Assignment-K10 : lithostratigraphy, chronostratigraphy, and biostratigraphy exercises** | the accuracy of explaining | 5% |
| 11 | [C4,P4,A4]  Students are able to analyse the correlation of rocks | The basic concept of sedimentary rocks correlations (understand datum/keybed)  [K11] : rocks correlation.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of comparing and explaining |  |
| 12 | [C4,P4,A4]  Students are able to analyse the correlation of rocks (lithocorrelation, chronocorrelation, and biocorrelation) | Comprehension of the differences in lithocorrelation, chronocorrelation, and biocorrelation  [K12] : lithocorrelation, chronocorrelation, and biocorrelation.ppt | Direct Lecture, Discussion, Video; | TM: 1x(3x50”) | Discussion  **Quiz-K12 : Stratigraphy and Correlation** | the accuracy of explaining | 5% |
| 13 | [C4,P4,A4]  Students are able to read a regional stratigraphy and its use | The basic concept of regional stratigraphy reading  [K13] :Regional geology map.ppt | Direct Lecture, Discussion, Video; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion  **Assignment -K13 : Practice on simulating the flow in the earth with program language** | the accuracy of explaining | 10% |
| 14 | [C4,P4,A4] Students are able to understand the sequence stratigraphy | The concept of sequence stratigraphy  [K14] : Introduction to Sequence Stratigraphy.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of explaining |  |
| 15 | [C4,P4,A4] Students are able to understand a stratigraphy, correlation, and sequence of rocks | Comprehensive understanding of sedimentary stratigraphy  [K15] : Journal.ppt | Discussion | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion  **Assignment-K15 : Presentation and resume about sedimentary stratigraphy** | the accuracy of explaining |  |
| 16 | End Semester Evaluation | | | | | | 30% |

**REFERENCES :**

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| 1. Norman J.Hyne., 2001.Nontechnical Guide To Petroleum Geology,Exploration.,Drilling and Production 2nd edition., Pennwell Book 2. North F.K (1985), Petroleum Geology Allen & Unwin. London.Sydney 3. Magoon B.and Dow G.AAPG memoir no 60 1994. The Petroleum Systems from Source to Trap 4. Koesoemadinata. 1980. Geologi Minyak dan Gas Bumi. ITB.Bandung |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Geotourism |
| **Course Code** | RF184629 |
| **Semester** | VI (Six) |
| **Credit** | 3 (T:2,P:1) SKS |
| **Lecturer** | 1.Dr. Ir. Amien Widodo, M.S.  2.Juan Pandu Gya Nur Rochman, S.Si., M.T. |

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| **Study Materials** | Geology | | |
| **Learning Outcome (LO)** | Attitude | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| General Skills | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| Knowledge | 3.1 | understanding the theoretical concept of natural science and the principles of applying mathematical engineering as the basic methodology of geophysics exploration approach on a specific natural phenomena in general; |
| 3.6 | understanding the complete operational insight related to geophysical engineering technology |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| Specific Skills | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| **LO - Course** | [C4,P4,A4] Students are able to analyse problems and geological potentials aspect which applicable for geotourism purposes and implement it for personal purpose or involve their surroundings including entrepreneurship purpose commercially. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4]  Students are able to understand the concept of geotourism and its problems | Introduction to Geotourism as well as its development, problems, and obstacles  [K1] : Introduction to Geotourism.ppt | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion | the accuracy of explaining |  |
| 2 | [C4,P4,A4]  Students are able to analyse the aspect of geology for tourism | Introduction to geological aspects and examples of its development  [K2] : The aspects of geology and its development.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of explaining |  |
| 3 | [C4,P4,A4]  Students are able to analyse the aspect of geology for tourism | The forms, processes and activities of volcanoes, volcanic landscapes and its interesting aspects  [K3] : Volcanoes Geotourism.ppt | Direct Lecture, Discussion, Video; | TM: 1x(3x50”) | Discussion | the accuracy of explaining |  |
| 4 | [C4,P4,A4]  Students are able to analyse the aspect of geology for tourism | The forms, processes and activities of karst, karst landscapes and its interesting aspects  [K3] : Karst Geotourism.ppt | Direct Lecture, Discussion, Video; | TM: 1x(3x50”) | Discussion | the accuracy of explaining |  |
| 5 | [C4,P4,A4]  Students are able to analyse the aspect of stratigraphy and structural geology for tourism | Sedimentation profile, tectonics, and its interesting aspects  [K5] : sedimentation and tectonics.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of explaining |  |
| 6 | [C4,P4,A4]  Students are able to analyse rivers and beaches for tourism | The systems of rivers, lakes, beaches, and sea | Direct Lecture, Discussion; | TM: 1x(3x50”) | Diskusi  **Quiz-K6** | the accuracy of explaining | 10% |
| 7 | [C4,P4,A4]  Students are able to analyse the aspects of geopark and its planning | Geopark UNESCO, Geotrack, promotion and socialization | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | the accuracy of explaining |  |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | [C4,P4,A4]  Students are able to analyse the aspects of geotourism, do the simulation and planning | Geological Aspects of East Java | Discussion | [BT+BM:2x(3x60”)] | Discussion | the accuracy of explaining |  |
| 10 | [C4,P4,A4]  Students are able to analyse the aspects of geotourism, do the simulation and planning | Geological Aspects of East Java | Discussion | [BT+BM:2x(3x60”)] | Diskusi  **Tugas-K10 :Resume Geowisata Jawa Timur** | the accuracy of explaining | 5% |
| 11 | [C4,P4,A4]  Students are able to analyse the aspects of geotourism, do the simulation and planning | Determination of rare, interesting, historical, and preservable geological aspects in East Java | Discussion | [BT+BM:2x(3x60”)] | Presentation | the accuracy of explaining | 10% |
| 12 | [C4,P4,A4]  Students are able to analyse the aspects of geotourism, do the simulation and planning | East Java geotourism potential site visit  -Mud Volcano  -Sites | Field Discussion | TM: 1x(3x50”)  [BT+BM:2x(3x60”)] | Discussion  **Assignment-K12 : East Java Geotourism Resume** | the accuracy of explaining | 5% |
| 13 | [C4,P4,A4]  Students are able to analyse the aspects of geotourism, do the simulation and planning | East Java geotourism potential site visit  -Post-mining  -Geothermal  -Volcanoes | Field Discussion | TM: 1x(3x50”)  [BT+BM:2x(3x60”)] | Discussion  **Assignment-K13 : East Java Geotourism Resume** | the accuracy of explaining | 5% |
| 14 | [C4,P4,A4]  Students are able to analyse the aspects of geotourism, do the simulation and planning | East Java geotourism potential site visit  -Beaches, Rivers, Lakes  -Karst | Field Discussion | TM: 1x(3x50”)  [BT+BM:2x(3x60”)] | Discussion  **Assignment-K13 : East Java Geotourism Resume** | the accuracy of explaining | 5% |
| 15 | [C4,P4,A4]  Students are able to analyse the aspects of geotourism, do the simulation and planning | Geotourism planning: Promotion, mapping, geotourism management planning | Guest Lecture | TM: 1x(3x50”) | Discussion | the accuracy of explaining |  |
| 16 | End Semester Evaluation | | | | | | 30% |

**REFERENCES :**

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| 1. Gray. M., 2005. Geodiversity and Geoconservation: What, Why, and How ?. Geodiversity & Geoconservation. The George Wright Forum, V. 22 No.3, 12 hal.  2. UNESCO, 2007, Guidelines and criteria for National Geoparks seeking UNESCO’s assistance to joint the GlobalGeoparks Network.  3. Brahmantyo, B., 2006. Klasifikasi Geomorfologi. Laboratorium Geomorfologi Institut Teknologi Bandung, Bandung  4. Bemmelen, R.W. van, 1949, Geology of Indonesia, Vol. IA, Martinus Nijhoff, The Hague, Netherland. Bennet, M.R. & P. Doyle, 1996. In: M.R. Bennet, P. Doyle, J.G. Larwood & C.D. Prosser (Eds.). Geology on your doorstep. Geological Society London, 3-10.  5. Jurnal dan laporan studi kasus |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Geophysical Instrumentation |
| **Course Code** | RF184630 |
| **Semester** | 3 (T:2, R:1) SKS |
| **Credit** | VI (Six) |
| **Lecturer** |  |

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| **Study Materials** | Electricity, Mathematics, Programming, Sensors, Geophysical instrumentation | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.2 | being able to show independent, quality, and measurable performance, |
| **Knowledge** | 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| **LO - Course** | [C3, P3, A3] Students are able to apply the work principle of instrumentation and application of electronic instrumentation related to geophysical methods. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | Students are able to understand the basic concept of instrumentation system | The basic concept of instrumentation system | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion | Activeness, interaction | - |
| 2 | Students are able to understand the concept of OP AMP (Operational Amplifier) | Op Amp (Operational Amplifier) | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion, assignment | Assignment result | 5% |
| 3 | Students are able to understand the application of Op-amp for signal filtering | Op Amp (Operational Amplifier) for signal filtering | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion | Activeness, interaction | - |
| 4 | Students are able to understand the application of Op-amp for voltage and current adjustment | Op Amp (Operational Amplifier) for voltage and current adjustment | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion, quiz | Quiz result | 10% |
| 5 | Students are able to understand the principle of sensor and transducer application | Sensor dan transducer | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion, practicum | Practicum result | 5% |
| 6 | Students are able to understand the application of sensor and transducer | The application of sensor and transducer | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion, practicum | Practicum result | 5% |
| 7 | Students are able to understand the application of Op-Amp and sensor | The application of Op Amp and sensor | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion | Activeness, interaction | - |
| 8 | Mid Semester Evaluation | | | | | | 25% |
| 9 | Students are able to understand the geoelectrical instrumentation | Geolectrical instrumentation | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion | Activeness, interaction | - |
| 10 | Students are able to understand the seismic instrumentation | Seismic instrumentation | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion, assignment | Assignment result | 5% |
| 11 | Students are able to understand the magnetic instrumentation | Magnetic instrumentation | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion | Activeness, interaction | - |
| 12 | Students are able to understand the electromagnetic instrumentation | Electromagnetic instrumentation | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion, quiz | Quiz result | 10% |
| 13 | Students are able to understand the gravitymetric instrumentation | Gravitymetric instrumentation | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion, practicum | Practicum report | 5% |
| 14 | Students are able to understand the laboratory equipment instrumentation | laboratory equipment instrumentation | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion, practicum | Practicum report | 5% |
| 15 | Students are able to understand the laboratory equipment instrumentation | laboratory equipment instrumentation | Direct Lecture  120 minutes  Discussion  30 minutes | 150 minutes | Presentation, discussion | Activeness, interaction | - |
| 16 | End Semester Evaluation | | | | | | 25% |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Exploration Management |
| **Cource Code** | RF184631 |
| **Semester** | VI (Six) |
| **Credit** | 3 (T:3) SKS |
| **Lecturer** | Dr. Ayi Syaeful Bahri, S.Si., M.T. |

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| **Study materials** | Geophysical exploration management concepts and functions: HR management functions, organization concepts and systems of exploration, arranging and managing teamwork, leadership and Human Resources, functions and planning processes; Planning techniques and methods; Assessing the feasibility of exploration / activities; Special Topic. | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.6 | understanding the complete operational knowledge related to the field of geophysical engineering technology; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| **LO – Course** | [C4,P4,A4] Able to applied and analyze a geophysical exploration activity with the aim of sustainability and efficiency (K3L) in exploration activities. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4] [Conceptual knowledge, analyze] Students are able to understand the Basic Concepts of Exploration Management | Introduction of the Method, Introduction of Exploration Management  [K1]: Introduction of General Management | Introductory Lecture, contract and  brainstorming; | TM: 2x(4x50”) | Discussion; (applied and development of Modern Management); Task-K1: Make a resume about basics of field management | Get to know the basic concepts of management | 5% |
| 2 | [C4,P4,A4][Conceptual knowledge, analyze]: Students are able to understand the Basic Concepts of Exploration Management | The Basic Concepts of Exploration Management | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion; (Basic concepts and principles of field management); | Accuracy of explanation |  |
| 3 | [C4,P4,A4][Conceptual knowledge, analyze]: Mastering the concepts and functions of HR management | The concepts and functions of HR management | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion; (HR management concepts and functions); | The accuracy of comparing and explaining |  |
| 4 | [C4,P4,A4][Conceptual knowledge, analyze]: Mastering the concepts and functions of HR management | The concepts and functions of HR management | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion; (HR management concepts and functions); | The accuracy of comparing and explaining |  |
| 5 | [C4,P4,A4][Conceptual knowledge, analyze]: Being able to explain the theoretical concepts, HR management functions in the field | The concepts and functions of HR management | Direct Lecture, Discussion; | TM: 2x(4x50”); | Presentation (case study)  K2: The task of making a resume about the HR management function and presenting it (task per group one case study) | The accuracy of comparing and explaining | 20% |
| 6 | [C4,P4,A4][Conceptual knowledge, analyze]: Being able to explain the theoretical concepts, HR management functions in the field | The concepts and functions of HR management | Direct Lecture, Discussion; | TM: 2x(4x50”); | Presentation (case study) | The accuracy of comparing and explaining |  |
| 7 | [C4,P4,A4][Procedural knowledge, analyze]:  Mastering the concept of geophysical exploration organization and management system | Geophysical exploration organization and management system | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion;  geophysical exploration organization and management system | The accuracy of comparing and explaining |  |
| 8 | Mid Semester Evaluation | | | | | | 20% |
| 9 | [C4,P4,A4][Procedural knowledge, analyze]: Mastering the concepts, principles and techniques of 1D and 2D modeling in the resistivity method | Geophysical exploration organization and management system | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion;  geophysical exploration organization and management system | The accuracy of comparing and explaining |  |
| 10 | [C4,P4,A4][Conceptual knowledge, analyze]: Mastering in compiling and managing teamwork | Organize and manage teamwork | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion;  Arrange and manage work teams | The accuracy of comparing and explaining |  |
| 11 | [C4,P4,A4][Procedural knowledge, analyze]: Mastering the concept and application of leadership and Human Resources | The concept and application of leadership and Human Resources | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion;  Leadership and human resources | The accuracy of comparing and explaining |  |
| 12 | [C4,P4,A4][Procedural knowledge, analyze]: Mastering the functions and planning processes of geophysical exploration | The concept and application of the geophysical exploration planning process | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion;  the applied of the geophysical exploration planning process | The accuracy of comparing and explaining |  |
| 13 | [C4,P4,A4][Procedural knowledge, Analyze]:  Being able to know the worthiness of geophysical exploration activities | The concept and application of geophysical exploration activities | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion;  the applied of geophysical exploration activities | The accuracy of comparing and explaining |  |
| 14 | [C4,P4,A4][Procedural knowledge, analyze]: Being able to know the worthiness of geophysical exploration activities | The concept and application of geophysical exploration activities | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion;  the applied of geophysical exploration activities  **Task K3: make a project per person (individual assignment) and present** | The accuracy of comparing and explaining | 25% |
| 15 | [C4,P4,A4][Procedural knowledge, analyze]: Being able to know the worthiness of geophysical exploration activities | The concept and application of geophysical exploration activities | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion;  the applied of geophysical exploration activities  **Task K3: make a project per person (individual assignment) and present** | The accuracy of comparing and explaining |  |
| 16 | End Semester Evaluation | | | | | | 30% |

**REFERENCES :**

1. Brown W, Exploration in Management, a Pelican Book Publisher

2. Soeharto, Iman., Manajemen proyek: Dari Konseptual sampai Operasional, Erlangga, 1997.

3. Jurnal dan laporan studi kasus

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Geographic Information Systems |
| **Course Code** | RF184632 |
| **Semester** | VI (Six) |
| **Credit** | 3 (Three) SKS |
| **Lecturer** | M.Singgih Purwanto, S.Si., M.T. |

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| **Study Materials** | Mapping, Geology | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.8 | understanding the principle and methods of mapping application that required in general geophysical engineering work; |
| **Specific Skills** | 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| **LO - Course** | [C3,P3,A3] Students are able to apply the concept and application of GIS, able to develop GIS and manage spatial data using GIS technology. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | Students are able to understand the learning subjects in this lecture,  Students are able to explain the scope of Geographic Information Systems in Geophysics | * GIS definition * GIS concept * Application of GIS in Geophysics | Direct Lecture  Discussion | 120 minutes  30 minutes | Discussion | Activeness in Discussion |  |
| 2 - 3 | Students are able to understand The concept of Coordinate Systems and Transformation | * 2D and 3D Coordinate Systems * Map Projection : UTM, Mecartor | Direct Lecture  Discussion | 50 minutes  100 minutes | Presentation | 1.Presentation layout format  2. Material Comprehension | 5 %  10 % |
| 4 - 5 | Students are able to understand the data structure in GIS | * Spatial Data and its types * Data Attributes and its types | Direct Lecture  Assignment | 150 minutes  150 minutes | Assignment: getting example of spatial data and attributes | Suitability of the task with the results | 5 % |
| 6 | Students are able to understand the input data in GIS. DEM data, and spatial operations | * Data from satellite image * Data topographic map | Direct Lecture  Discussion | 120 minutes  30 minutes | Discussion | Activeness in Discussion |  |
| 7 | Students are able to explain map visualisation based on cartographic rules | * Scales * Legends * Map Format | Direct Lecture  Assignment | 150 minutes  150 minutes | Cartographic mapping | Suitability of the task with the results | 5 % |
| 8 | **Mid Semester Evaluation** | | | | | | 25 % |
| 9 - 10 | Students are able to explain the data quality | * Vector Data * Raster Data | Direct Lecture  Discussion | 120 minutes  30 minutes | Discussion | Activeness in Discussion |  |
| 11 - 12 | Students are able to conduct a simple analysis in GIS | * Spatial data analysis * Visual data analysis | Direct Lecture  Discussion | 120 minutes  30 minutes | Discussion | Activeness in Discussion |  |
| 13 - 14 | Students are able to explain the concept of simple modelling in GIS | * correlate spatial data with data attribute | Direct Lecture  Assignment | 150 minutes  150 minutes | Cartographic mapping | Suitability of the task with the results | 5 % |
| 15 | Students are able to make a simple map using GIS in Geophysics field | * Geothermal manifestations map | Presentation | 150 minutes | Geothermal manifestation mapping | 1.Presentation layout format  2. Material Comprehension  3.Suitability of the task with the results | 15 % |
| 16 | **End Semester Evaluation** | | | | | | 30 % |

**REFERENCES :**

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| * + - 1. Puntodewo, Atie, Dkk.2003. Sitem Informasi Geografi Untuk Pengelolaan SDA. Center for International Forestry Research       2. Gorr, W. L. dan K. S. Kurland, 2008, GIS Tutorial Basic Workbook, ESRI Press.       3. Rolf, A. (editor), 2001, Principles of Geographic Information Systems, ITC Educational Textbook Series, ITC Enschede, The Netherlands.       4. Christman, N., 1997, Exploring Geographic Information Systems, John Wiley and Sons, New York. |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Applied Seismology |
| **Cource Code** | RF184633 |
| **Semester** | VI (Six) |
| **Credit** | 3 (T:3) SKS |
| **Lecturer** | Firman Syaifuddin, S.Si., M.T. |

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| **Study materials** | Wave, Geology | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyze and design system, process, product, or component in geophysics engineering in deep; |
| 3.2 | understanding geological knowledge that required to understand the geological process of a natural phenomenon by its characteristics; |
| 3.3 | understanding the theoretical concept of statistics to define the process complexity of a natural phenomenon; |
| 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyze and design system, process, product, or component in geophysics engineering in deep; |
| 3.7 | understanding the factual insights and technology application methods; codes and national/international standards as well as the regulations in force in his/her work area to carry out geophysical engineering technology work in depth; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented and poured in the form of scientific papers. |
| **LO – Course** | [C3,P3,A3] Students can apply seismology in engineering field, being able to make seismic zoning based on measurement data from microtremor and downhole seismic survey in determining Vs30. Being able to classify soil types based on geotechnical parameters. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C3, P3,A3]  Understanding what will be learned in this lecture.  Understanding the basic foundations of applied seismology. | 1. Introduction to Lecture:    • Semester Learning Plans    • College Contracts    • Scoring system  2. Review seismology courses | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion;  Make a summary | Understanding what will be learned in this lecture  Being able to explain the basic principles of applied seismology | "5%  Task " |
| 2 | [C3, P3,A3]  Understanding the concept of Ground Motion caused by earthquake events | Ground Motion | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Being able to explain the concept of Ground Motion caused by earthquake events | "5%  Task " |
| 3 | [C3, P3,A3]  Understand the concept of earthquake acceleration and the effects caused during an earthquake | Earthquake acceleration | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Being able to explain the concept of earthquake acceleration and the effects caused during an earthquake | "5%  Task " |
| 4 | [C3, P3,A3]  Knowing the concept of Seismic Zoning and microzonation | Seismic Zoning and microzonasi | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  **Quiz-01** | Being able to explain the concepts of Seismic Zoning and microzonation | "5%  Task "  **15%  Quiz** |
| 5 | [C3, P3,A3]  Knowing the concept of the local land effect on the destructive force caused by earthquake events | Local land effect | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Being able to explain the concept of the local land effect on the destructive force caused by earthquake events | "5%  Task " |
| 6 | [C3, P3,A3]  Able to classify soil types related to seismic activities | Classification of soil types | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to classify soil types related to seismic activities | "5%  Task " |
| 7 | [C3, P3,A3]  Able to explain the impact of an earthquake | Force due to earthquake | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Being able to explain the impact of an earthquake | "5%  Task " |
| 8 | Mid Semester Evaluation | | | | | | 40% |
| 9 | **[C3, P3,A3]**  Knowing the concept and conducting Probabilistic Seismic Hazard Analysis | Probabilistic Seismic Hazard Analysis | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Knowing the concept and conducting Probabilistic Seismic Hazard Analysis | "5%  Task " |
| 10 | **[C3, P3,A3]**  Knowing the concept and conducting Deterministic Seismic Hazard Analysis | Deterministic Seismic Hazard Analysis | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Knowing the concept and conducting Deterministic Seismic Hazard Analysis | "5%  Task " |
| 11 | [C3, P3,A3]  Knowing the concepts of measurement, processing and interpretation of microtremor data | Microtremor | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain concepts and be able to measurements, processing and interpretation of microtremor data | "5%  Task " |
| 12 | [C3, P3,A3]  Knowing the concept of measuring, processing and interpreting Downhole seismic survey data | Downhole seismic survey | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  **Quiz-02** | Knowing the concept of measuring, processing and interpreting Downhole seismic survey data | "5%  Task " |
| 13 | [C3, P3,A3]  Able to Interpretation of geotechnical data | Interpretation of geotechnical data | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to Interpretation of geotechnical data | "5%  Task " |
| 14 | [C3, P3,A3]  Knowing the seismic design concept of earthquake resistant buildings | Seismic design | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the seismic design concept of earthquake resistant buildings | "5%  Task " |
| 15 | [C3, P3,A3]  Being able to analyze and prepare earthquake disaster mitigation documents | Earthquake disaster mitigation | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to analyze and prepare earthquake disaster mitigation documents | "5%  Task " |
| 16 | End Semester Evaluation | | | | | | 40% |

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1. Maugeri, M, 2014, Earthquake Geotechnical Engineering Design, GEOTECHNICAL, GEOLOGICAL AND EARTHQUAKE ENGINEERING, Volume 28,Springer,London.
2. AKKAR, S., 2011, EARTHQUAKE DATA IN ENGINEERING SEISMOLOGY GEOTECHNICAL, GEOLOGICAL AND EARTHQUAKE ENGINEERING, Volume 14, Springer, London.
3. Yoshida, N., 2015, Seismic Ground Response Analysis, GEOTECHNICAL, GEOLOGICAL AND EARTHQUAKE ENGINEERING, Volume 36, Springer, London

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Geothermal Exploration |
| **Cource Code** | RF184734 |
| **Semester** | VII (Seven) |
| **Credit** | 3 (T:3) SKS |
| **Lecturer** | Dr. Widya Utama. DEA |

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| **Study materials** | Geophysics, Geology, Geochemistry | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysics engineering in deep; |
| 3.6 | understanding the complete operational knowledge related to the field of geophysical engineering technology; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.12 | understanding the concept, principle, workshop procedure, studio and laboratory activities, and Health and Safety Environment (HSE) in general; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented and poured in the form of scientific papers. |
| **LO – Course** | [ C3, A2, P3 ] Students are able to understand the total geothermal project work. Students are able to make a simple economic analysis and legal study of the development geothermal potential in the context of national energy empowerment. Students are able to do exploratory work order in the study of the geothermal potential area. Students are able to construct a simple conceptual model of a geothermal reservoir and evaluate the reservoir model also present it in the form of a geothermal energy prospect proposal that is usually used for completing IUP bidding documents at the Ministry of Energy and Mineral Resources. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4]  Students are able to understand the fundamental of Geothermal. | Introduction to the EM Method, the development of the EM method and general applications  K1: introduction to EM methods and their development.ppt | Introductory Lecture, contract and  brainstorming; | TM: 2x(4x50”) | Discussion, | Get to know EM application in general |  |
| 2 | [C4,P4,A4]  Students are able to explain the importance of risk analysis of the development geothermal energy in an area. | Basic principles  EM methods, Maxwell's Equation  K2: Electric Field Equation, Magnetic Field and Maxwell Equation | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion, | the accuracy of explaining |  |
| 3 | [C4,P4,A4]  Students are able to explain the processing of geological exploration data for preliminary studies of geothermal potential areas | Processing geological exploration data for preliminary studies of geothermal potential areas | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion, | the accuracy of explaining |  |
| 4 | [C4,P4,A4]  Students are able to explain the processing of geological exploration data for preliminary studies of geothermal potential areas | Processing geological exploration data for preliminary studies of geothermal potential areas | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion, | the accuracy of explaining |  |
| 5 | [C4,P4,A4]  Students are able to apply geophysical exploration data processing to delineation of potential geothermal prospects | Processing geophysical exploration data for delineation of potential geothermal prospects | Direct Lecture, Discussion; | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Practicum | The accuracy of applying the suitable filter to improve the data quality | 10% |
| 6 | [C4,P4,A4]  Students are able to apply geophysical exploration data processing to delineation of potential geothermal prospects | Processing geophysical exploration data for delineation of potential geothermal prospects | Direct Lecture, Discussion; | TM: 1x(4x50”) | Discussion, | the accuracy of explaining and comparing | 10% |
| 7 | [C4,P4,A4]  Students are able to explain the study of geology data | Study of geology data | Direct Lecture, Discussion; | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | **Task 6**: make a resume paper using the CSAMT and AMT methods –(Practicum) | The accuracy of applying the suitable filter to improve the data quality | 10% |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | [C4,P4,A4]  Students are able to explain the study of geology data | Study of geology data | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion, | the accuracy of explaining |  |
| 10 | [C4,P4,A4]  Students are able to explain geothermal geophysics | Students are able to explain geothermal geophysics | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion, | the accuracy of explaining |  |
| 11 | [C4,P4,A4]  Students are able to explain geothermal geophysics | Students are able to explain geothermal geophysics | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion,  Journal Resume | the accuracy of explaining | 10% |
| 12 | [C4,P4,A4]  Students are able to explain the geochemistry for the geothermal potential prospect area. | Geochemistry for the geothermal potential prospect area. | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion, | the accuracy of explaining |  |
| 13 | [C4,P4,A4]  Students are able to explain the geochemistry for the geothermal potential prospect area. | Geochemistry for the geothermal potential prospect area. | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion,  Practicum | the accuracy of explaining |  |
| 14 | [C4,P4,A4]  Students are able to make an integrative study report for the geothermal potential prospects area. | Making of an integrative study report on the prospects for the geothermal potential area. | Practicum | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Discussion,  Practicum | the accuracy of explaining |  |
| 15 | [C4,P4,A4]  Students are able to make an integrative study report for the geothermal potential prospects area. | Making of an integrative study report on the prospects for the geothermal potential area | Practicum | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Discussion,  Practicum | the accuracy of explaining |  |
| 16 | End Semester Evaluation | | | | Report Presentation |  | 30% |

**REFERENCES :**

1. Handbook of Geothermal Energy,Editors: Edwards, L.M., Chilingar, G.V. et al. , Gulf Publishing Company, 1982, 613 pp.
2. Goff, F., Janik, C.J. (2000), Geothermal Systems, Editors: Haraldur Sigurdsson, Encyclopedia of Volcanoes, Academic  
   Press, pp. 817-834

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Geotomography |
| **Cource Code** | RF184735 |
| **Semester** | VII (Seven) |
| **Credit** | 4 (Four) SKS |
| **Lecturer** | Juan Pandu Gya Nur Rochman, S.Si., M.T. |

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| **Study materials** | Programming, Geophysics | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysics engineering in deep; |
| 3.6 | understanding the complete operational knowledge related to the field of geophysical engineering technology; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.12 | understanding the concept, principle, workshop procedure, studio and laboratory activities, and Health and Safety Environment (HSE) in general; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented and poured in the form of scientific papers. |
| **LO – Course** | [C4, P3,A3] Students are able to apply the basic concepts of seismic and electric tomography imaging technology also create simple tomography programs. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Assessment** | | |
| **Criteria and Indicators** | **Student’s Learning Experience** | **Weight (%)** |
| **1-2** | Knowing what will be learned in this lecture,  Being able to explain the scope of Geotomography studies | * + Geotomography concept overview   + Developmental History   + The application | Lecture  120 minutes  Discussion  30 minutes | * Liveliness in discussion * Task completion * Match the contents of the task | **Task 1:**  Make a college resume  220 minutes  Assignments and independent learning  Response:  Make a resume for chapter 1 of the reference | 10% |
|  |
| **3-4** | Understanding the basic concepts of the Seismic Tomography Method | * Metode Seismik Tomografi * Overview Parameterisasi Model and Inversi | Lecture  240 minutes  Discussion  60 minutes | * Liveliness in discussion * Task completion * Match the contents of the task | **Task 2:**  Make a college resume  220 minutes  Assignments and independent learning |  |
| **5** | Able to understand the theoretical concepts of the Transformation Technique Method,  Fourier Projection Theorem, Back Projection and theorem  Series Expansion Technique Method | * Transformation Techniques * Fourier theorem * Back Projection * Method of Series Expansion | Lecture  240 minutes  Discussion  60 minutes | * Liveliness in discussion * Task completion * Match the contents of the task | **Task 3:**  Make a college resume  220 minutes  Assignments and independent learning  **Quiz 1:** |  |
| **6-7** | Able to do Forward Modeling in Seismic Tomography | * Ray Tracing * Bending Method * Full Wave Equation (Finite difference and finite element) | Lecture  240 minutes  Discussion  60 minutes | * Liveliness in discussion * Task completion * Match the contents of the task | **Task 4:**  Make a college resume  220 minutes  Assignments and independent learning  Forward Modeling Practicum |  |
| **8** | **Mid Semester Evaluation (Formative Evaluation-Evaluation which is intended to improve the learning process based on the assessment that has been done)** | | | | | |
| **9-10** | Understanding the fundamental of inversion in Seismic Tomography. | * Seismic Inversion Tomography * Inversion of the Series Expansion Method (SVD and Gauss Newton) * Back Projection Technique (BPT) | Lecture  240 minutes  Discussion  60 minutes | * Liveliness in discussion * Task completion * Match the contents of the task | **Task 6:**  Make a college resume  220 minutes  Assignments and independent learning |  |
| **11-12** | Understanding the SIRT method (Simultaneous Iterative Reconstruction Technique) and Algebraic Reconstruction Technique (ART) method. | * SIRT (Simultaneous Iterative Reconstruction Technique) * Algebraic Reconstruction Technique (ART) | Lecture  240 minutes  Discussion  60 minutes | * Liveliness in discussion * Task completion * Match the contents of the task | **Task 7:**  Make a college resume  220 minutes  Assignments and independent learning |  |
| **13-14** | Being able to apply the Seismic Tomography for global and regional scale. | Application of Seismic Tomography for depiction of a subduction zone | Lecture  240 minutes  Discussion  60 minutes | * Liveliness in discussion * Task completion * Match the contents of the task | **Task 8:**  Make a college resume  220 minutes  Assignments and independent learning  **Quiz 2:** |  |
| **15** | Being able to understand the application of tomographic in Cross Hole Seismic, Electrical Resistance Tomography (ERT), VLF (Very Low Frequency) | * Tomography ERT (Electrical Resistivity Tomography) * Cross hole tomography of the tunnel case * Radar Tomography | Students present the results of a literature study  **300** minutes | * Submission of material * Mastery of material * Active in discussion | Presentation |  |
| **16** | **Final Semester Evaluation (Evaluation intended to find out the final achievement of student learning outcomes)** | | | | | |

**REFERENCES :**

1. Wang, Y. “Seismic Amplitude Inversion in Reflection Tomography”, Elsevier science, 2003.
2. Iyer H.M. and Hirahara, K. (Ed.), 1993. Seismic Tomography: Theory and Practice. Chapman & Hall, London.
3. Nolet, G. (Ed.), 1987. Seismic Tomography with applications in global seismology and exploration geophysics. D. Reidel Publishing Company, Dordrecht.

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Integrated Field Survey |
| **Course Code** | RF184736 |
| **Semester** | VII (Seven) |
| **Credit** | 4 (Four) SKS |
| **Lecturer** |  |

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| **Study Materials** | Geology, Geophysics | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysical engineering in depth; |
| **Specific Skills** | 4.5 | being able to design a system, process, and component by analytical approach and technical standard, performance aspect, reliability, simplicity of application, and sustainability consideration, also take heed on economic factors, public health and safety, cultural, social and environment; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| **LO - Course** | [C4,P4,A4] Students are able to compare exploration methods and integrate as well as conduct the methods in geological and geophysical field survey. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1- 2 | Students are able to explain the resistivity 2D | 1. Determine resistivity value distribution in research area 2. Determine the lithology of research area. | Practicum | 1 x 50'  3 x 50' | Being able to Determine resistivity value distribution and the lithology in research area. | 1.Subject comprehension  2.Suitability of the task and the result | 10 % |
| 3 - 4 | Students are able to explain about Vertical Electrical Sounding (VES) | 1. Determine resistivity value distribution in research area 2. Determine the lithology of research area. | Practicum | 1 x 50'  3 x 50' | Being able to Determine resistivity value distribution and the lithology in research area. | 1.Subject comprehension  2.Suitability of the task and the result | 10% |
| 5- 6 | Students are able to explain the magnetic method | 1. Determine susceptibility value of research area 2. Understand magnetic anomaly of mud volcano | Practicum | 1 x 50'  3 x 50' | Being able to Determine susceptibility value and the lithology in research area. | 1.Subject comprehension  2.Suitability of the task and the result | 10% |
| 7 | Students are able to explain the seismic refraction method | Understand the wave arrival time on each layers | Practicum | 1 x 50'  3 x 50' | Being able to understand the wave arrival time on each layers | 1.Subject comprehension  2.Suitability of the task and the result | 10% |
| 8 | Mid Semester Evaluation | | | | | | 10 % |
| 9 | Students are able to explain the seismic reflection method | Understand the wave arrival time on each layers | Practicum | 1 x 50'  3 x 50' | Being able to understand the wave arrival time on each layers | 1.Subject comprehension  2.Suitability of the task and the result | 10 % |
| 10 - 12 | Students are able to explain VLF method | 1. Understand rock structure in sub-surface 2. Understand conductivity effect on sub-surface structure. | Practicum | 1 x 50'  2.x 50' | Being able to understand rock structure in sub-surface and conductivity effect on sub-surface structure. | 1.Subject comprehension  2.Suitability of the task and the result | 10 % |
| 13 - 14 | Students are able to explain microtremor method | Understand the characteristics of soil layers based on its dominant period/natural frequency  parameters and wave amplification factors | Practicum | 1 x 50'  3 x 50' | Being able to understand the characteristics of soil layers based on its dominant period/natural frequency  parameters and wave amplification factors | 1.Subject comprehension  2.Suitability of the task and the result | 10 % |
| 15 | Students are able to explain the geology observation | 1. Understand structural geology in research area 2. Understand local geology and regional geology of research area | Practicum | 1 x 50'  3 x 50'   * 1. 3 x 50'0' | Being able to Understand structural geology, local geology and regional geology of research area | 1.Subject comprehension  2.Suitability of the task and the result | 10 % |
| 16 | End Semester Evaluation | | | | | | 10 % |

**REFERENCES :**

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| * + - 1. Telford et al., Applied Geophysics, Cambridge Univ. Press, 1976       2. Reynolds, J.M., An Introduction to applied and environmental Geophysics. John Wiley and Sons, 1997.       3. Sheriff, R.E., dan L.P. Geldart, Exploration Seismology. Cambridge Univ. Press, 1995.       4. Grant & West, Interpretation Theory in Applied Geophysics, Mc. Graw-Hill Book Company, 1965. |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Seminar |
| **Cource Code** | RF184737 |
| **Semester** | VII (Seven) |
| **Credit** | 2 (T:2) SKS |
| **Lecturer** | Dr. Widya Utama, DEA |

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| **Study materials** | Scientific Writing, Language | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| **Knowledge** | 3.8 | understanding the principle and methods of mapping application that required in general geophysical engineering work; |
| **Specific Skills** | 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented and poured in the form of scientific papers; |
| **LO – Course** | [C3.P3,A3] Students are able to understand how to think scientifically, study topics for final assignments from national and international journals and present them in oral and scientific work papers. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C3.P3,A3]  Students are able to understand scientific reports | [K1]:  Lecture contract, introduction to scientific reports | Direct Lecture, Discussion, compare several writings and reports | TM: 1x(3x50”) | Discussion | Accuracy in understanding the structure of scientific reports |  |
| 2 | [C3.P3,A3]  Students are able to understand the structure of scientific reports | [K2]:  Structure of scientific reports | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | Accuracy in understanding the structure of scientific reports |  |
| 3 | [C3.P3,A3]  Students are able to understand Indonesian grammar in scientific reports | [K3]:  Language with correct Indonesian structure | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion[Task 3]: arrange sentences that are standard and correct | Accuracy in understanding correct scientific report sentences in Bahasa. | 10% |
| 4 | [C3.P3,A3]  Students are able to understand English grammar in scientific reports | [K4]:  English with the correct structure | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | Accuracy in understanding correct scientific report sentences in English |  |
| 5 | [C3.P3,A3]  Students are able to understand how to make good picture table illustrations in scientific reports | [K5]:  Format table and picture | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | The accuracy of understanding |  |
| 6 | [C3.P3,A3]  Students are able to understand how to make good picture table illustrations in scientific reports | [K6]:  Format table and picture | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | The accuracy of understanding |  |
| 7 | [C3.P3,A3]  Students are able to understand how to make good picture table illustrations in scientific reports | [K7]:  Format table and picture | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | The accuracy of understanding |  |
| 8 | **Mid Semester Evaluation** | | | | | | 30% |
| 9 | [C3.P3,A3]  Students are able to apply Ms.Words in scientific reports | [K9]:  Ms. Word optimization in making reports | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | The accuracy of understanding |  |
| 10 | [C3.P3,A3]  Students are able to compile of abstracts and introductory chapters | [K10]:  Format abstract and introductory | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | The accuracy of understanding |  |
| 11 | [C3.P3,A3]  Students are able to compile a literature review and theoretical basis | [K11]:  Format literature review and theoretical basis | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion[Task 11] : Make abstracts to the literature review chapter | The accuracy of understanding | 10% |
| 12 | [C3.P3,A3]  Students are able to compile the methodology chapter and research results | [K12]:  Format of research methodology and results | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | The accuracy of understanding |  |
| 13 | [C3.P3,A3]  Students are able to compile references and citations | [K13]:  Format bibliography and citations | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion[Task 13] : Create methodologies to bibliography | The accuracy of understanding | 10% |
| 14 | [C3.P3,A3]  Students are able to make publications | [K14]:  Paper, journal and poster format | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | The accuracy of understanding |  |
| 15 | [C3.P3,A3]  Students are able to make scientific presentations | [K15]:  Scientific presentation format | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion[Task15] : make scientific presentations | The accuracy of understanding | 10% |
| 16 | **End of Semester Evaluation (Proposal)** | | | | | | 30% |

**REFERENCES :**

1. Briscoe, M.H., A guide to scientific illustrations
2. Cargill, M. dan O’Connor, P., Writing Scientific Research Article
3. Jurnal Kebumian

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Mineral Deposit Exploration |
| **Cource Code** | RF184839 |
| **Semester** | VIII (Eight) |
| **Credit** | 3 (T:3) SKS |
| **Lecturer** | Anik Hilyah, S.Si., M.T. |

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| **Study materials** | Geology, Mechanics, Mineral, Geophysics | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.2 | understanding geological knowledge that required to understand the geological process of a natural phenomenon by its characteristics; |
| 3.3 | understanding the theoretical concept of statistics to define the process complexity of a natural phenomenon; |
| 3.8 | understanding the principle and methods of mapping application that required in general geophysical engineering work; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.13 | mastering the insights of sustainable development in the geophysical exploration methodologies and natural resource management; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented and poured in the form of scientific papers. |
| **LO – Course** | [C4,P4,A4] Students can understand the fundamentals of exploration activities (concepts, models, principles, planning and exploration stages of mineral deposits), are able to integrate analysis up to the reserve estimation stage. Concept and models Mineral sediment exploration. The concept includes several mineral deposit genes. Exploration models include geological and geophysical models that are commonly used, for example: geological surveys, geoelectric, geomagnetic, induced polarized, drilling, gravity, seismic. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4]  Students are able to understand the geology structure and Earth Structure | Introduction to Earth Structure  [K1]: Earth Structure.ppt | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion; (Understanding of the constituent components of the Earth from the core to the crust and the relationship with the structural geology) | the accuracy of explaining |  |
| 2 | [C4,P4,A4]  Students are able to understand the Earth's crust deformation (Divergent, Convergent and Transform) | Introduction to Earth Crust Deformation  [K2]: Tectonic Deformation Part 1.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion; (Various types of tectonic displacement crust);  **Task-K2: Divergent, convergent, and transform process resumes** | Get to know Plate Movements |  |
| 3 | [C4,P4,A4]  Students are able to explain the differences between brittle and ductile | Introduction to Brittle and Ductile in plate crusts  [K3]: Brittle and Ductile.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion; (Brittle and Ductile);  **Task-K3: Exercise about Brittle and Ductile, Difference between Divergent Convergence and Transform** | Understand the difference between the Brittle and Ductile also the structure that results from both |  |
| 4 | [C4,P4,A4]  Students are able to analyze kinematics and dynamics in plate movements | The concepts of kinematics and dynamics in structural geology  [K4]: Kinematics of Style.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion; (Plate tectonic dynamics);  **Task-K4: Make a Plate Motion Kinematics Resume** | Get to know a variety of plate movements from kinematic force dynamics |  |
| 5 | [C4,P4,A4]  Students are able to understand carbonate sedimentary rocks | The concept of stratigraphic sedimentary carbonate sedimentary rocks  [K5]: Introduction to carbonatan sedimentary rocks.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion; (carbonate sedimentary rocks);  **Quiz-K5: Clastic and carbonate sediments (constituent components)** | Get to know the components of carbonate rocks |  |
| 6 | [C4,P4,A4]  Students are able to understand the carbonate rock genesis (differences with clastic sedimentary rocks) | The concept of stratigraphic sedimentary carbonate sedimentary rocks  [K6]: Introduction to carbonate sedimentary rock genes.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion; (plate dynamics in geophysics); **Task-K6: Exercise about genesa carbonate sedimentary rock** | Get to know the genesa of carbonate sedimentary rocks |  |
| 7 | [C4,P4,A4]  Students are able to understand the origin of the sedimentary rock (genesis), its constituent components, texture, structure, minerals, then explain the depositional environment and its classification | The concept of stratigraphic sedimentary clastic and non-clastic sedimentary rocks  [K7]: Resume stratigraphic sediment of clastic and non-clastic sedimentary rocks | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion; (clastic and non-clastic sedimentary rocks);  **Task-K7: Exercise about resume differences between clastic and non-clastic sedimentary rocks** | Knowing the differences between clastic and nonclastic sedimentary rocks |  |
| 8 | **Mid Semester Evaluation** | | | | | | 30% |
| 9 | [C4,P4,A4] Students are able to understand the science of stratigraphy and the laws of stratigraphy | Introduction to stratigraphic sediments in the stratigraphic principle  [K9]: Introduction to the principle of stratigraphy.ppt | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion; (stratigraphic principle); | Get to know the laws in stratigraphic science |  |
| 10 | [C4,P4,A4]  Students are able to understand the differences between lithostratigraphy, chronostratigraphy, and biostratigraphy. | Introduction to lithostratigraphy, chronostratigraph, and biostratigraphy  [K10]: Introduction to advanced stratigraphy.ppt | Direct Lecture,  Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion; (understanding of stratigraphy); **Task-K10: Exercise about lithosphere, biostrat, and cronostrate** | the accuracy of explaining | 5% |
| 11 | [C4,P4,A4]  Students are able to analyze rock correlation | Basic concepts of sedimentary rock correlation (understanding datum / keybed)  [K11]: rock correlation.ppt | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion; | the accuracy of explaining and comparing |  |
| 12 | [C4,P4,A4]  Students are able to analyze rock correlations (lithocorrelation, biocorrelation, and chronocorrelation) | Understanding of the differences between lithocorrelation, biocorrelation, and chronocorrelation  [K12]: lithocorrelation, biocorrelation, chronocorrelation.ppt | Direct Lecture, Discussion;Video | TM: 1x(3x50”) | Discussion; **Quiz-K12 :Stratigraphyand Correlation** | the accuracy of explaining | 5% |
| 13 | [C4,P4,A4]  Students are able to read regional stratigraphy and its benefits | The basic concept of reading regional stratigraphy  [K13]: Regional Geological Map.ppt | Direct Lecture, Discussion;Video | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion; **Task-K13: Exercise to make a programming language about flow simulation in the earth** | the accuracy of explaining | 10% |
| 14 | [C4,P4,A4]  Students are able to understand the stratigraphic sequence | The concept of stratigraphic sequences  [K14]: Introduction to stratigraphic sequences | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion; | the accuracy of explaining |  |
| 15 | [C4,P4,A4]  Students are able to understand Rock Stratigraphy, Rock Correlation, Rock Sequences | Comprehensive understanding of stratigraphic sediments  [K15]: Jurnal.ppt | Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion; **Task-K15: Presentation and resume of stratigraphic sediments** | the accuracy of explaining |  |
| 16 | **End Semester Evaluation** | | | | | | 30% |

**REFERENCES :**

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| 1. Reynolds, J.M., 1997, An Introduction to Applied and Environmental Geophysics, John Wiley and Son. 2. Koesoemadinata, 2000, Geologi Eksplorasi 3. Peters, William C., 1978, Exploration and Mining Geology, John Wiley and Son 4. Telford, W.M., Geldart, L.P., Sherrif, R.E., 1990, Applied Geophysics, CambridgeUniv. Press. 5. Forrester, J.D., 1946, Principles of Field and Mining Geology, John Wiley and Son. |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Passive Electromagnetic Exploration |
| **Cource Code** | RF184840 |
| **Semester** | VIII (Eight) |
| **Credit** | 3 (T:2,P:1) SKS |
| **Lecturer** | Wien Lestari, S.T., M.T. |

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| **Study materials** | Wave, Mathematics, Geology | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysics engineering in deep; |
| 3.6 | understanding the complete operational knowledge related to the field of geophysical engineering technology; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.12 | understanding the concept, principle, workshop procedure, studio and laboratory activities, and Health and Safety Environment (HSE) in general; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented and poured in the form of scientific papers. |
| **LO – Course** | [C4,P4,A4] Students are able to understand the concepts, principles and techniques of system design, process or components of the Passive Electromagnetic Method (VLF, and MT) and carry them out procedurally starting from data collection, processing, analyzing the results of interpretation with subsurface geological conditions and modeling to solve geophysical engineering subsurface issue in mine exploration, hydrogeology, geotechnical engineering and the environment also responsible for the results of own work and groups through scientific reports and presentations. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4]  Students are able to understand the electromagnetic method (EM) and its development | Introduction to the EM Method, the development of the EM method and general applications  K1: introduction to EM methods and their development.ppt | Introductory Lecture, contract and  brainstorming; | TM: 2x(4x50”) | Discussion; | Get to know EM applications in general |  |
| 2 | [C4,P4,A4]  Students are able to explain the concept of EM methods | Basic principles  EM methods, Maxwell's Equation  K2: Electric Field Equation, Magnetic Field and Maxwell Equation | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion; | the accuracy of explaining |  |
| 3 | [C4,P4,A4]  Students are able to explain the concept of the EM-Magnetotelurik method | K3: Introduction to the magnetotelluric method, skin depth | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion; | the accuracy of explaining |  |
| 4 | [C4,P4,A4]  Students are able to explain the processing of the Magnetotellurik method | K4: introduction of the data processing stages of the MT method | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion; | the accuracy of explaining |  |
| 5 | [C4,P4,A4]  Students are able to apply processing Magnetotellurik method | K5: Case study, data processing | Direct Lecture, Discussion; | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Practicum | The accuracy of applying a good filter to improve data quality | 10% |
| 6 | [C4,P4,A4]  Students are able to explain the concept of CSAMT-AMT and apply Magnetotelurik processing methods | K6: Case study, data processing | Direct Lecture, Discussion; | TM: 1x(4x50”) | Discussion; | the accuracy of explaining and comparing |  |
| 7 | [C4,P4,A4]  Students are able to explain the concept of CSAMT-AMT and apply Magnetotelurik processing methods | K7 : CSAMT and AMT data processing | Direct Lecture, Discussion; | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Task 6: make a resume paper using the CSAMT and AMT methods -Practicum | The accuracy of applying a good filter to improve data quality | 10% |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | [C4,P4,A4]  Students are able to explain the concept of Very Low Frequency | K9 : Introduction to the VLF method | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion; | the accuracy of explaining |  |
| 10 | [C4,P4,A4]  Students are able to explain the processing phase of Very Low Frequency | K10 : Introduction to the processing stages | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion; | the accuracy of explaining |  |
| 11 | [C4,P4,A4]  Students are able to explain the processing step of Very Low Frequency | K11 : Introduction to the step of modeling and development of the VLF method | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion; Journal Resumes | the accuracy of explaining |  |
| 12 | [C4,P4,A4]  Students are able to apply the passive electromagnetic method | K12 : The development of the MT method | Direct Lecture, Discussion; | TM: 1x(4x50”); | Guest Lecture | the accuracy of explaining |  |
| 13 | [C4,P4,A4]  Students are able to apply the passive electromagnetic method | K12 : The development of the MT method | Practicum | TM: 1x(4x50”); | Practicum | the accuracy of explaining | 10% |
| 14 | [C4,P4,A4]  Students are able to apply the passive electromagnetic method | K14 : The development of the MT method | Direct Lecture, Discussion; | TM: 1x(4x50”); | Guest Lecture | the accuracy of explaining |  |
| 15 | [C4,P4,A4]  Students are able to apply the EM VLF method | K14 : Introduction to the processing step | Practicum | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Discussion; practicum | the accuracy of explaining | 10% |
| 16 | End Semester Evaluation | | | | Report presentation |  | 30% |

**REFERENCES :**

1.Telford, W., Geldart, L.P., Sheriff, R. E. (1976). Applied Geophysics.Cambridge Univ Press, Cambridge.

2. Griffiths, D. J. (1999). Introduction to Electrodynamics, 3rd ed., Prentice Hall.

3. Zhdanov, M. S. (2009). Geophysical Electromagnetic Theory and Methods. Elsevier.

4. Simpson, F. and Bahr, K. (2005). Practical Magnetotelluric. Cambridge.

5. Jurnal Geofisika

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Carbonate Exploration |
| **Cource Code** | RF184841 |
| **Semester** | VIII (Eight) |
| **Credit** | 3 (T:2,P:1) SKS |
| **Lecturer** | Dr. Ayi Syaeful Bahri, S.Si., M.T. |

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| **Study materials** | Definition of carbonate rocks, types, classification and general properties of rocks, calculating / measuring physical parameters of carbonate rocks; porosity, permeability, resistivity / conductivity, bulk modulus, aturation, wetability, capillarity and carbonate rocks as other Nature Herritage | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.2 | understanding geological knowledge that required to understand the geological process of a natural phenomenon by its characteristics; |
| 3.8 | understanding the principle and methods of mapping application that required in general geophysical engineering work; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented and poured in the form of scientific papers. |
| **LO – Course** | [C4,P4,A3] Students are able to apply and integrate geophysical methods to explore the physical properties of carbonate rocks as typical rocks (Nature Herritage). | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A3] [Conceptual knowledge, Analyze] Students are able to understand the Carbonate Rock Classification | Introduction; Definition and classification of Carbonate Rocks  [K1]: Introduction; Definition and classification of Carbonate Rocks | Introductory Lecture, contract and  brainstorming;  **(Task-K1: make a resume about the Carbonate Rock Classification and Definition)** | TM: 2x(4x50”) | Discussion;  (Carbonate Rock Classification and Definition); **Task-K1: Understanding the Carbonate Rock Classification and Definition** | Knowing the Classification and Definition of Carbonate Rocks | 5% |
| 2 | [C4,P4,A3][Conceptual knowledge, Analyze]: Able to explain the theoretical concept of carbonate rocks form as sedimentary rocks | The basic principle of the carbonate rocks form as sedimentary rocks | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion; (Concepts and basic principles of carbonate sedimentary rock formation); | the accuracy of explaining |  |
| 3 | [C4,P4,A3][Conceptual knowledge, Analyze]: Knowing the concepts and principles of Carbonate Rock Genesis and its depositional environment | Formation and carbonate depositional environments | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion; (Establishment Environment); **Task-K3: Understanding the Concept and Formation Environment** | the accuracy of explaining and comparing | 5% |
| 4 | [C4,P4,A3][Conceptual knowledge, Analyze]: Knowing the general physical properties of rocks and carbonate rocks | Physical characteristics of rocks and carbonate rocks | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion; (General Concept of the Physical Properties of Rocks) | the accuracy of explaining and comparing |  |
| 5 | [C4,P4,A3][Conceptual knowledge, Analyze]: Able to explain the theoretical concepts of the physical properties of rocks | Physical properties of rocks | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion; (Physical Properties of Rocks)) | the accuracy of explaining and comparing |  |
| 6 | [C4,P4,A3][Procedural knowledge, Analyze]: Able to explain the theoretical concepts of the physical properties of rocks | Physical properties of rocks | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion; (Physical Properties of Rocks)) | the accuracy of explaining and comparing |  |
| 7 | [C4,P4,A3][Procedural knowledge, Analyze]: Able to explain the theoretical concepts of the physical properties of rocks | Physical properties of rocks | Direct Lecture, Discussion; | TM: 2x(4x50”); | Discussion; (Physical Properties of Rocks)) | the accuracy of explaining and comparing |  |
| 8 | Mid Semester Evaluation | | | | | | 20% |
| 9 | [C4,P4,A3][Procedural knowledge, Analyze]: Able to understand and take measurements of physical parameters of rocks | Measurement of the physical properties of rocks | The practice of  measuring rock samples  in a Laboratory / class | Kerja Kelompok  2x(4x50”); | Discussion; (Physical Properties of Rocks)) | Accuracy in measuring, explaining and comparing rocks with their physical properties |  |
| 10 | [C4,P4,A3][Conceptual knowledge, Analyze]: Able to understand and take measurements of physical parameters of rocks | Measurement of the physical properties of rocks | The practice of  measuring rock samples  in a Laboratory / class | Kerja Kelompok  2x(4x50”); | Discussion; (Physical Properties of Rocks)) | Accuracy in measuring, explaining and comparing rocks with their physical properties |  |
| 11 | [C4,P4,A3][Procedural knowledge, Analyze]: Able to understand and take measurements of physical parameters of rocks | Measurement of the physical properties of rocks | The practice of  measuring rock samples  in a Laboratory / class | Kerja Kelompok  2x(4x50”); | Group Work  (Measurement of Physical Properties of Rocks) | Accuracy in measuring, explaining and comparing rocks with their physical properties | 20% |
| 12 | [C4,P4,A3][Procedural knowledge, Analyze]: Able to understand and take measurements of physical parameters of rocks | Presentation per Group; Measurement Results Physical properties of rocks | Student Presentations in  Classes | Kerja Kelompok  2x(4x50”); | Group Work  (Measurement of Physical Properties of Rocks) | Accuracy in measuring, explaining and comparing rocks with their physical properties | 10% |
| 13 | [C4,P4,A3][Procedural knowledge, Analyze]: Knowing the concepts and principles of Carbonate Rock Genesis and its depositional environment | The basic principle is the carbonate rocks form as sedimentary rocks | Carbonate Field Visit  around Surabaya | Kuliah Lapangan  6x50” | Group Work per site or location (field lecture | Accuracy in observing in the field |  |
| 14 | [C4,P4,A3][Procedural knowledge, Analyze]: Knowing the concepts and principles of Carbonate Rock Genesis and its depositional environment | The basic principle is the carbonate rocks form as sedimentary rocks | Carbonate Field Visit  around Surabaya | Kuliah Lapangan  6x50” | Group Work per site or location (field lecture | Accuracy in observing in the field |  |
| 15 | [C4,P4,A3][Procedural knowledge, Analyze]: Knowing the concepts and principles of Carbonate Rock Genesis and its depositional environment | The basic principle is the carbonate rocks form as sedimentary rocks | Carbonate Field Visit  around Surabaya | Kerja Kelompok  2x(4x50”); | Group Work per site or location (field lecture), Presented in Class | Accuracy in observing in the field | 20% |
| 16 | End Semester Evaluation | | | | | | 20% |

**REFERENCES :**

1. Schon, Physical Properties of Rock 8th Edition, Elsevier, Oxford UK, 2011

2. Telford, WM; Geldart, L.P; Sheriff, RE, 1998, Applied Geophysics, Cambridge Univ Press, Cambridge

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Passive Seismic Exploration |
| **Cource Code** | RF184842 |
| **Semester** | VIII (Eight) |
| **Credit** | 3 SKS (T:2,P:1) |
| **Lecturer** | Firman Syaifuddin, S.Si., M.T. |

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| **Study materials** | Wave, Geology | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.2 | understanding geological knowledge that required to understand the geological process of a natural phenomenon by its characteristics; |
| 3.3 | understanding the theoretical concept of statistics to define the process complexity of a natural phenomenon; |
| 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.7 | understanding the factual knowledge and technology application methods; national and international technical references (codes and standards) also regulations in their working area to carry out geophysical engineering technology work in depth; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented and poured in the form of scientific papers. |
| **LO – Course** | [C3,P3,A3] Students can understand the phenomena of naturally generated sesimic waves caused by fluid movement in hydrocarbon and geothermal reservoirs. Students can take measurements of passive seismic methods and know the types of tools used as passive seismic wave vibration recorders. Students are able to do passive seismic method data processing to get a picture of subsurface conditions in the form of both reservoir and non-reservoir. Students are able to analyze the phenomena and geological processes that occur based on the interpretation of data on passive seismic methods. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C3, P3,A3]  Understanding what will be learned in this lecture, understanding the basic foundations of the Passive Seismic method | Introduction to Lectures:  • Semester Learning Plan  • Lecture Contracts  • Assessment System  2. Review seismology courses | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion;  Make a summary | Understand what will be learned in this lecture  Able to explain the basic of the Passive Seismic method | "5%  Task" |
| 2 | [C3, P3,A3]  Understanding the concept of surface waves | Surface wave | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concept of surface waves | "5%  Task " |
| 3 | [C3, P3,A3]  Understanding passive seismic wave recording instruments | Passive seismic wave recording instrument | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the use of passive seismic wave recording instruments | "5%  Task " |
| 4 | [C3, P3,A3]  Knowing the concept of Geophone and its types | Geophone and its types | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  **Quiz-01** | Able to explain the concept of Geophone and its types | "5%  Task "  **15%  Quiz** |
| 5 | [C3, P3,A3]  Knowing the concept of Seismic Interferometry | Seismic Interferometry | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concept of Seismic Interferometry | "5%  Task " |
| 6 | [C3, P3,A3]  Able to do seismic interferometry data processing | Seismic interferometry data processing | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to do seismic interferometry data processing | "5%  Task " |
| 7 | [C3, P3,A3]  Able to interpret seismic interferometry data | Interpretation of seismic interferometric data | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to interpret seismic interferometric data | "5%  Task " |
| 8 | **Mid Semester Evaluation** | | | | | | 40% |
| 9 | **[C3, P3,A3]**  Knowing the concept of Microtremor | Microtremor | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concept of Microtremor | "5%  Task " |
| 10 | **[C3, P3,A3]**  Able to do data processing  and  Interpretation of Microtremor data | Microtremor data processing,  Interpretation of Microtremor data | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to do data processing  and  Interpretation of Microtremor data | "5%  Task " |
| 11 | [C3, P3,A3]  Knowing the concepts of SASW and MASW | SASW and MASW | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concepts of SASW and MASW | "5%  Task " |
| 12 | [C3, P3,A3]  Able to do SASW and MASW data processing | SASW and MASW data processing | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  **Quiz-02** | Able to do SASW and MASW data processing | "5%  Task " |
| 13 | [C3, P3,A3]  Able to do  Interpretation data of SASW and MASW | Interpretation data of SASW and MASW | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to do  Interpretation data of SASW and MASW | "5%  Task " |
| 14 | [C3, P3,A3]  Knowing the concept of Passive Seismic Tomography | Passive Seismic Tomogrphy | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concept of Passive Seismic Tomography | "5%  Task " |
| 15 | [C3, P3,A3]  Able to do data analysis Passive Seismic Tomogrphy data processing and Interpretation of seismic passive data | Passive Seismic Tomography data processing  Interpretation of seismic passive data | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to do data analysis Passive Seismic Tomogrphy data processing and Interpretation of seismic passive data | "5%  Task " |
| 16 | **End Semester Evaluation** | | | | | | 40% |

**REFERENCES :**

1. Landsberg, H.E., 1955, Principles and Applications of Microearthquake Methods, Academic Press,
2. Kayal, J.R., 2008, Microearthquake Seismology and Seismotectonics of South Asia, Springer, US
3. Okada, H.,Suto, K., 2003, The Microtremor Survey Method Geophysical Monograph Series, Society of Exploration Geophysicists.
4. Schuster,G. T., 2009, Seismic Interferometry, Cambridge University Press
5. Verdon, J. P., 2012, Microseismic Monitoring and Geomechanical Modelling of CO2 Storage in Subsurface Reservoirs, Springer-Verlag Berlin Heidelber

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Archeology Geophysics |
| **Course Code** | RF184843 |
| **Semester** | VIII (Eight) |
| **Credit** | 3 (T:3) SKS |
| **Lecturer** | Juan Pandu Gya Nur Rochman, S.Si., M.T. |

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| **Study Materials** | Wave, Mathematics, Geology | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysical engineering in depth; |
| 3.6 | understanding the complete operational knowledge related to the field of geophysical engineering technology; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.12 | understanding the concept, principle, workshop procedure, studio and laboratory activities, and Health and Safety Environment (HSE) in general; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.11 | capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented and poured in the form of scientific papers. |
| **LO - Course** | [C4,P3,A3] Students are able to analyse using geophysical approach on archeology, paleo disaster, sedimentation and stratigraphy, radiocarbon dating, as well as apply and utilize geophysical methods on illustrating sub-surface condition in archeological field. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4]  Students are able to understand the fundamental of Archeology | Fundamentals of Archeology | Introductory Lecture, contract and  brainstorming; | TM: 2x(4x50”) | Discussion | Get to know the application of geophysics in archeology |  |
| 2 | [C4,P4,A4]  Students are able to explain the geoscience approach in archeology | Fundamentals of Geoscience Approach in Archeology | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion | the accuracy of explaining |  |
| 3 | [C4,P4,A4]  Students are able to explain the geoscience approach in archeology | Fundamentals of Geoscience Approach in Archeology | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion | the accuracy of explaining |  |
| 4 | [C4,P4,A4]  Students are able to explain about Paleo Disaster | Paleo disaster | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion | the accuracy of explaining |  |
| 5 | [C4,P4,A4]  Students are able to explain about Paleo Disaster | Paleo disaster | Direct Lecture, Discussion; | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Discussion | The accuracy of applying the suitable filter to improve the data quality | 10% |
| 6 | [C4,P4,A4]  Students are able to explain the concept of Sedimentation Process and Stratigraphy | Sedimentation Process and Stratigraphy | Direct Lecture, Discussion; | TM: 1x(4x50”) | Discussion | the accuracy of explaining and comparing | 10% |
| 7 | [C4,P4,A4]  Students are able to explain the concept of Sedimentation Process and Stratigraphy | Sedimentation Process and Stratigraphy | Direct Lecture, Discussion; | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Assignment 6 : write a paper resume on CSAMT and AMT Methods -Practicum | The accuracy of applying the suitable filter to improve the data quality | 10% |
| 8 | Mid Semester Evaluation | |  |  |  |  | 30% |
| 9 | [C4,P4,A4]  Students are able to explain the concept of RadioCarbon Dating | Radiocarbon Dating | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion | the accuracy of explaining |  |
| 10 | [C4,P4,A4]  Students are able to explain the concept of Radiocarbon Dating | Radiocarbon Dating | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion | the accuracy of explaining |  |
| 11 | [C4,P4,A4]  Students are able to explain geophysics methods  :GPR, VLF | K11 : Introduction to modelling steps and developments of VLF method | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion  Journal Resume | the accuracy of explaining | 10% |
| 12 | [C4,P4,A4]  Students are able to explain the archeological methods by drone and camera | Archeological methods by drone and camera | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion | the accuracy of explaining |  |
| 13 | [C4,P4,A4]  Students are able to explain geophysics methods: Resistivity | Geophysical methods: Resistivity | Direct Lecture, Discussion; | TM: 1x(4x50”); | Discussion  Practicum | the accuracy of explaining |  |
| 14 | [C4,P4,A4]  Students are able to explain geophysics methods: Resistivity | Geophysical methods: Resistivity | Practicum | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Discussion  Practicum | the accuracy of explaining |  |
| 15 | [C4,P4,A4]  Study Case | Study Case | Practicum | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Discussion  Practicum | the accuracy of explaining |  |
| 16 | End Semester Evaluation | |  |  | Report Presentation |  | 30% |

**REFERENCES :**

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| * + - 1. Goldberg, P., & Macphail, R. (2006). Practical and Theoretical Geoarchaeology. Oxford: Blackwell       2. Holliday, V. T. (2004). Soils in Archaeological Research. New York, Oxford University Press. KEY REFERENCE FOR GEOARCHAEOLOGY OF SOILS       3. Stoops, G. and C. Nicosia, Eds. (2017). Archaeological Soil and Sediment Micromorphology. New York, Wiley and sons. |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Marine Geophysics |
| **Course Code** | RF184844 |
| **Semester** | VIII (Eight) |
| **Credit** | 3 (T:3) SKS |
| **Lecturer** | 1. Dr. Dwa Desa Warnana, S.Si., M.Si. 2. Wien Lestari, S.T., M.T. |

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| **Study Materials** | Geology, Mathematics, Physics, Wave | | |
| **Learning Outcome (LO)** | Attitude | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| General Skills | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| Knowledge | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.2 | understanding geological knowledge that required to understand the geological process of a particular natural phenomena by its characteristics; |
| 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysical engineering in depth; |
| 3.7 | understanding the factual insights and technology application methods; codes and national/international standards as well as the regulations in force in his/her work area to carry out geophysical engineering technology work in depth; |
| Specific Skills | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.9 | being able to recognize the difference between land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| **LO - Course** | [C4, P4, A4] Students are able to design and integrate geophysics exploration acquisitions which suitable with the research object. Students are able to interpret seafloor geomorphology, anomaly or object under the sea level from geophysics data. | | |

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| **Week** | **The Expected of Sub LO-Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience\*** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4] Students are able to understand and master the development of geophysics exploration on the sea and shore | Introduction to Marine Geophysics, the development of marine geophysics and its applications  [K1] : Introduction to Marine Geophysical Methods.ppt | Introductory Lecture, Brainstorming; | TM: 1x(3x50”) | Discussion (application and development of marine geophysics exploration, problems, and strategy); Task-K1 :Resume on development of marine geophysics exploration | Get to know the geoelectrical methods applications in general; | 5% |
| 2 | [C4,P4,A4] Students are able to understand and explain the geology and geomorphology of marine | Geology and oceanic plate history  [K2] : Introduction to marine geology and geomorphology methods .ppt | Direct Lecture, Discussion ; | TM: 1x(3x50”) | Discussion (marine geology and geomorphology);  Task-K2 :marine structure and geomorphology analysis from geographic position | The accuracy of explaining | 10% |
| 3 | [C4,P4,A4] Students are able to understand and explain the magnetic survey on the sea | Fundamentals of Marine Magnetic Survey  [K3] : Marine magnetic survey.ppt | Direct Lecture, Discussion ; | TM: 1x(3x50”) | Discussion (Marine magnetic survey); | The accuracy of explaining |  |
| 4 | [C4,P4,A4] Students are able to explain the deepwater geohazard | The concept of deepwater geohazard  [K4] : Introduction to deepwater geohazard.ppt | Direct Lecture, Discussion ; | TM: 1x(3x50”) | Discussion (deepwater geohazard); | The accuracy of explaining |  |
| 5 | [C4,P4,A4] Students are able to explain the Marine HSE Fundamentals | the Marine HSE Fundamentals  [K5] : Introduction to marine HSE.ppt | Direct Lecture, Discussion ; | TM: 1x(3x50”) | Discussion (marine HSE);  Task-K5 :resume guest lecture | The accuracy of explaining | 5% |
| 6 | [C4,P4,A4] Students are able to explain the Gravity method in marine Exploration | Gravity method in marine Exploration  [K6] : marine gravity survey.ppt | Direct Lecture, Discussion ; | TM: 1x(3x50”) | Discussion (marine gravity survey); | The accuracy of explaining |  |
| 7 | [C4,P4,A4]Students are able to explain some investigations and inventions of geoscience theory on oceanic crust, heat flow modelling, and navigation system | Marine investigations development  [K7] : Marine Geophysics Journal.ppt | Direct Lecture, Discussion ; | TM: 1x(3x50”) | Discussion (Marine Geophysics Investigations);  Task-K7 : Marine Geophysics Investigations related to geodynamics, magnetic and gravity presentation | The accuracy of explaining | 10% |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | [C4,P4,A4] Students are able to explain Seismology and seismic exploration in marine (deep water) | Fundamentals of Marine Seismic Methods  [K9] : Marine Seismic Survey.ppt | Direct Lecture, Discussion ; | TM: 1x(3x50”) | Discussion (Marine Seismic Methods); | The accuracy of explaining |  |
| 10 | [C4,P4,A4] Students are able to explain Seismology and seismic exploration in marine (deep water) | Marine seismic interpretation and modelling  [K10] : seismic survey interpretation and its development.ppt | Direct Lecture, Discussion ; | TM: 1x(3x50”) | Discussion (Marine Seismic Methods); | The accuracy of explaining |  |
| 11 | [C4,P4,A4] Students are able to explain geoelectric exploration in marine (deep water) | Fundamentals of Marine Geoelectric Methods  [K11] : Marine Geoelectric Survey.ppt | Direct Lecture, Discussion ; | TM: 1x(3x50”) | Discussion (Marine Geoelectric Methods); | The accuracy of explaining |  |
| 12 | [C4,P4,A4] Students are able to explain geoelectric exploration in marine (deep water) | Marine geoelectric interpretation and modelling  [K12] : marine geoelectric survey interpretation and its development.ppt | Direct Lecture, Discussion ; | TM: 1x(3x50”) | Discussion (Marine Geoelectric Methods); | The accuracy of explaining |  |
| 13 | [C4,P4,A4] Students are able to explain the application of mechanical wave on the sea | Fundamentals of mechanical wave application on the sea  [K13] :marine survey using mechanical wave.ppt | Direct Lecture, Discussion ; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Practicum data survey mechanic wave | The accuracy of explaining | 10% |
| 14 | [C4,P4,A4] Students are able to explain the application of mechanical wave on the sea | Marine survey using mechanical wave interpretation and modelling  [K14] : marine survey using mechanic wave interpretation and its development.ppt | Direct Lecture, Discussion ; | TM: 1x(3x50”) | Discussion (mechanical wave application on the sea); | The accuracy of explaining |  |
| 15 | [C4,P4,A4] Students are able to explain electromagnetic exploration in marine | Fundamentals of Marine electromagnetic methods  [K15] : Marine electromagnetic survey.ppt | Direct Lecture, Discussion ; | TM: 1x(3x50”) | Discussion (Marine electromagnetic survey); | The accuracy of explaining |  |
| 16 | End Semester Evaluation | | | | Data processing |  | 30% |

**REFERENCES :**

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| * + - 1. Reynolds, John M., 1997, An Introduction to Applied and Environmental Geophysics, John Wiley & Sons, England.       2. Jones, E. J. , 1999, Marine Geophysics, John Wiley & Sons.       3. Turcotte, D.L. , 1982, Geodynamics Application of continue Physics to geological Problems, John Wiley & Sons       4. Fowler, C.M.R. , 1990, The Solid Earth. Cambridge University Press.       5. Fu, L., and Cazenave, A., satellite altimetry and Earth sciences, Academic Press, 2001. |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Environment Geophysics |
| **Course Code** | RF184845 |
| **Semester** | VIII (Eight) |
| **Credit** | 3 (T:3) SKS |
| **Lecturer** | Dr.Dwa Desa Warnana, M.Si. |

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| **Study Materials** | Geologi, Lingkungan, Geofisika | | |
| **Learning Outcome (LO)** | Attitude | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| General Skills | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| Knowledge | 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.12 | understanding the concept, principle, workshop procedure, studio and laboratory activities, and Health and Safety Environment (HSE) in general; |
| Specific Skills | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| **LO - Course** | [C4,P4,A4] Students are able to master the concept, principle, and technique of designing system, process, or component applied geophysics methods on environmental problems and execute it procedurally started from data acquisition, processing, analysing interpretation result with geological condition of subsurface and modelling for physical environment problem solving along with its mitigation in deep, also be responsible for own work and group work through science report and presentation. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4,P4,A4] Students are able to understand the concept of environmental geophysics | Introduction | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”) | Discussion | The accuracy of explaining | 5% |
| 2 | [C4,P4,A4] Students are able to understand the various kinds of physical environmental pollution along with its mitigation | physical environmental pollution along with its mitigation | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion : Problems exercises | The accuracy of explaining | 10% |
| 3 | [C4,P4,A4] Students are able to understand the quality of environment | the quality of environment | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion : Task-10: Problems exercises | The accuracy of explaining | 10% |
| 4 | [C4,P4,A4] Students are able to understand the environmental geophysics techniques related to monitoring system | environmental geophysics techniques related to monitoring system | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion : Task-10: Problems exercises | The accuracy of explaining | 10% |
| 5 | [C4,P4,A4] Students are able to understand the environmental geophysics techniques related to physical environmental pollution mitigation | environmental geophysics techniques related to physical environmental pollution mitigation | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion : Task-10: Problems exercises | The accuracy of explaining | 10% |
| 6 | [C4,P4,A4] Study Case | Study Case | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion : Task-10: Problems exercises | The accuracy of explaining | 10% |
| 7 | [C4,P4,A4] Study Case | Study Case | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion : Task-10: Problems exercises | The accuracy of explaining | 10% |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | [C4,P4,A4] Students are able to conduct an environmental pollution mapping methods | physical environmental pollution along with its mitigation | Introductory Lecture, lecture contract and brainstorming | TM: 1x(3x50”) | Discussion | The accuracy of explaining |  |
| 10 | [C4,P4,A4] Students are able to understand the hydrogeology methods | hydrogeology methods | Direct Lecture, Discussion; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion : Task-10: Problems exercises | The accuracy of explaining | 5% |
| 11 | [C4,P4,A4] Students are able to analyse the pollution in the field | The concept and measurement of environmental pollution | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | The accuracy of explaining and comparing |  |
| 12 | [C4,P4,A4] Students are able to understand the terrestrial pollution | the terrestrial pollution | Direct Lecture, Discussion, Video; | TM: 1x(3x50”) | Discussion | The accuracy of explaining | 5% |
| 13 | [C4,P4,A4] Students are able to understand the marine pollution | the marine pollution | Direct Lecture, Discussion, Video; | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion | The accuracy of explaining | 10% |
| 14 | [C4,P4,A4] Study Case | Study Case | Direct Lecture, Discussion; | TM: 1x(3x50”) | Discussion | The accuracy of explaining |  |
| 15 | [C4,P4,A4] Study Case | Study Case | Discussion | TM: 1x(3x50”)  [BT+BM:2x(4x60”)] | Discussion and Presentation | The accuracy of explaining |  |
| 16 | End Semester Evaluation | | | | | | 30% |

**REFERENCES :**

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| Telford, W., Geldart, L.P., and Sheriff, R. E. (1976). Applied Geophysics.Cambridge Univ Press, Cambridge.  Ward, S.H., Editor 1990, Geotechnical and Environmental Geophysics, SEG.  Davis, M.L. and Cornwell, D.A., 1991, Introduction to Environmental Engineering, McGraw Hill, Inc.5.  Jurnal Geofisika, Sedimentary, and Metamorphic,3 rd |

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Mining Geophysics |
| **Cource Code** | RF184846 |
| **Semester** | VIII (Eight) |
| **Credit** | 3 (Three) SKS |
| **Lecturer** | Anik Hilyah, S.Si., M.T. |

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| **Study materials** | Mineral genesis, resource and reserve classification, sampling theory, application of gravity, radioactive, magnetic, seismic, geoelectric, electromagnetic and logging methods for mineral exploration. Reserve calculation. Various survey designs and methods for finding mineral deposits in various field conditions. | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.2 | understanding geological knowledge that required to understand the geological process of a natural phenomenon by its characteristics; |
| 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysics engineering in deep; |
| 3.7 | Understanding the factual knowledge and technology application methods; national and international technical references (codes and standards) also regulations in their working area to carry out geophysical engineering technology work in depth; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| **LO – Course** | [C4, P4, A4] Students are able to design and integrate various geophysical exploration acquisitions that are suitable for the target mineral. Students are able to interpret the characteristics fields that affect the sampling and interpret subsurface mineral conditions. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | Knowing the application of geophysical methods in mining | * Example application of geophysical methods in mining | Direct Lecture and Discussion; | 150 minutes | Discussion; | Students are able to know the types of mineral deposits and geophysical methods used |  |
| 2 | Knowing the classification of resources and reserves | * Classification of resources and reserves according to SNI and other countries * Relationship between the classification of resources and reserves with the stages of exploration | Direct Lecture and Discussion; | 150 minutes | Discussion; | Students are able to classify resources and reserves |  |
| 3 | Understanding the correct and accurate sampling method | * Sampling technique * Sampling method | Direct Lecture and Discussion; | 150 minutes | Discussion; | Students are able to apply the sampling method in according to geological conditions |  |
| 4 | Quiz 1 (Formative Evaluation-Evaluation intended to improve the learning process based on the assessment that has been done) | | | | | | 15% |
| 5 | Understanding nickel deposit exploration | * Application of geophysical methods in nickel deposit exploration | Direct Lecture and Discussion; | 150 minutes | Presentations, Discussions and assignments | Students are able to design surveys and interpret nickel deposits | 10% |
| 6 | Understanding the exploration of iron deposits | * Application of geophysical methods in iron deposits exploration | Direct Lecture and Discussion; | 150 minutes | Presentation and Discussion | Students are able to design surveys and interpret iron deposits |  |
| 7 | Understanding the exploration of aluminum deposits | * Application of geophysical methods in aluminium deposits exploration | Direct Lecture and Discussion; | 150 minutes | Presentation and Discussion | Mahasiswa mampu mendesain survei dan Students are able to design surveys and interpret aluminium deposits |  |
| 8 | Mid Semester Evaluation (Formative Evaluation-Evaluation which is intended to improve the learning process based on the assessment that has been done) | | | | | | 25% |
| 9 | Understanding copper deposits exploration | * Application of geophysical methods in copper deposits exploration | Direct Lecture and Discussion; | 150 minutes | Presentation and Discussion | Students are able to design surveys and interpret copper deposits |  |
| 10 | Understanding lead deposits exploration | * Application of geophysical methods in lead deposits exploration | Direct Lecture and Discussion; | 150 minutes | Presentation and Discussion | Students are able to design surveys and interpret lead deposits |  |
| 11 | Understanding PGE deposits exploration | * Application of geophysical methods in PGE deposits exploration | Direct Lecture and Discussion; | 150 minutes | Presentation and Discussion | Students are able to design surveys and interpret PGE deposits |  |
| 12 | Understanding gold deposits exploration | * Application of geophysical methods in gold deposits exploration | Direct Lecture and Discussion; | 150 minutes | Presentation and Discussion | Students are able to design surveys and interpret gold deposits |  |
| 13 | Quiz 2 (Formative Evaluation-Evaluation intended to improve the learning process based on the assessment that has been done) | | | | | | 15% |
| 14 | Understanding diamond deposits exploration | * Application of geophysical methods in diamond deposits exploration | Direct Lecture and Discussion; | 150 minutes | Presentations, Discussions and assignments | Students are able to design surveys and interpret diamond deposits | 10% |
| 15 | Understanding radioactive deposits exploration | * Application of geophysical methods in radioactive deposits exploration | Direct Lecture and Discussion; | 150 minutes | Presentation and Discussion | Students are able to design surveys and interpret radioactive deposits |  |
| 16 | End Semester Evaluation (Evaluation intended to find out the final achievement of student learning outcomes) | | | | | | 25 % |

**REFERENCES :**

1. Reynolds, John M., 1997, An Introduction to Applied and Environmental Geophysics, John Wiley & Sons, England.
2. Moon, Charles J., dkk, 2006, Introduction to Mineral Exploration, Blackwell Publishing, Australia.
3. Guilbert, John M., dkk, 2007, The Geology of Ore Deposits, Waveland Press Inc., US.
4. Everett, Mark E., 2013, Near-Surface Applied Geophysics, Cambridge University Press, UK.

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Reservoir Geophysics |
| **Cource Code** | RF184847 |
| **Semester** | VIII (Eight) |
| **Credit** | 3 (T:2,P:1) SKS |
| **Lecturer** | Firman Syaifuddin, S.Si., M.T. |

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| **Study materials** | Geology, Seismic | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyze and design system, process, product, or component in geophysics engineering in deep; |
| 3.2 | understanding geological knowledge that required to understand the geological process of a natural phenomenon by its characteristics; |
| 3.3 | understanding the theoretical concept of statistics to define the process complexity of a natural phenomenon; |
| 3.4 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyze and design system, process, product, or component in geophysics engineering in deep; |
| 3.7 | understanding the factual knowledge and technology application methods; national and international technical references (codes and standards) also regulations in their working area to carry out geophysical engineering technology work in depth; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| 4.10 | being able to organize the data and present it again by utilizing information technology that suits their needs; |
| 4.12 | being able to criticize the complete operational procedures in solving the problems of geophysical engineering technology that has been and / or is being implemented and poured in the form of scientific papers. |
| **LO – Course** | [C4,P4,A4] Students can understand the reservoir properties related to geological events and the presence of economic fluids. Students are able to do stratigraphic seismic analysis in interpreting seismic data. Students are able to integrate all reservoir data to be modeled. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C3, P3,A3]  Understand what will be learned in this lecture. Understand the basics of reservoir properties | 1. Introduction to Lecture:  • Semester Learning Plans  • College Contracts  • Scoring system  2. Review property reservoir courses | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion;  Make a summary | Understand what will be learned in this lecture  Able to explain the basics of reservoir properties | "5%  Task " |
| 2 | [C3, P3,A3]  Understand the concepts of Sedimentation and Stratigraphy | Sedimentation and stratigraphy | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concepts of Sedimentation and stratigraphy | "5%  Task " |
| 3 | [C3, P3,A3]  Understand the concept of depositional environment and facies | depositional environment and facies | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concept of depositional environment and facies | "5%  Task " |
| 4 | [C3, P3,A3]  Knowing the concept of seismic stratigraphy | Seismic stratigraphy | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  **Quiz-01** | Able to explain the concept of Seismic stratigraphy | "5%  Task "  **15%  Quiz** |
| 5 | [C3, P3,A3]  Knowing the concept of Seismic Inversion | Seismic Inversion | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concept of Seismic Inversion | "5%  Task " |
| 6 | [C3, P3,A3]  Able to do Post-stack inversion | Post-stack inversion | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to do Post-stack inversion | "5%  Task " |
| 7 | [C3, P3,A3]  Able to do Pre-stack inversion | Pre-stack inversion | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to do Pre-stack inversion | "5%  Task " |
| 8 | **Mid Semester Evaluation (Formative Evaluation-Evaluation that is intended to improve the learning process based on the assessment that has been done)** | | | | | | 40% |
| 9 | **[C3, P3,A3]**  Knowing the concepts of AVO Concept | AVO concept | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concepts of AVO | "5%  Task " |
| 10 | **[C3, P3,A3]**    Knowing the AVO analysis | AVO analysis | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Knowing AVO analysis | "5%  Task " |
| 11 | [C3, P3,A3]  Knowing the statistical concepts used in reservoir modeling | Geostatistics | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain concepts and be able to carry out statistical analyzes used in reservoir modeling | "5%  Task " |
| 12 | [C3, P3,A3]  Knowing the Kriging concept and be able to apply it in reservoir modeling | Kriging | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  **Quiz-02** | Able to explain the Kriging concept and be able to apply it in reservoir modeling | "5%  Task " |
| 13 | [C3, P3,A3]  Knowing the concept of Co-kriging and Gaussian simulation | Co-kriging and Gaussian simulation | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain the concept of Co-kriging and Gaussian simulation | "5%  Task " |
| 14 | [C3, P3,A3]  Knowing the concepts and be able to do static reservoir modeling | Static reservoir modeling | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to explain concepts and be able to do Static reservoir modeling | "5%  Task " |
| 15 | [C3, P3,A3]  Knowing the concepts and be able to do OOIP and OGIP volumetric evaluations | Volumetric evaluation of OOIP and OGIP | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Knowing the concepts and be able to do OOIP and OGIP volumetric evaluations | "5%  Task " |
| 16 | **Final Semester Evaluation (Evaluation intended to find out the final achievement of student learning outcomes)** | | | | | | 40% |

**REFERENCES:**

1. Dubrule, O., 2003, Geostatistics for Seismic Data Integration in Earth Model, SEG & EAGE
2. PYRCZ,M. J., DEUTSCH, C. V., 2014, GEOSTATISTICAL RESERVOIR MODELING, Oxford University Press, New York
3. Darling, T., “Well Logging and Formation Evaluation”, Elsevier Inc., 2005.Zobin, V. M., 2012, Introduction to Volcanic Seismology, Elsevier, London, UK
4. Tiab, D. and Donaldson, E.C., “Petrophysics 2nd.”, Elsevier, 2004.
5. Asquith, G. B. And Krygowski, D., “Basic Well Log Analysis, 2nd”, American Association of Petroleoum Geologist, 2004.
6. Brown, A., “Interpretation of Three-Dimensional Seismic Data”, American Association of Petroleoum Geologist, 2004.
7. Sheriff, R. E., Exploration Seismology, Cambridge Univ. Press. 1995.
8. Avseth, P., Mukerji, T., and Mavko, G., “Quantitative Seismic Interpretation”, Cambridge University Press., 2005.Thorne Lay, Terry C. Wallace-Modern Global Seismology, Vol. 58-Academic Press (1995).

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Interpretation of Seismic Data |
| **Cource Code** | RF184848 |
| **Semester** | VIII (Eight) |
| **Credit** | 3 (T:2, P:1) SKS |
| **Lecturer** | Firman Syaifuddin, S.Si., M.T. |

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| **Study materials** | Seismic, Computing | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.1 | understanding the theoretical concept of engineering sciences, engineering principles, and engineering design methods required to analyse and design system, process, product, or component in geophysics engineering in deep; |
| 3.2 | understanding geological knowledge that required to understand the geological process of a natural phenomenon by its characteristics; |
| 3.3 | understanding the theoretical concept of statistics to define the process complexity of a natural phenomenon; |
| 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysics engineering in deep; |
| 3.6 | understanding the complete operational knowledge related to the field of geophysical engineering technology; |
| 3.8 | understanding the principle and methods of mapping application that required in general geophysical engineering work; |
| 3.9 | mastering the principles of quality assurance in general in geophysics engineering work; |
| 3.10 | understanding the concepts and principle of environmental preservation in general from geophysical engineering activities; |
| 3.11 | mastering factual knowledge of current principles and issues in economic, socio-cultural and ecological issues in general that have an influence on the field of geophysics engineering; |
| 3.14 | mastering general concepts, principles, and techniques of effective communication orally and in writing for specific purposes in general; and |
| 3.15 | mastering factual knowledge about the development of cutting-edge technology and advanced materials in the field of geophysical engineering in deep |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| 4.3 | being able to conduct research that includes identification, formulation, and analysis of geophysical engineering problems; |
| 4.4 | being able to formulate alternative solutions to solve complex geophysical engineering problems by considering economic, health, public safety, cultural, social and environmental factors; |
| 4.5 | being able to design systems, processes, and components with an analytical approach and consider technical standards, aspects of performance, reliability, ease of application, sustainability and pay attention to economic, health and public safety, cultural, social and environmental factors; |
| 4.6 | capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.9 | being able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data; |
| **LO – Course** | [C4,P4,A4] Students can understand the phenomena of earthquake and are able to explain the concept of earthquake wave propagation. Students are able to determine the location of the earthquake source, the type of earthquake, and analyze the mechanism of earthquake occurrence. Students can understand the principles and application of earthquake monitoring equipment. Students can understand the basic concepts of seismology used in exploration. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C4, P3,A3]  Students are able to understand how the concept of subsurface mapping using geophysical methods and subsurface mapping with geological data | Introduction to Lecture:  • Semester Learning Plans    • College Contracts  • Scoring system  Subsurface Mapping | Introductory Lecture, contract and  brainstorming; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to do subsurface mapping | "5%  Task"" |
| 2 | [C3, P3,A3]  Students are able to understand how the concept of basin formation and can distinguish them | Basin Analysis | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Capable of analyzing the types of basins | "5%  Task"" |
| 3 | [C4, P3,A3]  Students are able to understand how the concept of petroleum system and its constituent components | Geology of Petroleum | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Capable of analyzing the types of petroleoum system concepts | "5%  Task"" |
| 4 | [C3, P3,A3]  Students ae able to understand the concept of seismic data acquisition and can evaluate the quality of seismic data | Seismic Data Acquisition | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  **Quiz-01** | Able to analyze the quality of seismic data and find out the misinterpretation traps caused by the effects of seismic data acquisition | "5%  Task""  **15%  Quiz** |
| 5 | [C4, P3,A3]  Students know the steps of seismic data processing and misinterpretation traps caused by errors in seismic data processing | Seismic Data Processing | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to analyze the quality of seismic data and find out the misinterpretation traps caused by the effects of seismic data processing | "5%  Task"" |
| 6 | [C4, P3,A3]  Students know the concept of correlation between wells and are able seismic well-tie. | Correlation of well data  Seismic well-tie | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to do well-tie seismic analysis | "5%  Task"" |
| 7 | [C3, P3,A3]  Students know the concept of interpretation seismic data qualitatively and are able to do structural interpretation | Interpretation of Qualitative Seismic Data | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to do structural interpretation of seismic data | "5%  Task"" |
| 8 | **Mid Semester Evaluation (Formative Evaluation-Evaluation that is intended to improve the learning process based on the assessment that has been done)** | | | | | | 40% |
| 9 | **[C3, P3,A3]**  Students know the concept of stratigraphic interpretation seismic data and are able to interpret stratifraphy | Stratigraphic Interpretation  Seismic Stratigraphy | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to do stratification analysis from seismic data | "5%  Task"" |
| 10 | **[C3, P3,A3]**  Students know the concept of depositional environment and the concept of quantitative interpretation | Sedimentation Environment  Quantitative Seismic Data Interpretation | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Being able to analyze the depositional environment from seismic data and be able to carry out quantitative interpretations | "5%  Task"" |
| 11 | [C3, P3,A3]  Students know the concept of seismic attributes and seismic inversion | Seismic attributes  Seismic inversion | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to do seismic attribute analysis and do seismic inversion | "5%  Task"" |
| 12 | [C3, P3,A3]  Students know the concept of velocity and the process of converting maps in the time domain into the depth domain | Depth Conversion & Velocity | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary  **Quiz-02** | Able to do depth conversion | "5%  Task"" |
| 13 | [C3, P3,A3]  Students are able to identify reservoir types and evaluate them | Reservoir Identification  Reservoir Evaluation | Direct Lecture,  Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Able to identify reservoir types and evaluate | "5%  Task"" |
| 14 | [C3, P3,A3]  Students are able to understand the development of the latest concepts and technologies in the interpretation of seismic data | Case Study Reference Paper | Group paper presentations, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Students are able to conduct paper reviews and understand their contents and are able to present the contents of existing papers | "5%  Task"" |
| 15 | [C3, P3,A3]  Students are able to understand the development of the latest concepts and technologies in the interpretation of seismic data | Case Study  Reference Paper  Study of literature from various sources | Group paper presentations, Discussion; | TM: 1x(3x50”) | Discussion;  Make a summary | Students are able to conduct paper reviews and understand their contents and are able to present the contents of existing papers | "5%  Task"" |
| 16 | **Final Semester Evaluation (Evaluation intended to find out the final achievement of student learning outcomes)** | | | | | | 40% |

**REFERENCES :**

1. Brown, A., “Interpretation of Three-Dimensional Seismic Data”, American Association of Petroleoum Geologist, 2004.
2. Sheriff, R. E., Exploration Seismology, Cambridge Univ. Press. 1995.
3. Avseth, P., Mukerji, T., and Mavko, G., “Quantitative Seismic Interpretation”, Cambridge University Press., 2005.Thorne Lay, Terry C. Wallace-Modern Global Seismology, Vol. 58-Academic Press,1995.

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Internship |
| **Cource Code** | RF184849 |
| **Semester** | VIII (Eight) |
| **Credit** | 3 (Three) SKS |
| **Lecturer** | Anik Hilyah, S.Si., M.T. |

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| **Study materials** | The application of geophysical knowledge and methods through internships in research institutions, private companies and government aims to increase knowledge and experience about the scope of geophysical work | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.5 | understanding the concepts, principles and techniques of system design, process or application component of geophysical engineering in procedurally starting from data retrieval, processing, interpretation and modeling to solve the problems of geophysics engineering in deep; |
| 3.6 | understanding the complete operational knowledge related to the field of geophysical engineering technology; |
| 3.7 | understanding the factual knowledge and technology application methods; national and international technical references (codes and standards) also regulations in their working area to carry out geophysical engineering technology work in depth; |
| **Specific Skills** | 4.1 | being able to apply the principles of mathematics, science and engineering principles into procedures, processes, systems or methodologies of geophysical engineering, to create or modify models in solving complex engineering problems in the fields of environment, settlement, marine and energy with the concept of sustainable development; |
| 4.2 | being able to find the source of engineering problems through the process of investigation, analysis, interpretation of data and information based on the principles of geophysical engineering; |
| **LO – Course** | [C4,P3,A3] Students are able to apply geophysical exploration methods, combine geophysical and geological data to produce accurate interpretations and have skills in geological and geophysical field surveys. | | |

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| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | Students are able to make internship proposals | Material that is relevant to the case study | Discussion; | 100 minute | Presentation | Internship proposal | 25% |
| 2 | Students are able to master a science or method to complete a case study | Material that is relevant to the case study | Internships in institutions / companies | 1 month | Presentation | Ability to complete case studies | 25% |
| 3 | Students are able to apply geophysical methods in a case study | Relevant geophysical methods | Discussion; | 100 minute | Presentation | Students are able to master internship material. | 25% |
| 4 | Students are able to make internship reports | Relevant geophysical methods | Discussion; | 100 minute | Task | Internship report | 25% |

**REFERENCES :**

1. Reynolds, J.M., An Introduction to applied and environmental Geophysics. John Wiley and Sons, 1997.
2. Sheriff, R.E., dan L.P. Geldart, Exploration Seismology. Cambridge Univ. Press, 1995.
3. Grant dan West, Interpretation Theory in Applied Geophysics, Mc. Graw-Hill Book Company, 1965.
4. Jurnal Geophysics dan Jurnal Near Surface Geophysics

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| **Program Study** | Geophysical Engineering Department |
| **Course** | Geothermal Engineering |
| **Cource Code** | RF184851 |
| **Semester** | VIII (Eight) |
| **Credit** | 3 (T:3) SKS |
| **Lecturer** | Dr. Widya Utama. DEA |

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| **Study materials** | Geology, Geophysics, Geochemistry | | |
| **Learning Outcome (LO)** | **Attitude** | 1.9 | demonstrating attitude of responsibility on work in his/her ﬁeld of expertise independently; |
| **General Skills** | 2.1 | being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; |
| 2.7 | being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his or her responsibility; |
| 2.8 | being able to conduct self-evaluation process to work group under his or her responsibility, and able to manage learning independently; |
| **Knowledge** | 3.6 | understanding the complete operational knowledge related to the field of geophysical engineering technology; |
| 3.7 | Understanding the factual knowledge and technology application methods; national and international technical references (codes and standards) also regulations in their working area to carry out geophysical engineering technology work in depth; |
| **Specific Skills** | 4.5 | being able to design systems, processes, and components with an analytical approach and consider technical standards, aspects of performance, reliability, ease of application, sustainability and pay attention to economic, health and public safety, cultural, social and environmental factors; |
| 4.7 | being able to improve the performance, quality or quality of a process through testing, measurement of objects, work, analysis, interpretation of data in accordance with procedures and standards of geophysical exploration activities by paying attention to geological rules and exploration purposes; |
| 4.8 | able to use the latest technology in carrying out geophysical engineering work in the field of environment, settlement, marine and energy; |
| **LO – Course** | [C3,P3,A3] Students understand geothermal exploitation, from well drilling to electricity generation and direct use | | |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Week** | **The Expected of Sub LO - Course** | **Learning Subject** | **Learning Methods** | **Time Estimation** | **Student’s Learning Experience** | **Criteria and Indicators** | **Weight (%)** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | [C3,P3,A3]  Students are able to understand the concept of geothermal | the concept of geothermal | Introductory Lecture, contract and  Brainstorming, Discussion; | TM: 2x(4x50”) | Discussion, | Get to know EM applications in general |  |
| 2 | [C3,P3,A3]  Students are able to explain the importance of geothermal exploitation in risk analysis of developing geothermal energy in an area. | geothermal exploitation in the risk analysis of developing geothermal energy in an area. | Direct Lecture,  Discussion; | TM: 1x(4x50”); | Discussion, | the accuracy of explaining |  |
| 3 | [C3,P3,A3]  Students are able to explain the hydrothermal system | hydrothermal system | Direct Lecture,  Discussion; | TM: 1x(4x50”); | Discussion, | the accuracy of explaining |  |
| 4 | [C3,P3,A3] Students are able to explain the hydrothermal system | hydrothermal system | Direct Lecture,  Discussion; | TM: 1x(4x50”); | Discussion, | the accuracy of explaining |  |
| 5 | [C3,P3,A3]  Students are able to apply data processing for geothermal conceptual models | geothermal conceptual model | Direct Lecture,  Discussion; | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Practicum | The accuracy of applying a good filter to improve data quality | 10% |
| 6 | [C3,P3,A3]  Students are able to apply data processing for geothermal conceptual models | geothermal conceptual model | Direct Lecture,  Discussion; | TM: 1x(4x50”) | Discussion, | the accuracy of explaining and comparing | 10% |
| 7 | [C3,P3,A3]  Students are able to understand fluid studies (thermodynamics) | fluid studies (thermodynamics) | Direct Lecture,  Discussion; | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Task 6: make a resume paper using the CSAMT and AMT-Practicum methods | The accuracy of applying a good filter to improve data quality | 10% |
| 8 | Mid Semester Evaluation | | | | | | 30% |
| 9 | [C3,P3,A3]  Students are able to explain the geothermal well drilling and completion | geothermal well drilling and completion | Direct Lecture,  Discussion; | TM: 1x(4x50”); | Discussion, | the accuracy of explaining |  |
| 10 | [C3,P3,A3]  Students are able to explain the geothermal well drilling and completion | geothermal well drilling and completion | Direct Lecture,  Discussion; | TM: 1x(4x50”); | Discussion, | the accuracy of explaining |  |
| 11 | [C3,P3,A3]  Students are able to explain geothermal well testing | Students are able to explain geothermal geophysics | Direct Lecture,  Discussion; | TM: 1x(4x50”); | Discussion,  Journal resume | the accuracy of explaining | 10% |
| 12 | [C3,P3,A3]  Students are able to explain geothermal well testing | Students are able to explain geothermal geophysics | Direct Lecture,  Discussion; | TM: 1x(4x50”); | Discussion, | the accuracy of explaining |  |
| 13 | [C3,P3,A3]  Students are able to explain the determination of resources and reserves | determination of resources and reserves | Direct Lecture,  Discussion; | TM: 1x(4x50”); | Discussion,  Practicum | the accuracy of explaining |  |
| 14 | [C3,P3,A3]  Students are able to understand steam production facilities and power plants | steam production facilities and power plants | Practicum | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Discussion,  Practicum | the accuracy of explaining |  |
| 15 | [C4,P4,A4]  Students are able to determine electrical power and steam consumption | determination of electrical power and steam consumption | Practicum | TM: 1x(4x50”);  [BT+BM:2x(4x60”)] | Discussion,  Practicum | the accuracy of explaining |  |
| 16 | End Semester Evaluation | | | | Report presentation |  | 30% |

**REFERENCES :**

1. Nenny Miryani Saptadji (2001): Teknik Panas Bumi, Diktat Kuliah Prodi Teknik Perminyakan.
2. D’Sullivan M.J & McKibbin R. (1989) : Geothermal Reservoir Engineering, a Manual for Geothermal Reservoir Engineering Course at the Geothermal Institute – University of Auckland.