CURRICULUM SYLLABUS

2018 - 2022

GEOPHYSICAL ENGINEERING DEPARTMENT

ITS
Institut
Teknologi
Sepuluh Nopember

TABLE OF CONTENT

A. EXPECTED LEARNING OUTCOME

Factor	No.	Learning Outcome
Attitude	1.1	believing in the oneness of God and able to demonstrate religious attitude;
	1.2	upholding the value of humanity in undertaking the task based on religion, morality and ethics;
	1.3	contributing in improving the quality of community life, nation and state and the advance ofcivilization based on Pancasila;
	1.4	playing a role as a proud citizen who loves his/her homeland , having a nationalism and responsibility to the country and nation;
	1.5	appreciating the diversity of cultures, point of view, religion and belief as well as opinion or the original findings of others;
	1.6	working together, having social sensitivity and caring for community and environment;
	1.7	law abiding and disciplined in community and state life;
	1.8	intemalizing values, norms and academic ethics;
	1.9	demonstrating attitude of responsibility on work in his/her field of expertise independently;
	1.10	intemalizing spirit of independence, struggle and entrepreneurship;
	1.11	trying his/her best to achieve perfect results, and

	1.12	working together to be able to make the most of his/her potential.
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 demonstrate independent performance, quality, and measurable;
	2.3	being able to examine the implications of the development or implementation of the science of technology which concerns and implements the value of humanities in accordance with its expertise based on rules, procedures and scientific ethics in order to produce solutions, ideas, design or art criticism, compile scientific descriptions of the study results in the form of thesis or final project report, and uploaded it in the college page;
	2.4	arrange the scientific description of the results of the above study in the form of a thesis or final project report and upload it on the college page;
	2.5	being able to take decisions appropriately in the context of problem solving in the area of expertise based on the results of information and data analysis;
	2.6	being able to maintain an expnaded networks with mentors, colleagues, colleagues both inside and outside the institutions;
	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;
	2.9	being able to document, store, secure, and recover data to ensure validity and prevent plagiarism;
	2.10	being able to develop themselves and compete in national and international level;
	2.11	being able to implement sustainability principles and develop knowledge;
	2.12	being able to implement information and communication technology (ICT) in the context of implementation of his or her work; and
	2.13	being able to apply entrepreneurship and understand technology-based entrepreneurship.
Knowledge	3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;
	3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;
	3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;
	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;
	3.7	understanding the factual knowledge and application of technology method; technical reference (code and standard) of national and international as well as regulations applicable in its working area to undertake the work of geophysical engineering technology in depth;
	3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work in general;
	3.9	understanding the general quality assurance principles in geophysical engineering work;
	3.10	understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering;
	3.11	understanding the factual knowledge of current principles and issues in economic, social cultural and ecological matters in general which have an influence on the field 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;
	3.13	understanding the insights of sustainable development in general from the application of geophysical exploration methodology and natural resources management;
	3.14	understanding the general concept, principles, and techniques of effective communication both orally and in writing for specific purposes in general; and
	3.15	understanding the factual knowledge of the development of cutting-edge technology and advanced materials in the field 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;
	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 taking the account economic, health, safety, public, cultural, social and environmental factors;
	4.5	capable of designing systems, processes and components with an analytical approach and taking

		into account technical standards, performance aspects, reliability, ease of application, sustainability and attention to economic, health and safety, public, 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;
	4.8	capable of using the latest technology in carrying out geophysical engineering work in the field of environment, settlement, marine and energy;
	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.

B. COURSE LIST

No.	Course Code	Course Name	Credit
SEMESTER I			
1.	UG18490[1-6]	Religion	2
2.	UG184912	Indonesian Language	2
3.	SF184101	Physics 1	4
4.	UG184913	Citizenship	2
5.	KM184101	Matemathics 1	3
6.	RF184101	Physical Geology	3
4.	RF184102	Introduction to Geophysical Engineering	2
		Number of Credits	18
SEMESTER II			
1.	UG184914	English Language	2
2.	SF184202	Physics 2	3
3.	SK184101	Chemistry 1	3
4.	KM184201	Matemathics 2	3
3.	UG184911	Pancasila	2
4.	RW184901	Introduction to Geospatial Information	2
5.	RF184203	Geophysical Computing	3
		Number of Credits	18
SEMESTER III			
1	RF184304	Fundamental Electronics	3
2	RF184305	Rock Physics	4
3	RF184306	Mathematical Geophysics	4
4	RF184307	Structural Geology	3
5	RF184308	Sedimentology and Stratigraphy	3
6	RF184309	Seismology	3
		Number of Credits	20
SEMESTER IV			
1	RF184410	Digital Data Analysis	4
2	RF184411	Gravity and Magnetic Exploration	4
3	RF184412	Ore Deposit	3
4	RF184413	Geostatistics	3
5	RF184414	Geodynamics	3
6	RF184415	Rock Mechanics	3
		Number of Credits	20
SEMESTER V			
1	RF184516	Geolectrical Exploration	4

2	RF184517	Seismic Exploration	4
3	RF184518	Inversion Method	3
4	RF184519	Geological Disaster Mitigation	3
5	RF184520	Thermodynamics	3
6	RF184521	Capita-Selecta	2
		Number of Credits	19
SEMESTER VI			
1	UG184916	Insights and Technology Applications	3
2	RF184622	Well Log Data Analysis	4
3	RF184623	Electromagnetic Exploration	4
4	RF184624	Geotechnical	4
5	RF1846NN	Elective Course	3
		Number of Credits	18
SEMESTER VII			
1	UG184915	Technopreneur	2
2	RF184734	Geothermal Exploration	3
3	RF184735	Geotomography	4
4	RF184736	Integrated Field Lecture	4
5	RF184737	Seminar	3
6	XXXXXXXX	Enrichment Course*	3
		Number of Credits	18

SEMESTER VIII			
1	RF184838	Thesis	4
2	RF1848NN	Elective Course	9
		Number of Credits	13

LIST of ELECTIVE COURSES

No.	Course Code	Course Name	Semester	Credit
1	RF184625	Seismic Data Processing and Acquisition	VI	3
2	RF184626	Digital Electronics	VI	3
3	RF184627	Groundwater Exploration	VI	3
4	RF184628	Petroleum Geology	VI	3
5	RF184629	Geotourism*	VI	3
6	RF184628	Geophysical Instrumentation	VI	3
7	RF184629	Exploration Management	VI	3
8	RF184630	Geographic Information System	VI	3
9	RF184631	Applied Seismology	VI	3
10	RF184839	Ore Deposit Exploration	VIII	3
11	RF184840	Passive Electromagnetic Exploration	VIII	3
12	RF184841	Carbonate Exploration	VIII	3
13	RF184842	Passive Seismic Exploration	VIII	3
14	RF184843	Archeological Geophysics	VIII	3
15	RF184844	Marine Geophysics	VIII	3
16	RF184845	Environmental Geophysics	VIII	3
17	RF184846	Mining Geophysics	VIII	3
18	RF184847	Reservoir Geophysics	VIII	3
19	RF184848	Seismic Data Interpretation	VIII	3
20	RF184849	Internship	VIII	3
21	RF184850	Apprenticeship	VIII	9
22	RF184851	Geothermal Engineering	VIII	3

C. SYLLABUS ACADEMIC

COURSE	**Course**	Physical Geology
	Course Code	RF184101
	Credit	3 SKS
	Semester	I (One)
DESCRIPTION OF COURSE		
Physical Geology is a geological science that includes the understanding of the earth, the structure of the earth in general, minerals and rocks, processes that exist on the surface; weathering, erosion, transportation, sedimentation, cementation, and compaction. Physical geology also discusses the processes that occur from within the earth include, the activity pambentukan magma, volcanism, earthquake and rock changes due to tectonic processes. Physical geology is also a human activity, especially in relation to disaster, earthquakes, land movement, environmental damage and geological resource utilization		
LEARNING OUTCOMES		
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		
3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;	

3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;
3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work in general;
3.10	understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering;
3.13	understanding the insights of sustainable development in general from the application of geophysical exploration methodology and natural resources management;
Specific Skills	
4.1	being able to apply the principles of math, 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 (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.

COURSE LEARNING OUTCOMES

[C4,P4,A4] Students are able to recognize geological objects and describe them, explain the geological phenomena found in the field and explain the process of occurrence. Understand the basic knowledge that includes mechanical and chemical processes on Earth.

MAIN TOPIC

Introduction (Earth Geology & Systems, Solar System)
• Minerals and rocks (atoms, minerals, crystals and their classification)
• Extrusive and Intrusive Frozen Rock (bowel reaction, extrusive and intrusive extrusive and frozen texture and structure)
• Volcanism (plate tectonics and volcanoes)
• Sedimentary rocks (clasfication of sedimentary rocks, sedimentation processes including weathering, erosion, transportation, deposition and lithification)
• Metamorphic rock (metamorphic rock classification, metamorphic rock formation, metamorphism, texture and metamorphic rock structure)
• Mountains & Deformation
• Earthquake
• Mass and land movement (definition, type, controlling factor and how to cope with ground movement)
• Hydrology and ground water cycle
• Rivers, beaches, lakes, deltas, etc. and their formation (settling environments)

PREREQUISITES

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REFERENCE

1. Smith and Pun,2006,Earthworks,Prentice Hall
2. Modul Praktikum Geologi Fisik Departemen Teknik Geofisika ITS
3. Tarbuck and Lutgens,2000, Earth Science,Prentice Hall

4. Hamblin,1989,The Earth Dynamic System,Mc Milan

COURSE	Course	Introduction to Geophysical Engineering
	Course Code	RF184102
	Credit	2 SKS
	Semester	I (One)

DESCRIPTION of COURSE

This course is an introduction to understanding and utilization of geophysical techniques as an integrated exploration method of condition. By utilizing logical methodology (physics, mathematics, geology, with engineering techniques, information engineering and instrumentation).

LEARNING OUTCOMES

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	
3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;
Specific Skills	
4.1	being able to apply the principles of math, 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 (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;

COURSE LEARNING OUTCOMES

[C4, P3, A3] Students are able to recognize the physical characteristics of geological phenomena on the surface of the earth through simple geophysical methodologies to derive an overview of the subsurface model and the dynamics of the Earth's crust. By building and utilizing simple models, students can understand their usefulness in accordance with exploration objectives.

MAIN SUBJECT

Introduction to the earth model by utilizing data on the surface of the earth to explain the dynamics of the earth, from the surface of the earth to the surface of the earth.

Using the physical characteristics of the earth (both rock and soil) to recognize natural phenomena and categorize them. Thus, the students know the boundaries of tectonic plates and their dynamics.

Through the measurement of these characteristics, students can build simple models of the earth and be able to use them to recognize the benefits of such knowledge for the application and development of geo-exploration technology, within the limits of knowledge and skills for the introductory level; for example: seismology, gravity, volcanology, rock physics, electricity in the field of energy and the environment.

Information technology simple applications that can be utilized are: google erath, google maps, GPS, compass

PREREQUISITES

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REFERENCE

1. John Milsom, Asger Eriksen, 2011, Field Geophysics - 304 pages, John Wiley & Sons - Science.
2. William Lowrie, 2007, Fundamentals of Geophysics, Cambridge University Press - Science.
3. Alan E. Mussett, M. Aftab Khan, 2000, Looking into the Earth: An Introduction to Geological Geophysics, Cambridge University Press - Science

COURSE		
	Course	Geophysical Computing
	Course Code	RF184203
	Credit	3 SKS
	Semester	II (Two)
DESCRIPTION of COURSE		
This course studies the basic science and programming techniques commonly used in survey design, data processing and data modeling of geophysical measurement methods, and development of computing hardware.		
LEARNING OUTCOMES		
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		
3.5	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 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;

COURSE LEARNING OUTCOMES

[C3, P3, A3] Students are able to apply the basics of programming, concepts and applications in the field of earth.

MAIN SUBJECT

- Basic computing and programming
- Basic Algorithms
- Quadratic equations
- Systems of linear equations
- Interpolation and curve fitting
- Derivative and numerical integral
- System of differential equations
- Introduction to Optimization

PREREQUISITES

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REFERENCE

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

COURSE		
	Course	Fundamental Electronics
	Course Code	RF184304
	Credit	3 SKS
	Semester	III (Three)
DESCRIPTION OF COURSE		
This course learns about the basics of electronics including the active and passive components of electronics, electronics laws and electronic circuit analysis. Students are expected to understand the problem of electronics in the application of work in the field of geophysics		
LEARNING OUTCOMES		
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;	
Knowledge		
3.4	understanding the theoretical concepts of engineering science (engineering sciences), engineering principles and engineering design methods required for and designing systems, processes, products or components in the field of geophysical engineering in depth;	
Specific Skills		
4.1	being able to apply the principles of math, 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 (sustainable development);	
4.10	being able to organize the data and present it again by utilizing information technology that suits their needs;	
COURSE LEARNING OUTCOMES		

[C3,P3,A2] Students are able to explain and apply the laws, basic theorems of electronics, the nature and workings of electronic components to solve the problem of electronic circuits
MAIN TOPIC
Basic concepts and laws of electronics, circuit analysis methods, BJT transistors, Diodes, Capacitors and inductors, 1st order circuit, 2nd order circuit, sinusoid and phasor, AC circuit analysis
PREREQUISITES
Calculus I, Calculus II, Basic Physics I and Basic Physics II
REFERENCE
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 3. Journal about electronics

COURSE		
	Course	Rock Physics
	Course Code	RF184305
	Credit	4 SKS
	Semester	III (Three)
DESCRIPTION of COURSE		
This course describes the characteristics of rock as an elastic porous medium, on a micro scale. Characterization is based on the rock physics measurements and the relation between variables to obtain important physical parameters that can be used further in geophysical exploration, especially on macro scale. Applications range from well log evaluation to geophysical measurements in the field. Evaluation of rock physics characteristics can provide corrections and guidance in the evaluation of subsurface physical conditions in accordance with exploration purposes. The subjects include knowledge of the physical properties (elasticity, electrical, hydrodynamics) of the rock matter matrix, the presence of pores in the rock, the presence of fluids (both single and multi-phase) in the pores.		
LEARNING OUTCOMES		
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		
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;	
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;

COURSE LEARNING OUTCOMES

[C3, P3, A3] Students are able to design a simple measurement system (tool and methodology) to be followed up by measuring the rock physics variable of laboratory scale. Students are able to understand the concepts and relationships between rock physics variables to extract important rock parameters for exploration purposes.

MAIN SUBJECT

Introduction: background and basic understanding of rock physics, rock as part of the earth's crust and soil as a result of weathering physics-chemistry of rocks, rocks and soil as the constituent of the earth's crust.
Measurement and modeling of rock physics characteristics: design of the acquisition and measurement of rock physics data on laboratory scale and its development on a field scale. Variables and parameters of rock characteristics: solid matter (matrix), pore space and fluid content in interacting pores. Implementation: the relation of rock characteristics to various scale of rock physics measurement and its application in geophysical exploration in the field.

PREREQUISITES

Fundamental Physics I and II, Mathematics I and II

REFERENCE

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.

COURSE	Course	Geophysics of Mathematics
	Course Code	RF184306
	Credit	4 SKS
	Semester	III (Three)

DESCRIPTION of COURSE

This course includes; Vector Analysis, Linier Equation System/SPL, Series to Solving Diffrential Equation Problems, Complex Number, Application of Special Functions for Solving Geophysical (Fourier Analysis; FT, FFT, DFT; Laplace, Legendre, Z-Transform)

LEARNING OUTCOMES

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;
Knowledge	
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;
Specific Skills	
4.1	being able to apply the principles of math, 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 (sustainable development);

COURSE LEARNING OUTCOMES

[C3,P3,A3] Being able to understand basic concepts of geophysical mathematics and applied in geophysical problems. Being Able to understand and able to solve problems; vector, Linear Equation System/SPL, Matrics,

Series, Complex Number, Integral, Ordinary Diffrential Equation, Partial Diffrential Equation, Fourier, and other Special Functions.
MAIN SUBJECT
Introduction, Vector Analysis, Series, Complex Number, Linear Equation System/SPL, Matrics, Ordinary Diffrential Equation, Integral, Fourier, and other Special Functions.
PREREQUISITES
Mathematics I , Mathematics II
REFERENCE
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

COURSE	**Course**	Structural Geology
	Course Code	RF184307
	Credit	3 SKS
	Semester	III (Three)
Description Of Course		
This course discusses the shape and architecture of the earth's crust and the process of its formation. This course also discusses the basic deformation process in rocks, mechanisms and understanding of strain, stress and force in tectonic deformation. Identify, map and analyze elements of geological structures such as fractures, faults, folds, foliations, hemispheres and lineages and their relationship to each other in the tectonic context of the plates. Analyzing the formation of geological structures with natural phenomena such as geological disasters including earthquakes and landslides, some of these applicable courses have much to do with traping on the exploration and exploitation of hydrocarbons, economic geology in mineral deposits, geothermal, etc		
Learning Outcome		
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		
3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;	

3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;
3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work in general;
3.10	understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering;
3.13	understanding the insights of sustainable development in general from the application of geophysical exploration methodology and natural resources management;
Specific Skills	
4.1	being able to apply the principles of math, 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 (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.

COURSE LEARNING OUTCOMES

[C4,P4,A4] Students are able to recognize elements of geological structure, perform description and analysis and explain the process of occurrence of a geological structure. Able to explain the relationship between tectonic and geological structural processes. Product of plate movements.

MAIN SUBJECT

• Introduction (earth structure and plate changes)
• The elements and forces of structural geology
• Descriptive analysis of kinematics and dynamics in structural geology
• The principle of stress and strain, brittle and ductile deformation
• Young Modulus Law
• Poisson Ratio
• Yield Strength
• Definition and Classification of Geological Structures, Stump, Cesarean, Folding, and their identification and procedure of identification
• Procedures to find various geological structures in the field, constructing structural maps (contours)
• Cross-section of structural geology
• Rose diagram for solid analysis
• Fault analysis and cesarean analysis using stereonet diagrams
• Regional structural and tectonic geological readings from a field

PREREQUISITES

Dynamic Geology

REFERENCE

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. Structural Geology Practicum Modul of Geophysical Engineering Department
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.

COURSE		
	Course	Sedimentology and Stratigraphy
	Course Code	RF184308
	Credit	3 SKS
	Semester	III (Three)
Description Of Course		
This course catapulted between two fields of geology, namely sedimentology and stratigraphy. Stratigraphy emphasizes the explanation of sedimentary rock genesis (clastic or non-clastic) whereas stratigraphy describes the relationship between layers in space and time relationships. Genesis sedimentary rock is useful to know the characteristics of rock that will culminate in the knowledge of transportation and energy deposition stratigraphy will be useful for some sort of remembering between rocks.		
Learning Outcomes		
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		
3.2	knowing the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;	
3.3	knowing the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;	
3.8	knowing the principles and methods of the mapping application that required in geophysical engineering work in general;	

3.10	knowing the concept and principle of environmental conservation in general from the activities of geophysical engineering;
3.13	knowing the insights of sustainable development in general from the application of geophysical exploration methodology and natural resources management;
Specific Skills	
4.1	being able to apply the principles of math, 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 (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.

COURSE LEARNING OUTCOME

[C4,P4,A4] Students can understand about the genesis of sedimentary rock and its relationship in space and time. Both of these meanings will provide a provision for students to understand the geometry of sedimentary rock layers which can then be used for interpretation of the distribution and rock properties, and ultimately can be interpreted or calculated the value of economic content in the sediment rock. Students are introduced to identify different kinds of sedimentary rocks to recognize physically in the laboratory. Furthermore, the relationship of rocks in space and time will be given stratigraphic correlation exercises and stratigraphic map making. Students understand the economic value of sedimentary rock and are able to read and present stratigraphic maps for exploration and development purposes.

MAIN SUBJECT

Introduction (components and genes of sedimentary rocks)
• Texture and structure of sedimentary rocks
• The relationship of sediment to the physical properties of rocks such as calculating porosity and permeability
• Sedimentation process and sedimentary rock genesis from sediment grain analysis
• Genesis of carbonate rock
• Classification of sedimentary rocks and carbonate rocks
• Litostratigraphy
• Chronostratigraphy
• Biostratigraphy
• Stratigraphic striates
• Litocorrelation
• Chronocell correlation
• Biocorrelation
• Description of sedimentary rocks physically
• Reading of regional stratigraphy.

PREREQUISITES

Physical Geology

REFERENCE

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.

COURSE	Course Name	Seismology
	Course Code	RF184309
	Credit	3 SKS (P=2 P=1)
	Semester	III (Tiga)

DESCRIPTION of COURSE

This course studies seismic waves: the theory of elasticity, the wave equation, the types of seismic waves; Seismograph: principle of seismograph work; Seismological networks: types of seismograph networks; Seismogram: ray and travel time in the spherical earth and its properties, the seismic wave phases of an earthquake; hypocenter: hypocenter determination method; Focal mechanisms: elastic thrust theory, cesarean section and seismic wave polarity, P wave radiation pattern, fault field representation in streography; Earthquake source time function modeling: Haskel source line, directivity, source spectrum; Magnitude: concepts and types of magnitudes; Energy: energy calculation concepts and methods; Intensity: understanding intensity and intensity scale; Earthquake statistics: magnitude relationship with frequency of earthquake occurrence; Seismotectonic: the relationship between the previous topics with plate tectonics.

LEARNING OUTCOMES

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	
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches

	methodology basis of geophysical exploration to a specific natural phenomenon in general;
3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;
3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;
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;
3.7	understanding the factual knowledge and application of technology method; technical reference (code and standard) of national and international as well as regulations applicable in its working area to undertake the work of geophysical engineering technology in depth;
Specific Skills	
4.1	being able to apply the principles of math, 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 (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.

COURSE LEARNING OUTCOMES

[C3,P3,A3] Students understand phenomena related to earthquake vibration and able to explain the concept of earth wave propagation. Students are able to determine the location of earthquake source, type of earthquake type, and analyze the mechanism of earthquake occurrence. Students understand the principles and application of earthquake monitoring tools. Students understand the basic foundations of seismological concepts used in exploration.

MAIN SUBJECT

- *Introduction,*
- *Stress and strain,*
- *The seismic wave equation,*
- *Ray theory: Travel times, Inversion of travel time data,*
- *Ray theory:Amplitude and phase,*
- *Reflection seismology,Surface waves and normal modes,*
- *Earthquakes and source theory*
- *Earthquake prediction,*
- *Instruments,*
- *noise, and anisotropy,*
- *Volcanic Seismology*

PREREQUISITES

Introduction to geophysical engineering, physical geology

REFERENCE

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. Jens Havskov, Gerardo Alguacil (auth.)-Instrumentation in Earthquake Seismology-Springer International Publishing
3. Barbara Romanowicz, Adam Dziewonski.2009.Seismology and Structure of the Earth_ Treatise on Geophysics-Elsevier
4. Agustin Udías. 2000. Principles of Seismology-Cambridge University Press
8. Thorne Lay, Terry C. Wallace. 1995. Modern Global Seismology, Vol. 58-Academic Press
9. V. I. Keilis-Borok (auth.), V. I. Keilis-Borok, Edward A. Flinn (eds.).1995.Computational Seismology-Springer US

COURSE	**Course**	Digital Data Analysis
	Course Code	RF184410
	Credit	3 SKS
	Semester	IV (Four)
DESCRIPTION of COURSE		
This course in depth basic signal digital data analysis that usually applied in signal processing geophysical data, such as Fourier Transform, Fast Fourier Transform, Discrete Fourier Transform, Convolution, Correlation, sampling theory and filtering.		
LEARNING OUTCOMES		
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		
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;	
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	understanding the general quality assurance principles in geophysical engineering work;	

Specific Skills	
4.1	being able to apply the principles of math, 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 (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;

COURSE LEARNING OUTCOMES

[C4,P4.A3] Being able to understand and applying basic concepts signal data digital in geophysical problems and its substantial to support processing and applying data analysis.

MAIN SUBJECT

Introduction, Fourier Analysis (Fourier Transform, Fast Fourier Transform, Discrete Fourier Transform), Sampling Theory, Convolution, Correlation and Filtering.

PREREQUISITES

Mathematical Geophysics
Seismology

REFERENCE

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

COURSE	**Course**	Gravity and Magnetic Exploration
	Course Code	RF184411
	Credit	4 (Four) SKS
	Semester	IV (Four)
DESCRIPTION of COURSE		
This course examines the theory of potential field of the earth, acquisition, data processing and interpretation of subsurface structures from gravity and magnetic field anomaly data		
LEARNING OUTCOMES		
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		
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;	
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;
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 of land and sea exploration field characteristics that can be affected into the quality of measurement data;
COURSE LEARNING OUTCOMES	
[C4, P3, A3] Students are able to apply the concept and technology of gravity and magnetic methods in describing subsurface conditions. Students are able to design the acquisition of gravity and magnetic exploration data.	
MAIN SUBJECT	
Potential field theory, Earth's material density, earth's gravitational and magnetic field, data acquisition, data reduction, regional and residual anomaly filtering, and interpretation	
PREREQUISITES	
Fundamental Physics II, Mathematics II, Rock Physics	
REFERENCE	
1. Hinze, William J., 2012, Gravity and Magnetic Exploration, Cambridge University Press, UK. 2. Blakely, Richard J., 1996, Potential Theory in Gravity and Magnetic Applications, Cambridge University Press, UK. 3. Pasteka, Roman, dkk, 2017, Understanding the Bouguer Anomaly, Elsevier, Netherlands. 4. Roy, Kalyan Kumar, 2007, Potential Theory in Applied Geophysics, Springer, Berlin.	

COURSE		
	Course	Ore Deposit
	Course Code	RF184412
	Credit	3 SKS
	Semester	IV (Four)
DESCRIPTION of COURSE		
This course discusses the natural wealth associated with mineral deposits that are economical and can be mined by people. Discussing about minerals that are economical include the basic concepts of mineral formation, geological conditions, thermal conditions, mineral association alterasinya, sediment model, dimension, aspect geochemistry and geophysics as well as associations with tectonic factors that control it		
LEARNING OUTCOMES		
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		
3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;	
3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;	
3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work in general;	

3.10	understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering;
3.13	understanding the insights of sustainable development in general from the application of geophysical exploration methodology and natural resources management;
Specific Skills	
4.1	being able to apply the principles of math, 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 (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.

COURSE LEARNING OUTCOMES

[C4,P4,A4] Students can understand the various natural resources associated with mineral deposits so they can be explored and exploited for economic purposes. Understand the various types of mineral deposits that are economically valuable and know where their existence is connected to the tectonic conditions of a geological environment. Know the process of mineral deposits formed in certain zones and predictions of its existence in the field (mineral deposit genesis).

MAIN SUBJECT

- Introduction (refreshing mineralogy and petrology)
  - Term in mineral deposits
  - Classification of mineral deposits
  - Fluid in mineral deposits
  - Transport of carrier fluid ore
  - Classification of mineral deposits
  - Differentiation of magma in the formation of mineral deposits
  - Mineral deposits are disseminated
  - Mineral deposits of magma differentiation and injection
  - Residual mineral deposits of magma solution
  - Sediment of pegmatite
  - Sediment type of greisen
  - Hydrothermal solution and hydrothermal alteration
  - Porphyry precipitate
  - Epithermal deposits
  - Skarn
  - VMS,
  - Seddex
  - MVT, BIF
  - Manganese oxide deposition
  - Evaporite and phosphate deposits
  - Placer precipitate
  - Orogenic deposition.

PREREQUISITES

Sedimentologi dan Stratigrafi

REFERENCE

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

COURSE	Course	Geostatistics
	Course Code	RF184413
	Credit	3 SKS
	Semester	IV (Four)

DESCRIPTION of COURSE

This course studies the application of geostatistics methods to describe the distribution of data vertically or laterally by using semivariogram analysis. Application of geostatistical methods for estimation of grade, thickness and volume of mineral reserves and reservoir characterization.

LEARNING OUTCOMES

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	
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;
3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;
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;
COURSE LEARNING OUTCOMES	
[C4, P3, A3] Students are able to estimate the volume deviation and reservoir characterization by geostatistical method.	
MAIN SUBJECT	
Basic statistical theory, conventional and unconventional geostatistics methods, variogram analysis and modeling, variogram pattern, dispersion variance, estimation variance, Krigging, reserve estimation, reservoir characterization and practicum using geostatistics software	
PREREQUISITES	
Mathematics II	
REFERENCE	
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	

COURSE	Course	Geodynamics
	Course Code	RF184414
	Credit	3 SKS
	Semester	IV (Four)

Description Of Course

The course that have the subject of dynamics in the earth. Including how the lithosphere movements that affect the formation of continents and oceans that exist on earth. Discusses also about the geological processes that occur in rocks, such as weathering, erosion, sedimentation so as to bring up some morphology / form a particular landscape.From it all can also raise the possibility of geological disasters that can occur in a certain place with specifically geological conditions.

Learning Outcome

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	
3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;
3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;

3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work in general;
3.10	understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering;
3.13	understanding the insights of sustainable development in general from the application of geophysical exploration methodology and natural resources management;
Specific Skills	
4.1	being able to apply the principles of math, 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 (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.

COURSE LEARNING OUTCOME

[C4,P4,A4] Students are able to explain the dynamics of the earth that includes processes and products such as earthquakes, landslides, mountain formation and coastline changes. Students are able to understand a basic understanding of the properties of Brittle and Ductile from the lithosphere. Explains the relationship of processes that occur with the appearance of the field. Understand geophysical calculations on the basis of occurrence of continental crust or oceanic crust.

MAIN SUBJECT

Introduction (Understanding the properties of Brittle and Ductile from lithosphere)
• Earthquake Event Process
• Process and activity G. Fire, Magma and its distribution in Indonesia
• Mountains Formation
• Beach and Process
• Ocean Floor Morphology
• Weathering and Impact Processes that can be generated especially Land Movement.
• Understanding the dynamics of the lithosphere
• The Earth-forming Theory and Its Relation to Earth Dynamics
• Earth structure and physical properties of its constituent material.
- Heat Transfer
- Fluida Mechanic
- Gravity
- Rheologi

PREREQUISITES

Physical Geology

REFERENCE

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

COURSE		
	Course	Rock Mechanics
	Course Code	RF184415
	Credit	3 SKS
	Semester	IV (Four)
DESCRIPTION of COURSE		
Describes the mechanical behavior of rocks, related to the rock response to the force field of the surrounding environment		
LEARNING OUTCOMES		
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;	
3.10	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 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;
COURSE LEARNING OUTCOMES	
[C4, P4, A4] can explain the concept and solve the basic problems of rock mechanics system in an integrated and comprehensive way for technical applications.	
MAIN SUBJECT	
Rocks and rock mechanics; Rock definition, rock composition, rock mechanical definition, rock properties, some characteristics of rock mechanics, several problems in rock mechanics, scope of rock mechanics, stress and strain analysis; Voltage analysis on plane, Mohr Circle of voltage, strain analysis. Physical properties and mechanical properties of rocks; Determination of physical and mechanical properties of rocks in laboratory, Determination of in situ mechanical properties. Rock Behavior; Elastic, elastoplastic, rock creep, rock relaxation, stress and strain relationships for linear and isotropic elastic behavior. Criteria for "Failure" rocks; Mohr Theory, Mohr-Coulomb Criteria, Criteria for	

maximum tensile stress, Maximum shear stress criteria. In situ voltage measurement in rock mass; Rosette deformation method, Flat jack method, over-coring method, Hydraulic fracturing. Technical classification of rock mass; Important factors in rock classification, rock mass properties, rock mass classification.
PREREQUISITES
• Geophysical Computing • Structural Geology • Rock Physics
REFERENCE
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. Journal of Geophysics

COURSE		
	Course	Geoelectrical Exploration
	Course Code	RF184516
	Credit	4 SKS
	Semester	V (Five)

DESCRIPTION of COURSE

Geoelectrical is one of the geophysical methods that aims to determine the electrical properties of rock layers beneath the soil surface by injecting an electrical current into the ground. This course will explain the geoelectric concept in several methods namely Self Potential (SP), Resistivity and Induced Polarization (IP) and its application in mining, hydrogeology, geotechnical and environmental exploration. Students will gain experience in geoelectric exploration planning from planning, data acquisition, processing and interpretation of geoelectric data so that a basic understanding of concepts and techniques will help students compete in the world of work. Activities will be carried out in group work so that students are able to think critically and train in team work to achieve common goals.

LEARNING OUTCOMES

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 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.

COURSE LEARNING OUTCOMES

[C4, P4, A4] Students are able to master the concepts, principles and techniques of system design, process or application of Geoelectrical component (Resistivity, Self Potential and Induced Polarization) and implement it procedurally starting from data retrieval, processing, subsurface geological conditions and modeling to resolve deep-seated geophysical engineering issues deeply in mine, hydrogeological, geotechnical and environmental exploration and responsible for own and group work outcomes through scientific reports and presentations.

MAIN SUBJECT

Introduction (classification of electrical methods, electrical properties of minerals and rocks), SP methods (potential self-emergence, procedures and measurements, interpretation and application), Resistivity methods (Definitions, electric fields from current electrodes on coated earth, various measurement configurations, equipment and measurement procedures, modeling resistivity), Polyzation-Induced Methods (Definition, Electroplated ground polarization, measurement configration, measurement tools and procedures, interpretation)

PREREQUISITES

Mathematical Geophysics

REFERENCE

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. Geophysics Journal

COURSE		
	Course	Seismic Exploration
	Course Code	RF184517
	Credit	4 SKS
	Semester	V (Five)
DESCRIPTION of COURSE		
This course explains the basic concepts of seismic wave propagation phenomena through acoustic and elastic isotropic medium and utilization of seismic reflection and refraction method as one of Geophysics method.		
LEARNING OUTCOMES		
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		
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;	
3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;	
3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;	

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
3.7	understanding the factual knowledge and application of technology method; technical reference (code and standard) of national and international as well as regulations applicable in its working area to undertake the work of geophysical engineering technology in depth;
3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work in general;
3.9	understanding the general quality assurance principles in geophysical engineering work;
3.10	understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering;
3.11	understanding the factual knowledge of current principles and issues in economic, social cultural and ecological matters in general which have an influence on the field 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;

3.13	understanding the insights of sustainable development in general from the application of geophysical exploration methodology and natural resources management;
3.14	understanding the general concept, principles, and techniques of effective communication both orally and in writing for specific purposes in general; and
3.15	understanding the factual knowledge of the development of cutting-edge technology and advanced materials in the field of geophysical engineering in depth.
Specific Skills	
4.1	being able to apply the principles of math, 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 (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 taking the account economic, health, safety, public, cultural, social and environmental factors;
4.5	capable of designing systems, processes and components with an analytical approach and taking into account technical standards, performance aspects, reliability, ease of application, sustainability and attention to economic, health and safety, public, 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;

COURSE LEARNING OUTCOMES

[C3,P3,A3] Students understand the basic concepts of Physics related to seismic wave propagation, Students must have knowledge about "exploration seismology", history, development and technology and terminology, Students recognize and understand seismic refraction method and reflection seismic method, Students have understanding about seismic data processing Technique refraction and 2D reflection.

MAIN SUBJECT

- The theory of seismic wave propagation
- Ray theory
- Seismic wave velocity & Seismic event characteristics
- Refraction seismic
- Acquisition and processing of refractive seismic data
- Simple refractive seismic interpretation and modeling
- Reflection seismic
- Design of seismic reflection data acquisition and processing
- Interpretation of seismic reflection
- Utilization of seismic methods in geophysical exploration

PREREQUISITES

Seismology

REFERENCE

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)

COURSE	Course	Inversion Method
	Course Code	RF184518
	Credit	3 SKS
	Semester	V (Five)

DESCRIPTION of COURSE

This course will study the basis of inversion, determining inversion parameters and solving inversion problems with several methods in both linear and non linear geophysics.

LEARNING OUTCOMES

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;
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.

COURSE LEARNING OUTCOMES

[C3, P3, A3] Students are able to apply the basic concept of inversion (Inverse Theorem) and inversion parameters of measured data to solve the inversion problems in both linear and non-linear geophysics

MAIN SUBJECT

The concept of geophysical data modeling (forward modeling and inversion), linear regression settlement with least squares principle, linear inversion problem formulation, linear inversion solution, linear inversion weighted and linear inversion degraded, non-linear inversion problem formulation, nonlinear inversion solution with linear (linearized) approach, non-linear inversion solution with global approach, systematic / grid search, random search, Monte-Carlo method, guided random search method, Simulated Annealing (SA) method, Genetic Algorithm AG) , Particle Swarm Optimasion (PSO).

PREREQUISITES

- Geophysics of Mathematics I
- Geophysics of Mathematics II
- Geophysical Computing

REFERENCE

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.

COURSE	Course	Geological Disaster Mitigation
	Course Code	RF184519
	Credit	3 SKS
	Semester	V (Five)

DESCRIPTION of COURSE

This course examines the many geological threats occurring in Indonesia and how its mitigation efforts to reduce the risk of not becoming catastrophic catastrophic catastrophic, destructive and disastrous catastrophes. This lecture is important for graduates in order to work can recognize how to mitigate various threats that exist in the vicinity.

LEARNING OUTCOMES

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	
3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work in general;
3.10	understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering;
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.
COURSE LEARNING OUTCOMES	
[C4, P4, A4] Students are able to explain about geological hazards such as earthquakes, tsunamis, liquefaction and amplification, active fault, erupting volcano, mud volcano, lava flood, erosion, landslide, rock slides, subsidence, flash floods, sedimentation and other natural hazards Students are able to understand mapping of disaster prone areas. Describe the relationship of each threat in a region. Students are able to do multi-threat mitigation (multihazards) in an area.	
MAIN SUBJECT	
Introduction, earthquake mitigation, libido mitigation and amplification, active fault mitigation, tsunami mitigation, eruption mitigation, mud volcano mitigation, banjr lava mitigation, erosion mitigation, landslide mitigation, landslide mitigation, mitigation mitles, banjir bandang	

mitigation, sedimentation mitigation and mitigation of other natural hazards
PREREQUISITES
Structural Geology, Seismologi, GIS
REFERENCE
1. Hamblin, W.K., 1982; The Earth's Dynamic Systems; 3rd Edition. Minesotta. 2. http://www.tulane.edu/~sanelson/Natural_Disasters/ 3. informatic for Disasters ://nidm.gov.in/PDF/modules/geo.pdf 4. ftp://ftp.itc.nl/pub/westen/Multi_hazard_risk_course/Powerpoints/Background%20paper%20Spatial%20data%20for%20hazard%20and%20risk%20assessment.pdf 5. https://www.bnpb.go.id/home/get_publikasi/12/buku 6. https://www.bnpb.go.id/home/get_publikasi/13/jurnal 7. https://www.marshall.edu/cegas/geohazards/2015pdf/Session1/03_GeobruggCanopyPP.pdf 8. https://www.bnpb.go.id/home/aplikasi

COURSE	Course Name	Thermodynamics
	Course Code	RF184520
	Credit	3 SKS
	Semester	V (Five)

DESCRIPTION of COURSE

This course studies fundamental of thermodynamics, phase diagrams, the interpretation of the function of the state, the variables of the state and its interrelations. Applications of thermodynamics in the earthscince (geology, geophysics, and geothermal).

LEARNING OUTCOMES

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	
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;
Specific Skills	
4.1	being able to apply the principles of math, 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;.

COURSE LEARNING OUTCOMES

[C4,P3,A3] Students are able to analyze system, thermodynamic law, empirical relationship of thermodynamic variable, thermodynamic component imaging technique, and interpretation in earth science, and thermodynamic application in earth sciences
MAIN SUBJECT
Basic concepts The Concept of Equilibrium Reversible / Irreversible Process Temperature and Law 0 thermodynamics Law I thermodynamics Law II Thermodynamics Entalphy Entrophy Dependence of thermodynamic functions on parameters T, P, and V. Clayperon & phase diagram Cycle Carnot, Rankine, and otto Maxwell Equations Thermodynamics Applications in Geology Thermodynamic Applications in Geothermal
PREREQUISITES
• Fundamental Physics I • Physical Geology • Fundamental Chemistry • Geophysical Mathematics
REFERENCE
3. Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey, Fundamentals Of Engineering Thermodynamics, John Wiley & Sons, 2014 4. Anderson, G.M.,Thermodynamics of Natural Systems (2nd edition),Cambridge University Press, 2009

COURSE	Course	Capita-Selecta
	Course Code	RF184521
	Credit	2 SKS
	Semester	V (Five)
DESCRIPTION of COURSE		
The course aim is to facilitate special topics correspond to development of current science and technology of geophysics.		
LEARNING OUTCOMES		
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		
3.1	knowing the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;	
3.2	knowing the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;	
3.6	knowing the complete operational knowledge related to the field of geophysical engineering technology	
3.13	knowing the insights of sustainable development in general from the application of geophysical exploration methodology and natural resources management;	

Specific Skills	
4.1	able to apply the principles of math, 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 (sustainable development);
4.3	able to conduct research that includes identification, formulation, and analysis of geophysical engineering problems;
4.11	capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and
COURSE LEARNING OUTCOMES	
[C4,P4,A3] able to understand depelovement of exploration technology in exploitation natural resources, environment and energy, special topic and its relevancy with current demand/and stake holder	
MAIN SUBJECT	
Topic course correspond to current demand/and stake holder	
PREREQUISITES	
-	
REFERENCE	
1.Telford, WM; Geldart, L.P; Sheriff, RE, 1998, Applied Geophysics, Cambridge Univ Press, Cambridge. 2. Geophysics Journal	

COURSE		
	Course	Well Log Data Analysis
	Course Code	RF184622
	Credit	4 SKS
	Semester	VI (Six)
DESCRIPTION of COURSE		
This course examines basic concepts of formation assessment, wellbore environment, working principles and well loging measurements, well logging theory including production logging interpretation, application for formation evaluation.		
LEARNING OUTCOMES		
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		
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;	
3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;	
3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;	

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
3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work in general;
3.9	understanding the general quality assurance principles in geophysical engineering work;
3.10	understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering;
3.11	understanding the factual knowledge of current principles and issues in economic, social cultural and ecological matters in general which have an influence on the field of geophysical engineering;
3.14	understanding the general concept, principles, and techniques of effective communication both orally and in writing for specific purposes in general; and
3.15	understanding the factual knowledge of the development of cutting-edge technology and advanced materials in the field of geophysical engineering in depth.
Specific Skills	
4.1	being able to apply the principles of math, 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 (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 taking the account economic, health, safety, public, cultural, social and environmental factors;
4.5	capable of designing systems, processes and components with an analytical approach and taking into account technical standards, performance aspects, reliability, ease of application, sustainability and attention to economic, health and safety, public, 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;
COURSE LEARNING OUTCOMES	
[C3,P3,A3] Students Mastering the basic concepts of formation assessment, wellbore environment, principles well logging measurements, understanding well logging theory including interpreting logging well data, can apply well logging concepts for formation evaluation.	

MAIN SUBJECT
• Basic rock physics parameters understand the term terms used in well logging, understand the types of well logging data types, understand the terms in borehole environment terms, familiar with well logging data collection equipment, • well log data acquisition, • Basic equations used in analyzing well logging data, Understanding the types of rock types, understanding the physical properties of rocks analyzed in well logging data, • Properties of nature of potential self-log data, gamma ray and resistivity, Understanding the information contained in each well logging data, • Properties of log data properties of density, sonic, neutron and porosity, Understand the information contained in each well logging data, • Properties of log data properties Magnetic resonance imaging (NMR) and Borehole imaging, Understanding the information contained in each well logging data, • How to evaluate the quality of data, understand how to define reservoir layers, understand how to calculate reservoir parameters, • How to interpret data of well logging by utilizing all available information, determining effective reservoir parameters, • Advanced interpretation techniques for well logging data, • integrate well logging data with seismic data, understand mechanical rock concepts, • The term economic term from the interpretation of well logging data, • Basics of geological concepts used in integrating well-logged interpretation results, Knowing the term reservoir engineering terms, • The term in drilling wells, understanding the physical properties of the wellbore, • Integrated well logging data analysis
PREREQUISITES
Physical Geology, Rock Physics
REFERENCE
10. Darling, T., “Well Logging and Formation Evaluation”, Elsevier Inc., 2005.Zobin, V. M., 2012, Introduction to Volcanic Seismology, Elsevier, London, UK.

11. Tiab, D. and Donaldson, E.C., “Petrophysics 2nd.”, Elsevier, 2004.
12. Asquith, G. B. And Krygowski, D., “Basic Well Log Analysis, 2nd”, American Association of Petroleoum Geologist, 2004.
13. Rider, M., “The Geological Interpretation of Well Logs, 2nd”, Rider-French Consulting Ltd., 2002.
14. Asquith, G.B. And Gibson, C.R., “Basic Well Log Analysis for Geologist”, American Association of Petroleoum Geologist, 1982.

COURSE		
	Course	Electromagnetic Exploration
	Course Code	RF184623
	Credit	4 SKS
	Semester	VI (Six)

DESCRIPTION of COURSE

Electromagnetic is one of the geophysical methods that aims to determine the physical characteristics of rocks below the soil surface by utilizing electric fields and magnetic fields. This course will explain the electromagnetic concept in several methods, namely magnetotelluric (MT) method, Ground Penetrating Radar (GPR), Very Low Frequency (VLF), and its application in energy exploration, mining, hydrogeology, geotechnical and environment. Students will gain experience in electromagnetic exploration planning from planning, data acquisition, processing and interpretation of geoelectric data so that a basic understanding of concepts and techniques will help students compete in the world of work. Activities will be carried out in group work so that students are able to think critically and train in team work to achieve common goals.

LEARNING OUTCOMES

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 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.

COURSE LEARNING OUTCOMES

[C4, P4, A4] Students are able to master the concept, principles and techniques of system design, process or application component of Electromagnetic Method (GPR, VLF, and MT) and implement it procedurally starting from data retrieval, processing, subsurface geology and modeling to resolve deep-seated geophysical engineering issues deeply in mine, hydrogeological, geotechnical and environmental exploration and responsible for own and group work outcomes through scientific reports and presentations.

MAIN SUBJECT

Basic concepts of electromagnetic fields (MT, CSAMT, VLF, GPR), Basic Principles of Electromagnetic Law Induction, Maxwell, magnetic tranfers, electrical tranfers, far field, near field, Electromagnetic design methods in mineral, oil and gas exploration and more earth resources ; source and recipient types; Low frequency EM method: magnetotelluric (MT), Magnetotelluric Audio Source (CSAMT), Magnetotelluric (RMT), Very Low Frequency (VLF), Transient Electromagnetic (TEM), EM induction High Frequency EM: Ground Penetrating Radar (GPR) , remote sensing, EM application examples in geotechnical studies, mining, hydrogeology, the study of exploration of the earth's crust, oil and gas and geothermal.

PREREQUISITES

Geophysical Mathematics

REFERENCE

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. Geophysics Journal

COURSE	Course	Geotechnical
	Course Code	RF184624
	Credit	3 SKS
	Semester	VI (Six)

DESCRIPTION of COURSE

Describes the application of geophysical methods to technical investigations to ensure that subsurface conditions regarding the location, design, construction, operation and maintenance of the engineering work can be accounted for and recommended.

LEARNING OUTCOMES

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	
3.1	understandingthe theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;
3.2	understandingthe geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;
3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;

3.7	understandingthe factual knowledge and application of technology method; technical reference (code and standard) of national and international as well as regulations applicable in its working area to undertake the work of geophysical engineering technology 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;
4.3	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 taking the account economic, health, safety, public, cultural, social and environmental factors;
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	beingable 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.

COURSE LEARNING OUTCOMES
[C4, P4, A4] Students are able to master the concepts, principles and techniques of system design, process or application component of geophysical method for engineering problems and implement it procedurally starting from data retrieval, processing, analyzing the interpretation result with sub surface geology and modeling to solve near-surface engineering problems in depth as well as responsible for own and group work outcomes through scientific reports and presentations.
MAIN SUBJECT
Preliminary; the meaning and role of geophysical methods for solving engineering problems, examples of applications of technical geophysical applications; physical parameters and engineering; technical geophysical methodology, analysis and interpretation; Application of geophysical methods for technical geological problems; application of geophysical methods for geotechnical problems (determination of geotechnical parameters of geophysical measurement, geotechnical evaluation of soil conditions: soil corrosion, soil strength, potential of liquefaction etc., construction materials, foundation structures, dams, etc.); case studies.
PREREQUISITES
Geophysics of Mathematics
REFERENCE
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. Journal of Geophysics

COURSE	**Course**	Seismic Data Processing and Acquisition
	Course Code	RF184625
	Credit	3 SKS
	Semester	VI (Six)
DESCRIPTION OF COURSE		
Learn more in seismic methods specifically at the seismic data acquisition and processing stage.		
LEARNING OUTCOMES		
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		
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;	
3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;	
3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;	
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
3.7	understanding the factual knowledge and application of technology method; technical reference (code and standard) of national and international as well as regulations applicable in its working area to undertake the work of geophysical engineering technology in depth;
3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work in general;
3.9	understanding the general quality assurance principles in geophysical engineering work;
3.10	understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering;
3.11	understanding the factual knowledge of current principles and issues in economic, social cultural and ecological matters in general which have an influence on the field of geophysical engineering;
3.13	understanding the insights of sustainable development in general from the application of geophysical exploration methodology and natural resources management;

3.14	understanding the general concept, principles, and techniques of effective communication both orally and in writing for specific purposes in general; and
3.15	understanding the factual knowledge of the development of cutting-edge technology and advanced materials in the field 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;
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;
4.6	being able to formulate alternative solutions to solve complex geophysical engineering problems by taking the account economic, health, safety, public, cultural, social and environmental factors;
4.7	capable of designing systems, processes and components with an analytical approach and taking into account technical standards, performance aspects, reliability, ease of application, sustainability and attention to economic, health and safety, public, cultural, social and environmental factors;
4.8	capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities;
4.9	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;
4.12	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.

COURSE LEARNING OUTCOMES

[C4,P4,A4] Students are able to create 2-dimensional and 3-dimensional seismic acquisition design, able to perform seismic data processing (basic seismic processing)

MAIN TOPIC

- Review of exploration seismic methods
- Design of 2-dimensional seismic acquisition
- 3-dimensional seismic design
- Acquisition of land and sea seismic
- Seismic geometry acquisition
- Seismic data signal analysis
- Pre-processing of seismic data
- Velocity analysis
- Migration of seismic data
- Recent data acquisition and processing technology

PREREQUISITES

Seismology , Seismic Exploration

REFERENCE

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

COURSE	Course	Digital Electronics
	Course Code	RF184626
	Credit	3 SKS
	Semester	VI (Six)

DESCRIPTION of COURSE

This course discusses the basic concepts of number systems, Logic, Boole Algebra, Comparator, Exclusive-OR, Arithmetic series, Flip-Flop, Counter, Shift Register, Binary Codes, Encoding, Decoding, Multiplexing. Students are expected to understand the theory and application of digital electronics that include the use of numerical systems for arithmetic operations, simplification of logic circuits, design of digital circuits in accordance with the specifications, the implementation of the results of logic design.

LEARNING OUTCOMES

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 required for and designing systems, processes, products or components in the field of geophysical engineering in depth;
4.1	being able to apply the principles of math, 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 (sustainable development);
4.10	being able to organize the data and present it again by utilizing information technology that suits their needs;
COURSE LEARNING OUTCOMES	
[C3,P3,A3] Students understand the theory and application of digital electronics and can demonstrate their use in the field of geophysics	
MAIN SUBJECT	
1. Understanding the system of quantities and the system of numbers and their conversions 2. The nature and workings of logic gates 3. Boolean algebra theorems 4. Method of simplification with karnaugh map 5. Digital arithmetic operation 6. Designing digital arithmetic circuits 7. The nature and workings of the flip-flop 8. Designing a counter circuit 9. Designing a series of registrers 10. Designing decoder circuit, encoder and multiplexer	
PREREQUISITES	
Fundamental Electronics, Digital Data Analysis	
REFERENCE	
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. Journal about digital electronics	

COURSE		
	COURSE	Groundwater Exploration
	COURSE CODE	RF184627
	CREDIT	3 SKS
	SEMESTER	VI (six)
Description Of Course		
This course discusses the concepts of groundwater formation. How the groundwater mechanism can accumulate as aquifer, hydrogeology of an area, the quality of an aquifer. Exploration method for determining an aquifer (exploration technique and geophysical method commonly used to know aquifer), ground water geochemistry and groundwater modeling and simulation.		
Learning Outcomes		
Attitude		
1.9	demonstrating attitude of responsibility on work in his/her field of expertsei independently;	
General Skill		
2.1	able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that cares and implements the humanities value appropriate to their area of expertise;	
2.7	able to take responsibility for the group work achievement, to supervise and evaluate the completion of work assigned to the worker under his or her responsibility;	
2.8	able to conduct self-evaluation process for the group work under their responsibility and manage learning independently;	
Knowledge		
3.2	knowing the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;	
3.3	knowing the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;	
3.8	knowing the principles and methods of the mapping application that required in geophysical engineering work in general;	

3.10	knowing the concept and principle of environmental conservation in general from the activities of geophysical engineering;
3.13	knowing the insights of sustainable development in general from the application of geophysical exploration methodology and natural resources management;
Specific Skills	
4.1	able to apply the principles of math, 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 (sustainable development);
4.2	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	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	able to recognize the difference of land and sea exploration field characteristics that can be affected into the quality of measurement data;
4.10	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

COURSE LEARNING OUTCOMES
[C4,P4,A4] Students are able to know the concept and scope of work in the exploration and mapping of groundwater, important geological conditions in the formation of aquifer systems, physical properties and groundwater chemistry to determine its quality, groundwater exploration technique basics, water mapping and modeling methods soil
MAIN SUBJECT
• Introduction (Introduction to groundwater geology) • System aquifer • Hydrogeochemistry • Groundwater sampling technique • Geophysical and geochemical exploration techniques for groundwater • Groundwater mapping (creating a hydrogeological map) • Groundwater modeling and simulation • Ground water petrophysics • Physical and chemical parameters of groundwater.
PREREQUISITES
Geoelectrical Exploration
REFERENCE
15. Robert A.Bisson and Jay H.Lehr.Modern Groundwater Exploration : Discovering New Water Resources in Consolidated Rock Using Innovate Hydrogeologic Concepts,Exploration,Drilling, Aquifer Testing, and management method.libgen.2004 16. Geolectrical Exploration Module of Geophysical Engineering Department, ITS 17. Bell, Fred G., 2003, Engineering Geology, Elsevier

COURSE	Course	Petroleum Geology
	Course Code	RF184628
	Credit	3 SKS
	Semester	VI (Six)

Course Description	
This course covers the petroleum system from the origin of oil and gas, rock system, reservoir, migration, capture so that it can be concluded to discuss about 3 aspects of learning such as generation, maturation, and accumulation. Also discuss about the existing petroleum system in Indonesia. Learning in creating contour maps, isopach / thickness maps	
Learning Outcome	
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	
3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;
3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;
3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work in general;
3.10	understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering;

3.13	understanding the insights of sustainable development in general from the application of geophysical exploration methodology and natural resources management;
Specific Skills	
4.1	being able to apply the principles of math, 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 (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.

COURSE LEARNING OUTCOMES

[C4,P4,A4] Students discussed the basic understanding of the availability of oil and gas in the earth's crust and the principles of exploration. Students understand the concept of oil and gas formation, oil and gas accumulation, petroleum systems, oil and gas exploration, and regulation of oil and gas business in Indonesia.

MAIN SUBJECT

Introduction (oil and gas understanding physically and chemically)
• The basic concept of oil and gas formation
• Origin of petroleum
• The concept of the parent rock
• The concept of reservoir rock
• The concept of rock hood (seal)
• The concept of hydrocarbon migration (primary and secondary migration)
• The concept of hydrocarbon trapping (trapping mechanism)
• Oil and gas exploration methods
• Calculation of hydrocarbon reserves
• Risk analysis
• Map of the structure
• Isopach map
• Prospect of hydrocarbons.

PREREQUISITES

Structural Geology,Sedimentology Stratigraphy

REFERENCES

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

COURSE		
	Course	Geotourism*
	Course Code	RF184629
	Credit	3 SKS
	Semester	VI (Six)
DESCRIPTION of COURSE		
This course introduces specific topics to broaden the application of geophysical methods and technologies; Geological tourism provides knowledge about aspects of development of geological aspects in the world of tourism. Studying geological potential for tourism as well as problems and obstacles of geological aspects promoted as tourism capitals, tourism in the general sense, understanding of geological tourism, geotourism design, geopark and geotrack, information revitalization and geological interpretation, promotion and dissemination. economics, geotourism case study.		
LEARNING OUTCOMES		
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		
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the basis of the methodology of geophysical exploration approaches to a specific natural phenomenon in general;	
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 in the activities of geophysical engineering;	

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;

COURSE LEARNING OUTCOMES

[C4, P4, A4] Students are able to apply and analyze a tourist area with geological and geophysical analysis with the aim of sustainability and conservation.

MAIN SUBJECT

- Introduction to geological aspects
- Development of geological tourism aspect
- Geopark and Geotrack concepts
- Geographic Information System Application
- Case study

PRASYARAT

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REFERENCE

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. Journal and Case Study

COURSE	Course	Geophysical Instrumentation
	Course Code	RF184630
	Credit	3 SKS
	Semester	VI (Six)

DESCRIPTION of COURSE

This course discusses instrumentation in geophysics including operational amplifiers, sensors and instrumentation applications on geophysical equipment. Students are expected to be able to understand the working principles of instrumentation and the application of electronics instrumentation related to geophysical methods.

LEARNING OUTCOMES

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;
Knowledge	
3.4	understand the theoretical concepts of engineering science (engineering sciences), engineering principles and engineering design methods required for and designing systems, processes, products or components in the field of geophysical engineering in depth;
Specific Skills	
4.1	being able to apply the principles of math, 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 (sustainable development);
4.10	being able to organize the data and present it again by utilizing information technology that suits their needs;

COURSE LEARNING OUTCOMES

[C3,P3,A3] Students are able to apply the working principles of instrumentation and application of electronics instrumentation related to geophysical methods.
MAIN SUBJECT
Sensors, Processing sensor cues, Op-amps for signal calibration, Op-amps for voltage and current regulation, Instrumentation of geophysical equipment
PREREQUISITES
Digital Electronics, Computation of Geophysics, Mathematics in Geophysics
REFERENCE
1. Sedra & Smith, "Microelectronic Circuits Sixth Edition", Oxford University Press 2. Maik Schmidt, "Arduino A Quict-Start Guide", The Pragmatic Bookshelf 3. Journal about geophysics instrumentation

COURSE	Course	Exploration Management
	Course Code	RF184631
	Credit	3 SKS
	Semester	VI (Six)

DESCRIPTION of COURSE

The course aim to fulfill hard skill and soft skill knowledge management in geophysical exploration activities

LEARNING OUTCOMES

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	
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;
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;
Specific Skills	
4.1	being able to apply the principles of math, 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;
COURSE LEARNING OUTCOMES	
[C4,P4,A4] able to understand, apply, and analysis in geophysical exploration activities due to sustainability, effectivity and efficiency	
MAIN SUBJECT	
Concepts and function of management in exploration geophysics; human resources management, organization system, design and taks force management, technic and methods in planning, HSE, and case study.	
PREREQUISITES	
REFERENCE	
1. Brown W, Exploration in Management, a Pelican Book Publisher 2.Soeharto, Iman., Manajemen proyek: Dari Konseptual sampai Operasional, Erlangga, 1997.	

COURSE		
	Course	Geographic Information System
	Course Code	RF184632
	Credit	3 SKS
	Semester	VI (Six)
DESCRIPTION of COURSE		
This course provides insight and knowledge to the students about the concept of Geographic Information System, its development, and its application in earth science		
LEARNING OUTCOMES		
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;	
Knowledge		
3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work in general	
Specific Skills		
4.11	capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data	
COURSE LEARNING OUTCOMES		
[C3,P3,A3] Students are able to apply GIS concepts and applications, able to perform GIS development and manage spatial data by utilizing GIS technology		
MAIN SUBJECT		
Students are able to apply GIS concepts and applications, able to perform GIS development and manage spatial data by utilizing GIS technology		
PREREQUISITES		
Introduction to Geospatial Information		
REFERENCE		
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.

COURSE		
	Course	Applied Seismology
	Course Code	RF184633
	Credit	3 SKS
	Semester	VI (Six)

DESCRIPTION OF COURSE

Recognition of the causes of tectonic earthquakes, magnetism and earthquake intensity, earthquake lanes tectonic plates, seismicity spreading centers, seismicity. Damage caused by earthquake, understanding about earthquake intensity measurement. How many methods of ground motion measurement, such as the murphy-O Brien method, Gutenberg-Richter, Kanai etc. Analysis of earthquake disaster. Local soil types and how the effects of earthquake waves pass through alluvial soil, granite soil and so on. Classification of soil type based on its natural dominant period, classification of surface soil according to: Kanai, S. Omate and N. Nakajima soil structure and period distribution curve on solid soil, soft and very soft. Some seismic zoning contests include: Seismicity index, cumulative seismic hazard index, regional average seismic hazard index and value b. Earthquake forces in buildings of various seismic coefficients. Acceleration and attenuation of earthquake waves in the subduction / crust zone and cesarean section. Earthquake disaster analysis is statistically and seismically challenged.

LEARNING OUTCOMES

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	
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the

	approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;
3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;
3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;
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
3.7	understanding the factual knowledge and application of technology method; technical reference (code and standard) of national and international as well as regulations applicable in its working area to undertake the work of geophysical engineering technology in depth;
3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work in general;
3.9	understanding the general quality assurance principles in geophysical engineering work;
3.10	understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering;

3.11	understanding the factual knowledge of current principles and issues in economic, social cultural and ecological matters in general which have an influence on the field 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;
3.13	understanding the insights of sustainable development in general from the application of geophysical exploration methodology and natural resources management;
3.14	understanding the general concept, principles, and techniques of effective communication both orally and in writing for specific purposes in general; and
3.15	understanding the factual knowledge of the development of cutting-edge technology and advanced materials in the field 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;
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;
4.6	capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities;

4.8	capable of using the latest technology in carrying out geophysical engineering work in the field of environment, settlement, marine and energy;
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.

COURSE LEARNING OUTCOMES

[C4,P4,A4] Students can apply seismology in the field of engineering, able to make seismic zoning based on data measuring both microtremor and downhole seismic survey in determining Vs30. Able to classify soil types based on geotechnical parameters.

MAIN TOPIC

Introduction, Seismic Hazard,
Ground Motion,
Earthquake Acceleration,
Seismic Zoning,
Effects of local soil,
Earthquake force,
Probabilistic Seismic Hazard Analysis,
Deterministic Seismic Hazard Analysis,
Microtremor and Downhole seismic survey

PREREQUISITES

Seismology

REFERENCE

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.

COURSE		
	Course	Geothermal Exploration
	Course Code	RF184734
	Credit	3 SKS
	Semester	VII (Seven)

DESCRIPTION of COURSE

Students must also understand the rules of geothermal exploration within the framework of total geothermal potential development projects, both in technical, economic and legal aspects.
This course invites students to understand the conceptual model of geothermal through geophysical, geological and geochemical data processing and physical model approach based on the rules of increasing geothermal gradient due to both volcanic and non volcanic symptoms.
The conceptual model builds on integrative studies of various geological exploration results as a preliminary approach, then through a geophysical methodology approach to delineate the alleged area of prospects that will be reinforced by evidence of geochemical measurements of geothermal phenomena on the Earth's surface.

LEARNING OUTCOMES

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	
3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work 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;

COURSE LEARNING OUTCOMES

[C3,A2,P3] Students are able to understand the geothermal exploration section within the total working context of the geothermal project. Students are able to make a simple analysis of economic analysis and legal studies of the development of geothermal potential in the context of national energy empowerment. Students are able to perform exploration work sequences in the study of geotermal potential of a region. Students are able to construct a simple geothermal reservoir conceptual model and evaluate the reservoir model and present it in the form of a geothermal energy prospect proposal for an area that is used for the completeness of IUP bidding documents at the ESDM ministry.

MAIN SUBJECT

Introduction: the importance of geothermal exploration in the risk analysis of geothermal energy development in an area.
Geological exploration data processing for early geotermal potential area assessment
Geophysical exploration data processing for delineation of prospective geothermal potential areas
Geo-geophysical-geochemical data assessment of potential geothermal prospect area
The preparation of an integrative assessment report on the prospect of geothermal potential of a region.

PREREQUISITES

Electromagnetic Exploration, Seminars, Geoelectrical Exploration, Gravity Exploration and Geomagnetism, Thermodynamics

REFERENCE

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
3. DiPippo, R. (2008):Geothermal Power Plants: Principles, Applications, Case Studies and Environmental Impact, Elsevier, Second Edition, 493 pp

4. Hochstein, M.P., Browne, P.R.L. (2000), Surface Manifestation of Geothermal Systems With Volcanic Heat Sources, Editors: Haraldur Sigurdsson, Encyclopedia of Volcanoes, Academic Press, pp. 835-855.
5. Proceedings World Geothermal Congress 2005, International Geothermal Association, Antalya-Turkey.

COURSE	Course	Geotomography
	Course Code	RF184735
	Credit	4 SKS
	Semester	VII (Seven)
DESCRIPTION of COURSE		
This course studies the concept of tomography in sub-surface imagery by utilizing seismic waves and electrical properties of the earth and its application to the earth globally and in exploration activities		
LEARNING OUTCOMES		
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 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.

COURSE LEARNING OUTCOMES

[C4, P3, A3] Students are able to apply basic concepts of seismic and electric tomography imaging technology and create simple tomography programs.

MAIN SUBJECT

Preliminary
The basic concept of seismic tomography
Basic concept of electrical impedance tomography
Ray tracing
Model parameters
Model solution
Examples of tomographic applications
Introduction of seismic crosshole method

PREREQUISITES

Introduction to Geophysical Engineering
Geophysical Computing
Seismic Exploration

REFERENCE

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.

COURSE	**Course**	Integrated Field Lecture
	Course Code	RF184736
	Credit	4 (Four)
	Semester	VII (Seven)
DESCRIPTION of COURSE		
This course is an application of geological and geophysical concepts and methods in the field.		
LEARNING OUTCOME OF STUDY PROGRAM THAT SUPPORTED		
Attitude		
1.9	demonstrating attitude of responsibility on work in his/her field of expertise independently;	
General Skill		
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	knowing 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	
4.5	capable of designing systems, processes and components with an analytical approach and taking into account technical standards, performance aspects, reliability, ease of application, sustainability and attention to economic, health and safety, public, cultural, social and environmental factors;	
4.7	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;	
COURSE LEARNING OUTCOME		

[C4,P4,A4] Students are able to compare exploration methods and able to integrate and implement in geological and geophysical field surveys
TOPIC
• Surface geological observation • Geological mapping • Survey design • The concept of exploration • Refraction seismic method • gravity and magnetic methods • Geoelectric method • Ground Penetrating Radar Method
PREREQUISITES
Physical Geology Introduction to Geospatial Information Exploration of Heavy and Magnetic Styles Electromagnetic Exploration Geoelectric Exploration Seismic Exploration
MAIN REFERENCES
1. Telford et al., Applied Geophysics, Cambridge Univ. Press, 1976
SUPPORTER 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 & West, Interpretation Theory in Applied Geophysics, Mc. Graw-Hill Book Company, 1965.

COURSE		
	Course	Seminar
	Course Code	RF184737
	Credit	2 SKS
	Semester	VII (Seven)
DESCRIPTION of COURSE		
This course is pre-preparation of the final project from title selection, literature review, paper writing, paper presentations and preservation of papers in front of the examining team.		
LEARNING OUTCOMES		
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;	
Knowledge		
3.8	general concepts, principles, and communication techniques both orally and in writing for specific purposes;	
Specific Skills		
4.3	being able to conduct research that includes identification, formulation, and analysis of geophysical engineering problems;	
COURSE LEARNING OUTCOMES		
[C4, P4, A4] Students are able to understand the ways of scientific thinking, review topics for the final assignment of national and international journals and present them in oral and scientific papers.		
MAIN SUBJECT		
Techniques of scientific writing, reference, geophysical communications, scientific presentations, publications		
PREREQUISITES		
Already taken the main courses of Geophysical Exploration Method		
REFERENCE		
1. Briscoe, M.H., A guide to scientific illustrations 2. Cargill, M. dan O'Connor, P., Writing Scientific Research Articel 3. Geophysics Journal		

COURSE	**Course**	Thesis
	Course Code	RF184838
	Credit	4 SKS
	Semester	VIII (Eight)
DESCRIPTION of COURSE		
This course studies about the procedures of research, scientific writing and guidelines to conduct seminars written in the form of the final stages of the undergraduate stage is guided by a lecturer or an expert in the field.		
LEARNING OUTCOMES		
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;	
2.2	being able to demonstrate independent performance, quality, and measurable;	
2.4	arrange the scientific description of the results of the above study in the form of a thesis or final project report and upload it on the college page;	
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 knowledge and application of technology method; technical reference (code and standard) of national and international as well as regulations applicable in its working area to undertake the work of geophysical engineering technology 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;
4.3	being able to conduct research that includes identification, formulation, and analysis of geophysical engineering problems;
COURSE LEARNING OUTCOMES	
[C4, P3, A3] Students are able to conduct research on geophysical studies and scientific presentations	
MAIN SUBJECT	
Study the reference of geophysical study, analyze theory or method, take real or synthetic data, process data and modeling, analyze and interpretation of model, make conclusion, write thesis and do presentation in front of lecturer of examiner team.	
PREREQUISITES	
All subjects of national content, ITS founder and prodi prodi until semester VII	
REFERENCE	
1. Department Final Implementation Guidelines 2. Geophysical and Geological Text Book already given in the lecture. 3. Journal of Geophysics and Journal Near Surface Geophysics	

COURSE		
	COURSE	Ore Deposit Exploration
	COURSE CODE	RF184839
	CREDIT	3 SKS
	SEMESTER	VIII (Eight)
Description Of Course		
This course discusses the natural wealth associated with mineral deposits that are economical and can be mined by humans along with the methods of exploration used. The basic concepts of exploration include preliminary geological surveys to geophysical methods commonly used in the mineral deposits exploration process. The exploration strategy along with the economic calculations of the sediment values and the exploration process.		
Learning Outcomes		
Attitude		
1.9	demonstrating attitude of responsibility on work in his/her field of expertsei 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 cares and implements the humanities value appropriate to their area of expertise;	
2.7	being able to take responsibility for the group work achievement, to supervise and evaluate the completion of work assigned to the worker under his or her responsibility;	
2.8	being able to conduct self-evaluation process for the group work under their responsibility and manage learning independently;	
Knowledge		
3.2	demonstrating attitude of responsibility on work in his/her field of expertsei independently;	
3.3	being able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that cares and implements the humanities value appropriate to their area of expertise;	
3.8	being able to take responsibility for the group work achievement, to supervise and evaluate the completion of work assigned to the worker under his or her responsibility;	

3.10	being able to conduct self-evaluation process for the group work under their responsibility and manage learning independently;
3.13	demonstrating attitude of responsibility on work in his/her field of expertsei independently;
Specific Skills	
4.1	being able to apply the principles of math, 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 (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

COURSE LEARNING OUTCOMES

[C4,P4,A4] Students can understand the basics of exploration activities (concepts, models, principles, planning and stages of exploration of mineral deposits), capable of performing integrated analysis to the stage of reserve estimation. The concept and model of mineral deposits exploration. The concept includes several minerals of mineral deposits. The exploration model includes commonly used geological and geophysical models, for example: geological, geo-magnetic, geomagnet, induced polarized, drilling, gravity (seismic) surveys.

MAIN SUBJECT

• Introduction (The concept of mineral resources)
• Regional geological model of mineral resources and their relationship between geological processes
• Geological model
• Geophysical methods (including several geophysical methods that are often used for exploration in the search for mineral deposits such as gravity, IP, magnetic, resistivity, seismic, etc.)
• The concept of exploration and exploration methods
• Exploration strategy
• Integration between geological and geophysical exploration methods
• Methods of acquisition of geological and geophysical data
• Calculation of reserves
• Sample case of integrated study of mineral deposits exploration.

PREREQUISITS

Ore Deposit

MAIN REFERENCES

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

COURSE		
	Course	Passive Electromagnetic Exploration
	Course Code	RF184840
	Credit	3 SKS
	Semester	VIII (Eight)
DESCRIPTION of COURSE		
Electromagnetic is one of the geophysical methods that aims to determine the physical characteristics of rocks below the soil surface by utilizing electric fields and magnetic fields. This course will explain passive electromagnetic concepts in several methods, namely magnetotelluric (MT) and Very Low Frequency (VLF) method, as well as its application in energy exploration, mining, hydrogeology, geotechnical and environment. Students will gain experience in electromagnetic exploration planning from planning, data acquisition, processing and interpretation of geoelectric data so that a basic understanding of concepts and techniques will help students compete in the world of work. Activities will be carried out in group work so that students are able to think critically and train in team work to achieve common goals.		
LEARNING OUTCOMES		
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 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.

COURSE LEARNING OUTCOMES

[C4, P4, A4] Students are able to master the concepts, principles and techniques of designing systems, processes or application components of passive electromagnetic methods (VLF, and MT) and implementing them procedurally starting from data retrieval, processing, analyzing the results of interpretation with geological conditions subsurface and modeling to solve deep-seated geophysical engineering problems deeply in mine, hydrogeological, geotechnical and environmental exploration and responsible for own and group work results through scientific reports and presentations.

MAIN SUBJECT

Basic concepts of passive electromagnetic fields (MT, CSAMT, VLF), Basic Principles of Electromagnetic Law Induction, Maxwell, magnetic tranfers, electrical tranfers, far field, near field, Electromagnetic design methods in mineral, oil and gas exploration and more earth resources; source and recipient types; Low frequency EM method: magnetotelluric (MT), Magnetotelluric Audio Source (CSAMT), Magnetotelluric (RMT), Very Low Frequency (VLF), Transient Electromagnetic (TEM), EM induction, EM applications in geotechnical, mining, hydrogeology, the study of exploration of the earth's crust, oil and gas and geothermal.

PREREQUISITES

Geophysical Mathematics

REFERENCE
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. Geophysics Journal

COURSE	**Course**	Carbonate Exploration
	Course Code	RF184841
	Credit	3 SKS
	Semester	VIII (Eight)
DESCRIPTION of COURSE		
The course discuss formation geology and physics properties of carbonate rocks as sedimentary rock and its Nature Heritage.		
LEARNING OUTCOMES		
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		
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;	
3.2	knowing the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;	
3.8	knowing the principles and methods of the mapping application that required in geophysical engineering work in general;	
Spesific Skills		
4.1	able to apply the principles of math, 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 (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	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.
COURSE LEARNING OUTCOMES	
[C4,P4,A3] able to applying and integrating geophysical methods to explore physical properties of carbonate rocks and its natural heritage.	
MAIN SUBJECT	
Introdustion, general properties of carbonate rocks, classification of carbonate rocks, physical properties of carbonate rocks, measurements of physical properties of carbonate rocks (ie. Porosity, permeability, resistivity/conductivity, mechanical properties).	
PREREQUISITES	
Geology Physics Rock Physics	
REFERENCE	
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	

COURSE		
	Course	Passive Seismic Exploration
	Course Code	RF184842
	Credit	3 SKS
	Semester	VIII (Eight)
DESCRIPTION of COURSE		
This course studies the utilization of seismic waves without source or passive such as in the field of exploration and monitoring of hydrocarbon reservoirs, exploration and monitoring of geothermal reservoirs, and the utilization of passive seismic waves to illustrate the earth structure globally by utilizing earthquake waves as well as ambient noise by utilizing interferometric techniques.		
LEARNING OUTCOMES		
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		
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;	
3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;	

3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;
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
3.7	understanding the factual knowledge and application of technology method; technical reference (code and standard) of national and international as well as regulations applicable in its working area to undertake the work of geophysical engineering technology in depth;
3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work in general;
3.9	understanding the general quality assurance principles in geophysical engineering work;
3.10	understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering;
3.11	understanding the factual knowledge of current principles and issues in economic, social cultural and ecological matters in general which have an influence on the field 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;
3.13	understanding the insights of sustainable development in general from the application of geophysical exploration methodology and natural resources management;
3.14	understanding the general concept, principles, and techniques of effective communication both orally and in writing for specific purposes in general; and
3.15	understanding the factual knowledge of the development of cutting-edge technology and advanced materials in the field of geophysical engineering in depth.
Specific Skills	
4.1	being able to apply the principles of math, 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 (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;
4.6	capable of selecting resources and utilizing geophysical engineering design and analysis tools based on appropriate information and computing technologies to perform geophysical engineering activities;

4.8	capable of using the latest technology in carrying out geophysical engineering work in the field of environment, settlement, marine and energy;
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.

COURSE LEARNING OUTCOMES

[C3, P3, A3] Students understand the phenomenon of naturally produced sesimic waves caused by fluid movement in hydrocarbon and geothermal reservoir. Students can perform the measurement of passive seismic method as well as to know the kind of tool type used as passive seismic wave vibration recorder. Students are able to perform data processing of passive seismic method to get description of subsurface condition in the form of reservoir and non reservoir. Students are able to analyze the phenomena and geological processes that occur based on the interpretation of passive seismic data method.

MAIN SUBJECT

- Preliminary
- Surface waves
- Passive seismic wave recording instrument
- Geophone and its types
- Seismic interferometry
- Miktrotremor
- SASW and MASW
- Passive Seismic Tomography

PREREQUISITES

Seismology, Seismic Exploration

REFERENCE

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

COURSE	Course	Archeological Geophysics
	Course Code	RF184843
	Credit	3 SKS
	Semester	VIII (Eight)

DESCRIPTION of COURSE

This course examines the approach of geosciences in archeology, the understanding of archaeological concept, Paleodisaster, Sedimentation and Stratigraphy Process, Radiocarbon dating, the application of geophysical methods that can be used to map the alleged surface location of archaeological sites.

LEARNING OUTCOMES

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	understandingthe 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 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	beingable 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.

COURSE LEARNING OUTCOMES

[C4, P3, A3] Students are capable of analyzing geophysical statements in archeology, paleodisaster, sedimentation and stratigraphy, radiocarbon dating, applying and utilizing geophysical methods to describe subsurface conditions in archaeological fields.

MAIN SUBJECT

- Basic Concepts of Archeology
- Approach to Geoscience in Archeology
- Paleo disaster
- Sedimentation and Stratigraphy Processes
- RadioCarbon Dating
- Geophysical Methods
- Interpretation of Geophysical Data in Archeology
- Case study

PREREQUISITES

- Geological disaster mitigation
- Electromagnetic exploration
- Geoelectric Exploration

REFERENCE

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.

COURSE	Course	Marine Geophysics
	Course Code	RF184844
	Credit	3 SKS
	Semester	VIII (Eight)

DESCRIPTION of COURSE

This course discusses the application of geophysical methods to map the potential of marine resources by analyzing the characteristics of marine geophysical data. Students take geophysical measurements at sea and are able to design surveys for offshore exploration and research purposes

LEARNING OUTCOMES

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	
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;
3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;
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 knowledge and application of technology method; technical reference (code and standard) of national and international as well as regulations applicable in its working area to undertake the work of geophysical engineering technology 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 of land and sea exploration field characteristics that can be affected into the quality of measurement data;
COURSE LEARNING OUTCOMES	
[C4, P4, A4] Students are able to design and integrate various geophysical exploration acquisitions in accordance with the object of research. Students are able to interpret the geomorphology of the seafloor, anomalies or underwater objects from geophysical data.	
MAIN SUBJECT	
Plate tectonics, earthquakes, isostation, gravity, coat dynamics, oceanic backs, transform fault, hydrothermal, subduction zones, sedimentary basins, ocean floor basin anomalies, sea gravity anomalies, ocean geophysical data interpretation	
PREREQUISITES	
gravity and magnetic exploration, electromagnetic exploration, geoelectric exploration, seismic exploration	
REFERENCE	

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.

Fu, L., and Cazenave, A., satellite altimetry and Earth sciences, Academic Press, 2001.

COURSE		
	Course	Environmental Geophysics
	Course Code	RF184845
	Credit	3 SKS
	Semester	VIII (Eight)
DESCRIPTION of COURSE		
Describes geophysical techniques or methods for environmental applications specifically relating to the estimation, monitoring and mitigation of environmental pollution.		
LEARNING OUTCOMES		
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	understandingthe 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 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.

COURSE LEARNING OUTCOMES

[C4, P4, A4] Students are able to master the concepts, principles and techniques of system design, process or application component of geophysical method for environmental problem and implement it procedurally starting from data retrieval, processing, analyzing the interprestasi result with subsurface geology and modeling to solve the physical environment problems as well as to mitigate them deeply and be responsible for their own work and group work through scientific reports and presentations.

MAIN SUBJECT

Introduction: environmental quality, various kinds of physical environmental pollution and its mitigation; Environmental geophysical techniques related to monitoring and mitigation of environmental pollution; willing case.

PREREQUISITES

Physical Geology
Geoelectric Exploration

REFERENCE

1. Ward, S.H., Editor 1990, Geotechnical and Environmental Geophysics, SEG.
2. Davis, M.L. and Cornwell, D.A., 1991, Introduction to Environmental Engineering, McGraw Hill, Inc.

COURSE	Course	Mining Geophysics
	Course Code	RF184846
	Credit	3 SKS
	Semester	VIII (Eight)

DESCRIPTION of COURSE

This course studies the classification of resources and reserves, reserve calculations, mineral resource potentials in Indonesia and in the world. Application of geophysical methods for mineral exploration.

LEARNING OUTCOMES

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	
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;
3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;
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 knowledge and application of technology method; technical reference (code and standard) of national and international as well as regulations applicable in its working area to undertake the work of geophysical engineering technology 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;
COURSE LEARNING OUTCOMES	
[C4, P4, A4] Students are able to design and integrate geophysical exploration acquisitions related to mineral targets. Students are able to interpret field characteristics that affect sampling and interpret subsurface mineral conditions.	
MAIN SUBJECT	
Mineral genesis, classification of resources and reserves, sampling theory, application of gravity, radioactive, magnetic, seismic, geoelectric, electromagnetic and logging methods for mineral exploration. Calculation of reserves. A wide variety of survey designs and methods for finding mineral deposits in various field conditions.	
PREREQUISITES	
Mineral deposits, geostatistics, gravity and magnetic exploration, electromagnetic exploration, geoelectrical exploration, seismic exploration	
REFERENCE	
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.

COURSE	Course	Reservoir Geophysics
	Course Code	RF184847
	Credit	3 SKS
	Semester	VIII (Eight)

DESCRIPTION OF COURSE	
Studying reservoir characterization methods using geophysical data such as seismic and well data	
LEARNING OUTCOMES	
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	
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;
3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;
3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;
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
3.7	understanding the factual knowledge and application of technology method; technical reference (code and standard) of national and international as well as regulations applicable in its working area to undertake the work of geophysical engineering technology in depth;
3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work in general;
3.9	understanding the general quality assurance principles in geophysical engineering work;
3.10	understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering;
3.11	understanding the factual knowledge of current principles and issues in economic, social cultural and ecological matters in general which have an influence on the field 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;

3.13	understanding the insights of sustainable development in general from the application of geophysical exploration methodology and natural resources management;
3.14	understanding the general concept, principles, and techniques of effective communication both orally and in writing for specific purposes in general; and
3.15	understanding the factual knowledge of the development of cutting-edge technology and advanced materials in the field 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;
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 taking the account economic, health, safety, public, cultural, social and environmental factors;
4.5	capable of designing systems, processes and components with an analytical approach and taking into account technical standards, performance aspects, reliability, ease of application, sustainability and attention to economic, health and safety, public, 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;
4.8	capable of using the latest technology in carrying out geophysical engineering work in the field of environment, settlement, marine and energy;
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.

COURSE LEARNING OUTCOMES

[C4,P4,A4] Students understand the basic property reservoir associated with the event of geology and the existence of economic fluid. Students are able to perform stratigraphic seismic analysis in interpreting seismic data Students are able to integrate all reservoir data for modeling

MAIN TOPIC

· Stratigraphic seismic
· Inversion Seismic
· AVO
· Geostatistics

PREREQUISITES

Seismic Data Interpretation

REFERENCE

5. Dubrule, O., 2003, Geostatistics for Seismic Data Integration in Earth Model, SEG & EAGE
6. PYRCZ,M. J., DEUTSCH, C. V., 2014, GEOSTATISTICAL RESERVOIR MODELING, Oxford University Press, New York Darling, T., "Well Logging and Formation Evaluation", Elsevier Inc., 2005.Zobin, V. M., 2012, Introduction to Volcanic Seismology, Elsevier, London, UK
7. Tiab, D. and Donaldson, E.C., "Petrophysics 2nd.", Elsevier, 2004.
8. Asquith, G. B. And Krygowski, D., "Basic Well Log Analysis, 2nd", American Association of Petroleoum Geologist, 2004.
9. Brown, A., "Interpretation of Three-Dimensional Seismic Data", American Association of Petroleoum Geologist, 2004.
10. Sheriff, R. E., Exploration Seismology, Cambridge Univ. Press. 1995.
11. 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

COURSE		
	Course	Seismic Data Interpretation
	Course Code	RF184848
	Credit	3 SKS
	Semester	VIII (Eight)
DESCRIPTION OF COURSE		
This course discusses the interpretation of 2D and 3D seismic data both quantitatively and qualitatively as well as the geological interpretation recorded on seismic data		
LEARNING OUTCOMES		
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		
3.1	understanding the theoretical concepts of natural science and principles in applying engineering mathematics as the approaches methodology basis of geophysical exploration to a specific natural phenomenon in general;	
3.2	understanding the geological knowledge to understand the geological processes that are characteristic of a particular natural phenomenon in general;	
3.3	understanding the theoretical concepts of statistics to determine the processes probability from a natural phenomenon in general;	

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
3.7	understanding the factual knowledge and application of technology method; technical reference (code and standard) of national and international as well as regulations applicable in its working area to undertake the work of geophysical engineering technology in depth;
3.8	understanding the principles and methods of the mapping application that required in geophysical engineering work in general;
3.9	understanding the general quality assurance principles in geophysical engineering work;
3.10	understanding the concept and principle of environmental conservation in general from the activities of geophysical engineering;
3.11	understanding the factual knowledge of current principles and issues in economic, social cultural and ecological matters in general which have an influence on the field 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;

3.13	understanding the insights of sustainable development in general from the application of geophysical exploration methodology and natural resources management;
3.14	understanding the general concept, principles, and techniques of effective communication both orally and in writing for specific purposes in general; and
3.15	understanding the factual knowledge of the development of cutting-edge technology and advanced materials in the field 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;
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 taking the account economic, health, safety, public, cultural, social and environmental factors;
4.5	capable of designing systems, processes and components with an analytical approach and taking into account technical standards, performance aspects, reliability, ease of application, sustainability and attention to economic, health and safety, public, 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;
4.8	capable of using the latest technology in carrying out geophysical engineering work in the field of environment, settlement, marine and energy;
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.

COURSE LEARNING OUTCOMES

[C4,P4,A4] Students understand phenomena related to earthquake vibration and able to explain the concept of earth wave propagation. Students are able to determine the location of earthquake source, type of earthquake type, and analyze the mechanism of earthquake occurrence. Students understand the principles and application of earthquake monitoring tools. Students understand the basic foundations of seismological concepts used in exploration.

MAIN TOPIC
Seismic Exploration Review Qualitative Interpretation Mapping Under Surface Basin Analysis Petroleum geology Seismic Data Acquisition Seismic Data Processing Structure Interpretation Interpretation of Stratigraphy Deposition Environment Quantitative Interpretation " Seismic Attributes Seismic Inversion Depth Conversion & Velocity Reservoir identification Reservoir Evaluation
PREREQUISITES
Seismic Exploration, Well Log Data Analysis
REFERENCE
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

COURSE	Course	Internship
	Course Code	RF184849
	Credit	3 SKS
	Semester	VIII (Eight)
DESCRIPTION of COURSE		
Application of geophysical concepts and methods through apprenticeships in research institutions, private and government companies aims to increase knowledge and experience about the scope of geophysical work		
LEARNING OUTCOMES		
Attitude		
1.9	demonstrating attitude of responsibility on work in his/her field of expertise independently;	
General Skill		
2.1	able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that cares and implements the humanities value appropriate to their area of expertise;	
2.5	able to take decisions appropriately in the context of problem solving in the area of expertise, based on the results of information analysis and data;	
2.6	able to maintain and develop networks with counselors, colleagues, peers both within and outside of their institutions;	
Knowledge		
3.5	knowing 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	knowing the complete operational knowledge related to the field of geophysical engineering technology	
3.7	knowing the factual knowledge and application of technology method; technical reference (code and standard) of national and international as well as regulations applicable in its	

	working area to undertake the work of geophysical engineering technology in depth;
Specific Skills	
4.1	able to apply the principles of math, 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 (sustainable development);
4.2	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;
COURSE LEARNING OUTCOMES	
[C4, P3, A3] Students are able to apply geophysical exploration methods, combine geophysical and geological data to produce accurate interpretations and have proficiency in geological and geophysical field surveys.	
MAIN SUBJECT	
Application of geophysical exploration concepts and methods in various case studies	
PREREQUISITES	
Physical Geology, Structural Geology, Gravity and Magnetic Exploration, Electromagnetic Exploration, Geoelectric Exploration and Seismic Exploration	
REFERENCE	
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. Journal of Geophysics and Journal of Near Surface Geophysics	

COURSE		
	Course	Geothermal Engineering
	Course Code	RF184851
	Credit	3 SKS
	Semester	VIII (Eight)

DESCRIPTION of COURSE

The hot steam from the earth must be drained into the turbine chamber to drive the turbine generating system and so on out to be reinjected beneath the earth's surface. Physical (major) and chemical (minor) changes are the main study material in this course. Water vapor from the reservoir can be in single or double phase conditions throughout its journey. drilling techniques, reservoir engineering, well testing, steam production facilities, production techniques, geothermal utilization for power generation, direct utilization or utilization for the non-electricity sector, and legal aspects.

LEARNING OUTCOMES

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	
3.6	understanding the complete operational knowledge related to the field of geophysical engineering technology
3.7	understanding the factual knowledge and application of technology method; technical reference (code and standard) of national and international as well as regulations applicable in its working area to undertake the work of geophysical engineering technology in depth;
Specific Skills	

4.5	capable of designing systems, processes and components with an analytical approach and taking into account technical standards, performance aspects, reliability, ease of application, sustainability and attention to economic, health and safety, public, 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	capable of using the latest technology in carrying out geophysical engineering work in the field of environment, settlement, marine and energy;

COURSE LEARNING OUTCOMES

[C3,P3,A3] Students understand the exploitation of geothermal, from drilling wells to electricity generation and direct utilization.

MAIN SUBJECT

Engineering reservoir, drilling, production and utilization of geothermal and legal aspects

PREREQUISITES

Geothermal Exploration

REFERENCE

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.