Module Handbook

Master Programme in Geophysical Engineering

FACULTY OF MINING AND PETROLEUM ENGINEERING
INSTITUT TEKNOLOGI BANDUNG
2022

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Module Handbook Lists

Master Program of Geophysical Engineering

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Master Program of Geophysical Engineering

1. Advanced Mathematics in Geophysics

Module designation	Advanced Mathematics in Geophysics
Module level	Master
Code, if applicable	TG5111
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	First Semester / first Year
Module coordinator(s)	Prof.Dr. Wawan Gunawan A. Kadir, MS
Lecturer(s)	Prof.Dr. Wawan Gunawan A. Kadir, MS
Language	Bahasa Indonesia
Relation to curriculum	Major Subject / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>1 hour</td></tr>
<tr><td>Supervision and consultation</td><td>1 hour</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>2 hours</td></tr>
<tr><td>Class project</td><td>38 hours</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr>
<td>
Understand basic concept of the Mathematic equations that equations that will be applied on geophysical methods.
Understand power series and its expanding in some mathematic equations that can be applied on geophysical methods.
Understand the concept of complex number and its solution in rectangular and polar coordinate systems.
Understand basic concept of some special functions and its background used on geophysical methods.
Understand expanding power series and complex number on Fourier and Laplace transform
Understand basic concept of convolution and its relationship with Fourier-Laplace transforms.
</td>
<td>
Able to apply expanding Powers series real harmonic and complex harmonic on geophysical problem.
Understand to apply Euler’s equation on Fourier and Laplace transformation.
Familiar in application of Delta and step functions for defining subsurface (interior of the earth) on geophysical data, and its response on geophysical data.
Able to apply Fourier and Laplace transforms, and convolution on geophysical data.
</td>
<td>
Take possession of capability for problem solving in geophysical method using expanding function of power series real and complex harmonic oscillation.
Capable in application of Delta and step functions for defining subsurface (interior of the earth) on geophysical data, and its response on geophysical data.
Capability in application of Fourier and Laplace transforms, convolution on geophysical data analysis.
</td>
</tr>
</table>
</td></tr>
<tr><td>Content</td><td>Introduction, Infinite Series, definition of Power Series and its convergence, extent of function by power series, definition of Complex Number, argand diagram, complex number in polar coordinate, complex infinite series, application of Series and Complex Number in Geophysical methods. Fourier series, finite Fourier series, Fourier integral, Fourier transform, convolution, application in geophysics, Laplace Transform, generalized Fourier transform, laplace transform of delta function, convolution and laplace transform, strain in a inelastic solid, seismometer, Wave Equation,vibration of string, Helmholtz eq., solution in cylindrical and polar coordinate system</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td rowspan="3">equal</td></tr>
<tr><td>Final Test</td><td>√</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td></tr>
<tr><td>Laboratory work</td><td>-</td><td></td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>1. Boas, M.J., Mathematical method in the physical sciences, 2nd ed., John Wiley & Sons, 1983.
2. Farlow, S.J., Partial Differential Equations for Scientists & Engineers, John Wiley & Sons, 1982
3. Rikitake, Sato, Hagiwara, Applied Mathematic for Earth Scientist, Terra Scientist Publishing Comp., 1987</td></tr>
</table>

2. Advanced Wave and Field in Geophysics

Module designation	Advanced Wave and Field in Geophysics
Module level	Master
Code, if applicable	TG5112
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	First Semester / first Year
Module coordinator(s)	
Lecturer(s)	Dr. Darharta Dahrin, MS, Dr.Eng.Ir. T.A. Sanny, M.Sc.
Language	Bahasa Indonesia
Relation to curriculum	Major Subject / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	-
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>3 hours</td></tr>
<tr><td>Tutorial session</td><td>3 hour</td></tr>
<tr><td>Supervision and consultation</td><td>-</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>9 hours</td></tr>
<tr><td>Total workload per week</td><td>15 hours</td></tr>
<tr><td>Presentation</td><td>2hours</td></tr>
<tr><td>Class project</td><td>13 hours</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>240 hours</td></tr>
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<tr><td>Credit points</td><td>3</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• The students are able to explain the wave and Field in geophysics and how to formulate the wave and field in various cases in geophysics.</td><td>• The students are able resolve the wave and field parameters in mathematics, and then they are able to use these formulas in seismology and potential geophysics.</td><td>• Possess the capability to apply the wave and field theories in seismology and all potential methods in geophysics.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The topics on the subject are focused into the following subtopics: fundamental concept of wave on geophysics, Green function, Fourier Series, Fourier integral, discrete spectral analysis, Vibration, Acoustic wave, Elastic waves; Compressional wave, shear waves, derivative of the elastic wave equation, boundary condition, reflection and transmission coefficient, Reflection in term of convolution, Fluid-solid boundary, Material symmetry, isotropic and anisotropic media, Hamiltonian’s rays equation, Lagrangian equation, Christoffel equation, Euler equation, Fermat principle, and Ray parameter. Field equation, potential, loop and mutual induction on magnetic field, scale theorem on uniform field, multiple, transient, induced polarization theorem, electric induction models, electric polarization POTENTIAL FIELD: Solution of potential field equation. Laplace, Poisson, and diffusion equation. GRAVITY POTENTIAL: gravity potential field analysis, gravity field of the earth. MAGNETIC POTENTIAL: magnetic dipole field, magnetic field of the earth, magnetic anomalies</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>35%</td></tr>
<tr><td>Final Test</td><td>√</td><td>35%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>30%</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>

1. Aki, K. & Richard, R., Advance Theory of Seismology,2002
2. Berkhout, A. J., Applied Seismic Wave Theory, Elsevier, 1987
3. Blakely, R.L., 1996, Potential Theory in Gravity and Magnetic Applications.
4. Boas, M.L., 2006, Mathematical Methods in the Physical Sciences, 3rd. Ed. John Wiley and Sons
5. Bullen, K.E., An Introduction to the Theory of Seismology, Cambridge University Press, 1985.
6. Griffiths, D.J., 1999, Introduction to Electrodynamics, 3rd ed., Prentice Hall.
7. Lowrie, W., 2011, A student’s Guide to Geophysical Equations, Cambridge Univ. Press. 8. Slawinski, M.A., 2003, Seismic Waves and Rays in Elastic Media, Pergamon-Elsevier Scinece Limited.. 9. Turcotte, D.L. and Schubert, G., 1982, Geodynamics Application of continuum Physics to geological Problems, John Wiley & Sons. 10. Wait, J.R., 1982, Geo-Electromagnetism, Academic Press

</td></tr>
</table>

3. Advanced Signal Geophysical Analysis

Module designation	Advanced Signal Geophysical Analysis
Module level	Master
Code, if applicable	TG5114
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	First Semester / first Year
Module coordinator(s)	Prof.Dr. Wawan Gunawan A. Kadir, MS
Lecturer(s)	Prof.Dr. Wawan Gunawan A. Kadir, MS
Language	Bahasa Indonesia
Relation to curriculum	Major Subject / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>2 hours</td></tr>
<tr><td>Supervision and consultation</td><td>2 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>4 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>2 hours</td></tr>
<tr><td>Class project</td><td>38 hours</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr>
<td>• Understand basic concept of analog, continuous, digital, and discrete data.
• Understand relationship between signal, system, and output of the system in geophysical data.
• Understand the principal of digitization and its application on geophysical data acquisition.
• Understand analog and discrete Fourier transform, and its application on some special function.
• Physical meaning of convolution and correlation process, and its theorem on time and frequency domain, and application on geophysical data.
• Understand basic concept of filtering and its process on time and frequency domains, and its application on geophysical data.</td>
<td>• Able to design geophysical data acquisition based on the concept of digitization and sampling theory.
• Understand to apply the Fourier transform for analyzing geophysical data in spectral domain.
• Familiar in application of convolution and correlation processes in time and frequency domains for geophysical data.
• Able to apply filtering process through convolution and correlation process in time and frequency domains, and its application on geophysical data processing.</td>
<td>• Take possession of capability for designing geophysical data acquisition based on the concept of digitization and sampling theory.
• Capable in application of the Fourier transform for analyzing geophysical data in spectral domain.
• Has capability in application of convolution and correlation processes in time and frequency domains for geophysical data.
• Has capability in filtering process through convolution and correlation in time and frequency domains, and its application on geophysical data processing.</td>
</tr>
</table>
</td></tr>
<tr><td>Content</td><td>Introduction: Signal, noise, and system in geophysics, analog and digital signal, digitation; Fourier transform and its application in geophysical data: Fourier series, Fourier integral, properties of Fourier transform; Discrete Fourier transform: Fourier coefficient, Fourier integral, FFT; Convolution in geophysics: convolution in time and frequency, space and wave number, convolution properties, meaning of convolution, design of software; Correlation in geophysical data: definition, cross and auto correlation; Sampling theory in geophysics: sampling function, sampling theorem, aliasing in time and freq domain; Phase properties of digital signal; Filtering geophysical data; Cases of digital signal application in geophysics.</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td rowspan="3">equal</td></tr>
<tr><td>Final Test</td><td>√</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td></tr>
<tr><td>Laboratory work</td><td>-</td><td></td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>1. Oram Brigham, B, The Fast Fourier Transform and its Applications, Prentice-Hall Inc., 1988.
2. Robinson, A. B., Geophysical Signal Analysis, Prentice-Hall Inc., 1980.</td></tr>
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4. Research Methodology

<table>
<tr><td>Module designation</td><td>Research Methodology</td></tr>
<tr><td>Module level</td><td>Master</td></tr>
<tr><td>Code, if applicable</td><td>TG5024</td></tr>
<tr><td>Sub-heading, if applicable:</td><td>-</td></tr>
<tr><td>Courses included in the module, if applicable:</td><td></td></tr>
<tr><td>Semester(s) in which module is taught</td><td>Second Semester / first Year</td></tr>
<tr><td>Module coordinator(s)</td><td>Prof. Dr. Satria Bijaksana</td></tr>
<tr><td>Lecturer(s)</td><td>Prof. Dr. Satria Bijaksana</td></tr>
<tr><td>Language</td><td>Bahasa Indonesia</td></tr>
<tr><td>Relation to curriculum</td><td>Major Subject / Compulsory Course</td></tr>
<tr><td>Type of teaching, contact hours</td><td>
<table>
<tr><td>Class lectures
Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.</td><td>√</td></tr>
<tr><td>Presentation
Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.</td><td>√</td></tr>
<tr><td>Tutorial session
Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.</td><td>√</td></tr>
<tr><td>Class project and discussion
Lecturer gives students a project which related to current issues and course material.</td><td>√</td></tr>
<tr><td>Supervision and consultation
This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.</td><td>√</td></tr>
<tr><td>Practical or experimental laboratory work
Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.</td><td>-</td></tr>
<tr><td>Field trip
Visit field area or company which is related to course material.</td><td>-</td></tr>
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</table>

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>-</td></tr>
<tr><td>Tutorial session</td><td>9 hours</td></tr>
<tr><td>Supervision and consultation</td><td>15 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>4 hours</td></tr>
<tr><td>Individual studies</td><td>11 hours</td></tr>
<tr><td>Total workload per week</td><td>-</td></tr>
<tr><td>Presentation</td><td>240 hours</td></tr>
<tr><td>Class project</td><td>-</td></tr>
<tr><td>Field trip</td><td>9 hours</td></tr>
<tr><td>Total workload per semester</td><td>15 hours</td></tr>
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</td></tr>
<tr><td>Credit points</td><td>3</td></tr>
<tr><td>Requirement’s prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understand the importance of literature review in proposing research work
• Understand the importance in recognizing research gap that could be exploited as research question in his/her research proposal
• Understand the importance of publishing his/her own scholarly work in scientific journal.
• Understand the need to make a sound working proposal that he/she would use to complete his/her research work.
• Understand the importance of time scheduling and costing in research proposal.</td><td>• Able to find the required literatures using database (Google Scholar, SCOPUS), contacting authors and other means.
• Able to identify research gap in the literature and exploit it for his/her research work.
• Able to communicate with his/her own research supervisor to write a sound working proposal.</td><td>• Able to write a sound working proposal that not only meet the specific requirement of the School of Graduate Studies but also lead to publication in scientific journal.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>Concept of research methodology and scientific methods. Elements and process of research: selection of topics, problem statement, conceptual framework, research hypothesis, research method and design, research operationalization and results finding. Implementation of research methodology for thesis proposal preparation. Scientific and technical communication: writing technical report and scientific paper, effective presentation</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Draft of proposal</td><td>√</td><td>30%</td></tr>
<tr><td>Final proposal</td><td>√</td><td>40%</td></tr>
<tr><td>Presentation of proposal</td><td>√</td><td>30%</td></tr>
<tr><td>Laboratory work</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>1. Guidelines for Thesis and Dissertation, School of Graduate Studies (http://www.sps.itb.ac.id/in/pedoman-tesis-dan-disertasi)
2. ID Satria Bijaksana: Komunikasi Geofisika - Literatur dalam Geofisika (https://www.youtube.com/watch?v=75vYQ-yTYag)
3. How To Choose A Research Topic For A Dissertation or Thesis (https://www.youtube.com/watch?v=hXvoKE6_wQo)
4. How To Write A Literature Review In 3 Simple Steps (https://www.youtube.com/watch?v=lw8HPXJP1VA)
5. Ultimate Guide to write Perfect Research Proposal (https://www.youtube.com/watch?v=m_yCeVuB1XU)</td></tr>
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5. Fieldwork

<table>
<tr><td>Module designation</td><td>Fieldwork</td></tr>
<tr><td>Module level</td><td>Master</td></tr>
<tr><td>Code, if applicable</td><td>TG6232</td></tr>
<tr><td>Sub-heading, if applicable:</td><td>-</td></tr>
<tr><td>Courses included in the module, if applicable:</td><td></td></tr>
<tr><td>Semester(s) in which module is taught</td><td>Second Semester / first Year</td></tr>
<tr><td>Module coordinator(s)</td><td>Dr.Ir. Agus Laesanpura, MS</td></tr>
<tr><td>Lecturer(s)</td><td>Dr.Ir. Agus Laesanpura, MS</td></tr>
<tr><td>Language</td><td>Bahasa Indonesia</td></tr>
<tr><td>Relation to curriculum</td><td>Major Subject / Compulsory Course</td></tr>
<tr><td>Type of teaching, contact hours</td><td>
<table>
<tr><td>Class lectures
Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.</td><td>√</td></tr>
<tr><td>Presentation
Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.</td><td>√</td></tr>
<tr><td>Tutorial session
Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.</td><td>√</td></tr>
<tr><td>Class project and discussion
Lecturer gives students a project which related to current issues and course material.</td><td>√</td></tr>
<tr><td>Supervision and consultation
This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.</td><td>√</td></tr>
<tr><td>Practical or experimental laboratory work
Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.</td><td>√</td></tr>
<tr><td>Field trip
Visit field area or company which is related to course material.</td><td>√</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>1 hours</td></tr>
<tr><td>Supervision and consultation</td><td>2 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>1 hours</td></tr>
<tr><td>Individual studies</td><td>4 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>5 hours</td></tr>
<tr><td>Class project</td><td>15 hours</td></tr>
<tr><td>Field trip</td><td>50 hours</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
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</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td>Advanced Geophysical Mathematics (Taken Simultaneously)
Waves and Terrain in Geophysics (Taken Simultaneously)</td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr>
<td>• Understand the importance of geological information and geological observation in geophysical works.
• Understand the principles and methodologies in general geophysical methods (gravity, magnetic, refraction seismology, geoelectricty, GPR (ground penetrating RADAR), EM methods).
• Understand the importance of combined methods in geophysical exploration.
• Understand the basic elements in designing geophysical surveys.</td>
<td>• Having field experience in geological and geophysical survey.
• Able to conduct basic geological survey that include field observation, data processing and producing basic geological map.
• Able to design simple geophysical survey by considering the availability of manpower, instruments, logistics, transports etc.
• Able to operate basic geophysical instruments in the field including simple trouble shooting
• Able to handle and process data generated by geological and geophysical surveys.
• Able to make simple interpretation on the results of geophysical surveys.
• Able to communicate his/her own finding through oral presentation as well as through written report.
• Able to work in a team in the stressful field environment.</td>
<td>• Confidence in leading a simple geophysical survey.
• Confidence in becoming part of large geophysical survey in charge a specific task.
• Willingness to learn more about field geophysics.</td>
</tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Content</td><td>In this course, the knowledge on how to make a geological and geophysical surveys will be given. The course includes: exploration concept, planning, geological observation, geological mapping, data acquisition, processing and interpretation. Several geophysical method will be applied on the field, namely: refraction seismic, gravity, magnetic, geoelectrical, and Ground Penetrating Radar</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>-</td><td>-</td></tr>
<tr><td>Final Test</td><td>√</td><td>15%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>10%</td></tr>
<tr><td>Field work</td><td>√</td><td>35%</td></tr>
<tr><td>Report</td><td>√</td><td>40%</td></tr>
</table>
</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>1. Robinson E, C. Coruh, Basic Exploration Geophysics, John Wiley & sons
2. Telford et al., Applied Geophysics, Cambridge Univ. Press, 1976
3. Milsom J., Field Geophysics. John wiley & sons
4. Sheriff, R.E., dan L.P. Geldart, Exploration Seismology. Cambridge Univ. Press, 1995.</td></tr>
</table>

6. Earthquake Seismology

Module designation	Earthquake Seismology
Module level	Master
Code, if applicable	TG5031
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	Earthquake Seismology
Semester(s) in which module is taught	first Semester / first Year
Module coordinator(s)	Prof. Sri Widiyantoro, Ph.D.
Lecturer(s)	Prof. Sri Widiyantoro, Ph.D., Dr. Wahyu Triyoso, Dr. Afnimar, Prof. Dr. Andri Dian Nugraha
Language	Indonesian
Relation to curriculum	Major Subject / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant conveys main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>3 hours</td></tr>
<tr><td>Tutorial session</td><td>-</td></tr>
<tr><td>Supervision and consultation</td><td>3 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>9 hours</td></tr>
<tr><td>Total workload per week</td><td>15 hours</td></tr>
<tr><td>Presentation</td><td>3 hours</td></tr>
<tr><td>Class project</td><td>12 hours</td></tr>
<tr><td>Field trip</td><td></td></tr>
<tr><td>Total workload per semester</td><td>240 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>3</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understanding the concept of seismology and its implication to earthquake.
• Understanding earthquake source and mechanism.
• Understanding wave propagation through medium and its elasticity properties.
• Understanding earthquake and fault mechanics, deformation and rheology, and dislocation model, pre- and co-seismic.</td><td>• Able to describe seismic wave and polarization in seismology.
• Able to describe source theory of earthquake.
• Able to characterize earthquake-fault mechanic parameters.
• Able to do basic deformation modeling.</td><td>• Have the ability on determining and analyzing seismic wave phases recorded on a three-component seismometer.
• Familiar in reading “beach-ball“ focal mechanism and its relation to faulting parameters, and familiar in quantifying magnitude, energy and intensity.
• Have the ability to characterize the earthquake-fault mechanic parameters.
• Have the ability or basic knowledge to do the basic deformation modeling of pre- and co-seismic cases.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>1. Introduction: A brief history of seismology; 2. Stress and strain: the stress tensor, the strain tensor, the linear stress-strain relationship; 3. The seismic wave equation and solution: The momentum equation, plane waves, polarization, spherical waves, Snell’s law, ray path and travel time curves; 4. Ray theory: travel times, inversion of travel times, geometrical spreading, amplitudes and phase; 5. Surface waves and normal modes: Love waves, Rayleigh waves, Dispersion, Global and observing surface waves; 6. Anisotropy: Basic physic concept, Hooke’s low representation, shear-wave-splitting; 7. Seismic moment tensor: definition, the moment tensor and elastic dislocation, Eigen analysis, type of sources; 8. Earthquake location: hypocentre determination, absolute and relative methods; 9. Earthquake and fault mechanics: Force, stress and strain, and dislocation model; 10. Elastic deformation and rheology: Deformation and rheology, dislocation model, pre- and co-seismic.</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>30%</td></tr>
<tr><td>Final Test</td><td>√</td><td>40%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>30%</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>

1. Fowler, C.M.R., The Solid Earth: An Introduction to Global Geophysics, Cambridge University Press, Cambridge, 2nd edition, 2005.
2. Shearer, P., Introduction to seismology, Cambridge university press, Second Edition, 2009.
3. Stein, S. and Wysession, M., An introduction to seismology, earthquakes and earth structure, Blackwell publishing, 2007.
4. Udias, A., Principle of Seismology, Cambridge University Press, Cambridge, 1999.
5. Christopher H. Scholz, The Mechanics of Earthquakes and Faulting, Cambridge University Press, 2002.

</td></tr>
</table>

7. Geodynamics and Seismotectonics

Module designation	Geodynamics and Seismotectonics
Module level	Master
Code, if applicable	TG6031
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	Geodynamics and Seismotectonics
Semester(s) in which module is taught	Second Semester / first Year
Module coordinator(s)	Prof. Sri Widiyantoro, Ph.D.
Lecturer(s)	Prof. Sri Widiyantoro, Ph.D., Prof. Dr. Andri Dian Nugraha, Dr. Zulfakriza, Dr. Endra Gunawan
Language	Indonesian
Relation to curriculum	Major Subject / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant conveys main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>3 hours</td></tr>
<tr><td>Tutorial session</td><td>-</td></tr>
<tr><td>Supervision and consultation</td><td>3 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>9 hours</td></tr>
<tr><td>Total workload per week</td><td>15 hours</td></tr>
<tr><td>Presentation</td><td>3 hours</td></tr>
<tr><td>Class project</td><td>12 hours</td></tr>
<tr><td>Field trip</td><td></td></tr>
<tr><td>Total workload per semester</td><td>240 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>3</td></tr>
<tr><td>Requirement prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr>
<td>Students understand: plate tectonics, mantle convection, plate boundary, Wilson cycle, hot spot, triple junction, Earth’s interior, kinematics, morphology and deformation; Mechanics: Force and rheology; and dynamics process.
Students understand subduction zone, Wadati-Benioff zone, and fault plane solution determination
Students understand active faults in the world, and seismic hazard.
Students understand the dynamics of the plate interiors.
Students understand tectonic process related to an earthquake cycle.</td>
<td>Able to describe describe principles of plate tectonics, mantle convection, Wilson cycle, hot spot, triple junction, kinematics, morphology and deformation; Mechanics: Force and rheology; and dynamics process.
subduction zone, Wadati-Benioff zone, and fault plane solution determination
Able to describe active faults and seismic hazard
Able to describe the basic for further study related to Earth's plates dynamics.
Able to describe the tectonic processes related to an earthquake cycle.</td>
<td>Familiar with tectonic processes etc.
Familiar with subduction zone worldwide, Benioff zone, and fault plane solution determination
Familiar with active faults and seismic hazard
Possess an extensive knowledge to describe the basic for further study related to Earth's plate’s dynamics.
Possess ability to describe the physical process related to an earthquake cycle</td>
</tr>
</table>
</td></tr>
<tr><td>Content</td><td>1. Plate tectonics; 2. Mantle convection, Plate boundary, Wilson cycle; 3. Hot spot, triple junction; Earth interior; 4. Kinematics: morphology and deformation; 5. Mechanics: Force and rheology; 6. Dynamics process; 7. Earthquakes, subduction, Wadati-Benioff zone; 8. Focal mechanism; 9. Seismic hazard; 10. Earthquake cycle: interseismic; 11. Earthquake cycle: coseismic; 12. Earthquake cycle: postseismic.</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>45%</td></tr>
<tr><td>Final Test</td><td>√</td><td>45%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>10%</td></tr>
<tr><td>Laboratory work</td><td>-</td><td></td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>

Stein, S. and Wysession, M.: "An Introduction to Seismology, Earthquakes, and Earth Structure", Wiley, New Jersey, 1991.
Scholz, C., H.: "The mechanics of earthquakes and faulting", Cambridge university press, Cambridge, 2002
Segall, P.: "Earthquake and Volcano Deformation", Princeton University Press, Princeton, 2010.
Turcotte, D.L. and Schubert, G.: "Geodynamics", Cambridge University Press, Cambridge, 2014

</td></tr>
</table>

8. Geohazard and Volcano Physics

Module designation	Geohazard and Volcano Physics
Module level	Master
Code, if applicable	TG6032
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Second Semester / first Year
Module coordinator(s)	Prof.Dr. Antonius Nanang Tyasbudi P. M.Sc.
Lecturer(s)	Prof.Dr. Antonius Nanang Tyasbudi P. M.Sc., Prof.Dr. Andri Dian Nugraha S.Si.,M.Si., Dr. Zulfakriza, S.Si.,MT, Dr. rer. nat. David Prambudi Sahara, ST,MT
Language	Bahasa Indonesia
Relation to curriculum	Major Subject / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>3 hours</td></tr>
<tr><td>Tutorial session</td><td>-</td></tr>
<tr><td>Supervision and consultation</td><td>3 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>9 hours</td></tr>
<tr><td>Total workload per week</td><td>15 hours</td></tr>
<tr><td>Presentation</td><td>3 hours</td></tr>
<tr><td>Class project</td><td>12 hours</td></tr>
<tr><td>Field trip</td><td></td></tr>
<tr><td>Total workload per semester</td><td>240 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>3</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understanding basic concept of tsunami, earthquake source, and volcanic activity
• Understanding geohazard phenomenon and its implication</td><td>• Able to describe source of earthquake and tsunami
• Able to describe earthquake circle and volcano seismology
• Able to describe probabilistic seismic hazard analysis</td><td>• Possesses an extensive knowledge to describe the basic for further study related to geohazard and volcanic activity
• Possesses ability describe the seismic hazard analysis</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>1.Earthquake predictions: forecasting and prediction, the earthquake cycle, earthquake triggering, searching for precursors, approach and application to predict earthquake; 2.Earthquake hazard: seismicity, magnitude, and intensity, estimation of ground motion, probabilistic seismic hazard analysis, deterministic seismic hazard analysis, estimating seismic risk, empirical and analytical methods of damage estimation; 3. Tsunami hazard; 4.Volcano seismology: seismicity at volcanoes, origin of volcano tectonic and eruption earthquake, source properties, volcano-tectonic earthquake, earthquake swarms, volcanic tremor, explosion earthquake, seismic monitoring, prediction of eruption</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>35 %</td></tr>
<tr><td>Final Test</td><td>√</td><td>35 %</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>30 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td></td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>1. Scholz, C., H., The mechanics of earthquakes and faulting, Cambridge university press, Second Edition, 2002
2. Volcanic Seismology, 1992, Volume 3, ISBN : 978-3-642-77010-4</td></tr>
</table>

9. Computational Seismology

Module designation	Seismology Computation
Module level	Master
Code, if applicable	TG5032
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Third Semester / second Year
Module coordinator(s)	Dr. Wahyu Triyoso, M.Sc.
Lecturer(s)	Dr. Tedi Yudistira, S.Si.,M.Si., Dr. Afnimar, M.Sc, Dr. Wahyu Triyoso, M. Sc., Dr.rer.nat. Andri Hendriyana, ST,MT
Language	Bahasa Indonesia
Relation to curriculum	Major Subject / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>3 hours</td></tr>
<tr><td>Tutorial session</td><td>-</td></tr>
<tr><td>Supervision and consultation</td><td>3 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>9 hours</td></tr>
<tr><td>Total workload per week</td><td>15 hours</td></tr>
<tr><td>Presentation</td><td>3 hours</td></tr>
<tr><td>Class project</td><td>12 hours</td></tr>
<tr><td>Field trip</td><td></td></tr>
<tr><td>Total workload per semester</td><td>240 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>3</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>▪ Understanding the concept of seismology computation.
▪ Understanding basic numerical method in seismology
▪ Understanding basic concept of green function, convolution, and deconvolution
▪ Understanding basic concept of velocity modeling, subsurface imaging</td><td>• Able to understand the numerical method and algorithm in seismology
• Able to understand the implementation the time series and signal theory in seismology.
• Able to understand and to do the basic modeling of the subsurface and imaging in seismology</td><td>• Have the ability on implementing the numerical method and algorithm in seismology computation.
• Could implement the time series and signal processing in seismology.
• Have the ability or basic knowledge to do the basic subsurface modeling and imaging.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>1.Seismological instrumentation: seismograms and signals, seismometer and installation; 2.Earthquake monitoring: identifying P- and S-phase, seismic network, inverse problems; 3.Numerical methods in seismology: finite-difference, finite-element, spectral-element, wave propagation in 1D, 2D, 3D; 4.Computational of elastic wave in the earth: elastic waves equations, boundary and initial conditions, seismic sources, scattering, seismic wave problems as linear systems, waves in a discrete world; 5.Reflection seismology: zero-offset sections, common mid-point stacking, source and deconvolution, migration, velocity analysis, receiver function, Kirchhoff theory; 6.Seismic tomography: one-dimensional velocity inversion, linier programming, three-dimensional velocity inversion, delay time tomography, application.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>40%</td></tr>
<tr><td>Final Test</td><td>√</td><td>40%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20%</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
</table>

Media employed	Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.
Reading list	1. Shearer, P., Introduction to seismology, Cambridge university press, Second Edition, 2009 2. Stein, S. and Wysession, M., An introduction to seismology, earthquakes and earth structure, Blackwell publishing, 2007 3. Igel, H., Computational seismology, Oxford, 2017

10. Acquisition and Processing of Seismic Data

Module designation	Acquisition and Processing of Seismic Data
Module level	Master
Code, if applicable	TG5122
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Third Semester / Second Year
Module coordinator(s)	Prof.Dr.rer.nat. Awali Priyono
Lecturer(s)	Prof.Dr.rer.nat. Awali Priyono
Language	Bahasa Indonesia
Relation to curriculum	Major Subject / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	-
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	-
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	-
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	√
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>-</td></tr>
<tr><td>Supervision and consultation</td><td>-</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>4 hours</td></tr>
<tr><td>Individual studies</td><td>4 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>-</td></tr>
<tr><td>Class project</td><td>-</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td>Signal Analysis</td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr>
<td>• Advanced exploration seismology, seismic history and technology and terminology.
• Advanced theory seismic wave travel time, reflected, refracted waves, ray geometry, Seismic resolution.
• Knowledge of seismic data acquisition, consideration, objectives and limitation, parameter, equipment and technic. Land and marine survey design.
• Knowledge of seismic data processing: preprocessing seismic velocity analysis, seismic migration and filtering.
• Knowledge New Seismic Technology in Acquisition and Processing</td>
<td>• Good understanding of the equipment and technic of land and marine 2D and 3D seismic acquisition, survey parameter design.
• Good understanding of 2D and 3D seismic data processing technic, and able to process seismic data from raw data to final stack section.
• Familiar with industrial seismic processing system software.</td>
<td>• Able to explain basic concept of exploration seismology.
• Be able to use basic knowledge of basic concept of exploration seismology to 2D and 3D design of marine and land seismic survey.
• Be able to find the best processing flow and parameter for a specific seismic data.
• Be able to process seismic data from filed record to stack migration section</td>
</tr>
</table>
</td></tr>
<tr><td>Content</td><td>The topics subject are focused into the following subtopics : fundamental concept of reflection seismic its application of subsurface image reconstruction for exploration and exploitation. 2D and 3-D seismic data acquisition and design. Standard processing: geometry setting and formatting, pre-processing, NMO and velocity analysis, migration and filtering. Advance seismic data processing: effect anisotropy in the velocity analysis, velocity analysis and modeling, pre-stack depth migration (PSDM), influence of attenuation in the seismic data and its correction, Converted waves and 3C-processing. Broadband Seismic, Vertical Seismic Profilling, Crosshole Seismic and New Tecnologies.</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>25 %</td></tr>
<tr><td>Final Test</td><td>√</td><td>25 %</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>25 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>25 %</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>

1. Evans, B.J., A Handbook for Seismic Data Acquisition in Exploration, SEG, 1997.
2. Dondurur, D., Acquisition and Processing of Marine Seismic Data, 1st Edition, 2018
3. Sheriff, R. E., Exploration Seismology, Cambridge Univ. Press., 1995.
4. Onajite, E., Seismic Data Analysis Technique for Hydrocarbon Exploration. 1st Edition, 2013.
5. Özdogan Yilmaz, Seismic Data Analysis: Processing, Inversion,and Interpretation of Seismic Data, Vol I and II, Publisher, Society of Exploration Geophysicists, 2001

</td></tr>
</table>

11. Petroleum System

Module designation	Petroleum System
Module level	Master
Code, if applicable	GL5025
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	First Semester / first Year
Module coordinator(s)	Prof.Dr. Eddy Ariyono Subroto
Lecturer(s)	Prof.Dr. Eddy Ariyono Subroto
Language	Bahasa Indonesia
Relation to curriculum	
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	-
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	-
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>-</td></tr>
<tr><td>Supervision and consultation</td><td>-</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>4 hours</td></tr>
<tr><td>Individual studies</td><td>4 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td></td></tr>
<tr><td>Class project</td><td></td></tr>
<tr><td>Field trip</td><td></td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr>
<td>• Understand all components of the petroleum system comprehensively, starting from the parent rock, the maturation of organic matter, migration from the parent rock to the reservoir rock, the cover layer (hood) and calculating the risk of an exploration.
• Understand the meaning of sedimentation basins and their analytical techniques</td>
<td>▪ Identify the charge element begins with the deposition of the source rock and the establishment of its volumetric potential, or feedstock, for the system.
▪ Identify charge access involves converting this potential to expelled volumes, making, and then moving, the volumes from source bed to trap/reservoir.
▪ Understand the unconventional reservoirs, this is within or adjacent to the source bed itself.</td>
<td>▪ Able to Integrate geology, geophysics and geochemical information in analyzing the petroleum system
▪ Understand hydrocarbon bearing basin: source rock, reservoir, seal trap, migration, and the correct timing of hydrocarbon generation.</td>
</tr>
</table>
</td></tr>
<tr><td>Content</td><td>Discussion on every component of a petroleum system including source rock, reservoir rock, migration from source to reservoir, trap and trapping mechanism, cap-rock and seal, and hydrocarbon accumulation. Discussion will also covers risk calculation regarding the petroleum system in a hydrocarbon exploration. Every component will be detailly discussed and an integration evaluation among the components will be given to yield a comprehensive understanding.</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>40 %</td></tr>
<tr><td>Final Test</td><td>√</td><td>40 %</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td></td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>

Magoon L.B. and Dow W.G. (ed.), The Petroleum System – From Source to Trap, , AAPG Memoir 60, Tulsa., 1994
Bordenave M.L. (ed.), Applied Petroleum Geochemistry, , Editions Technip, Paris, 1993
Cooper B., Practical Petroleum Geochemistry, , Robertson Scientific Publications, London (UK)., 1990
Merrill R.K. (ed.), Source and Migration Processes and Evaluation Techniques, , Treatise Petroleum Geology. AAPG, Tulsa, 1991

</td></tr>
</table>

12. Advanced Rock Physics

Module designation	Advanced Rock Physics
Module level	Master
Code, if applicable	TG5225
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Second Semester / first Year
Module coordinator(s)	Ignatius Sonny Winardhie, Ph.D.
Lecturer(s)	Ignatius Sonny Winardhie, Ph.D. Dr. Fatkhan
Language	Bahasa Indonesia
Relation to curriculum	Major Subject / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tells main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td></td></tr>
<tr><td>Supervision and consultation</td><td>2 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td></td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>2 hours</td></tr>
<tr><td>Class project</td><td>8 hours</td></tr>
<tr><td>Field trip</td><td></td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understand how to analyze for determining lithology, porosity, pore fluids, and saturation.
• Understand how to bridges seismic data and reservoir properties and parameters.
• Understand the effects of various rock and reservoir parameters on seismic properties.</td><td>• Able to solve problems related to rock physics (modelling, fluid substitutions, effective medium theories).
• Able to solve problems related to seismic anisotropy.</td><td>• Possess ability to solve problems related to rock physics challenges.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>Student are expected to understand how elastic properties of rock change when fluid fills the rock, concept of effective medium theory, physical modelling to help understand in wave propagation and anisotropy of rock</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>30%</td></tr>
<tr><td>Final Test</td><td>√</td><td>40%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>30%</td></tr>
<tr><td>Laboratory work</td><td>-</td><td></td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>
1. Avseth, P., Mukerji, T., and Mavko., G., 2005, Quantitative Seismic Interpretation: Applying Rock Physics Tools to Reduce Interpretation Risk, Cambridge Univ. Press.
2. Mavko, G., Mukerji, T., and Dvorkin, J., 1998, the rock physics handbook: tools for seismic analysis in porous media: Cambridge Univ. Press.
3. Mavko, G., Rock Physics for Geophysical Reservoir Characterization and Recovery Monitoring, Rock Physics laboratory, Stanford University.
4. Schon, J., 2004, Physical Properties of Rock: Fundamentals and principles of Petrophysics, Elsevier.
5. Thomsen, L, 2002, Understanding Seismic Anisotropy in Exploration and exploitation, SEG.
6. Wang, Z, 2001, Fundamentals of rock physics: Geophysics, vol 66, 398-412.
</td></tr>
</table>

13. Advanced Seismic Interpretation

Module designation	Advanced Seismic Interpretation
Module level	Master
Code, if applicable	TG5131 (TG5034)
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Second Semester / first Year
Module coordinator(s)	Prof. Sigit Sukmono
Lecturer(s)	Prof. Sigit Sukmono, Dona Sita A., S.T., M.T.
Language	Bahasa Indonesia
Relation to curriculum	Major Subject / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	-
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>3 hours</td></tr>
<tr><td>Tutorial session</td><td>3 hours</td></tr>
<tr><td>Supervision and consultation</td><td>-</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>9 hours</td></tr>
<tr><td>Total workload per week</td><td>15 hours</td></tr>
<tr><td>Presentation</td><td>2 hours</td></tr>
<tr><td>Class project</td><td>13 hours</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>240 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>3</td></tr>
<tr><td>Requirements prerequisites</td><td>TG5122 Advanced Seismic Reflection Data Acquisition & Processing.</td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr>
<td>• Understanding relations of rock-physics parameters with Vp, Vs and density, and then with seismic amplitude responses.
• Understanding how to apply knowledge in point 1 to do seismic interpretation for hydrocarbon exploration which include forward modeling, well-seismic tie, stratigraphy & structural interpretation, 3D seismic interpretation and analysis of lithology-porosity-fluids effects.
• Understanding how to do time-depth conversion.
• Understanding interpretation pitfalls.</td>
<td>• Able to do related amplitude response forward modeling with the rock physic parameters given.
• Able to identify the phase, polarity, resolution, lithology-porosity-fluids effects and related pitfalls for the seismic data given.
• Able to do well-seismic tie, seismic stratigraphy and structural interpretation with the log data given.
• Able to do time-depth conversion with the velocity function given.
• Able to define physical properties of the reservoir based on AVO attributes</td>
<td>• Possess the capability to do seismic interpretation for hydrocarbon exploration and development.
• Possess reservoir characterization including reservoir geometry delineation, physical properties description and reservoir monitoring</td>
</tr>
</table>
</td></tr>
<tr><td>Content</td><td>Objective & procedure, principle of carbonate sedimentation, model facies, diagenesis, porosity, analysis sequence, facies, system-tract (LST, TST, HST) and depositional environment, diagenesis associated with system-tract, rock-physics model : Biot-Gassman, Wang, KusterToksoz, application of seismic attributes, pos-stack & pre-stack inversion for mapping facies, porosity and fluids.</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>30%</td></tr>
<tr><td>Final Test</td><td>√</td><td>40%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>30%</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>1. Sukmono, S., Carbonate Seismic Reservoir Analysis, Diktat Kuliah, ITB, 2011.
2. Palaz & Marfurt, Carbonate Seismology, SEG, 1997</td></tr>
</table>

14. Reservoir Geophysics

<table>
<tr><td>Module designation</td><td>Reservoir Geophysics</td></tr>
<tr><td>Module level</td><td>Master</td></tr>
<tr><td>Code, if applicable</td><td>TG6041</td></tr>
<tr><td>Sub-heading, if applicable:</td><td>-</td></tr>
<tr><td>Courses included in the module, if applicable:</td><td></td></tr>
<tr><td>Semester(s) in which module is taught</td><td>Third Semester / second Year</td></tr>
<tr><td>Module coordinator(s)</td><td>Prof.Dr.Ir. Sigit Sukmono, M.Sc.</td></tr>
<tr><td>Lecturer(s)</td><td>Prof.Dr.Ir. Sigit Sukmono, M.Sc., Dona Sita A., S.T., M.T.</td></tr>
<tr><td>Language</td><td>Bahasa Indonesia</td></tr>
<tr><td>Relation to curriculum</td><td>Major Subject / Compulsory Course</td></tr>
<tr><td>Type of teaching, contact hours</td><td>
<table>
<tr><td>Class lectures
Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.</td><td>√</td></tr>
<tr><td>Presentation
Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.</td><td>√</td></tr>
<tr><td>Tutorial session
Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.</td><td>√</td></tr>
<tr><td>Class project and discussion
Lecturer gives students a project which related to current issues and course material.</td><td>√</td></tr>
<tr><td>Supervision and consultation
This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.</td><td>-</td></tr>
<tr><td>Practical or experimental laboratory work
Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.</td><td>-</td></tr>
<tr><td>Field trip
Visit field area or company which is related to course material.</td><td>-</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>3 hours</td></tr>
<tr><td>Tutorial session</td><td>3 hours</td></tr>
<tr><td>Supervision and consultation</td><td>-</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>9 hours</td></tr>
<tr><td>Total workload per week</td><td>15 hours</td></tr>
<tr><td>Presentation</td><td>2 hours</td></tr>
<tr><td>Class project</td><td>13 hours</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>240 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>3</td></tr>
<tr><td>Requirements prerequisites</td><td>TG5131 (TG5034) Advanced Seismic Interpretation</td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr>
<td>• Understanding relationship between rock-physics parameters (such as porosity and water-saturation) and V_p, V_s, Density.
• Understanding basic concept of band-limited seismic signal, wavelet, reflection coefficient, convolution theorem, seismic amplitude responses, and seismic resolution in relation to previous point.
• Understanding basic concept of inversion methodology applied to seismic data.
• Understanding how to analyze post-stack and pre-stack seismic data as a response of impedance contrast.
• Understanding a number of seismic inversion methodologies along with their limitations and advantages.
• Understanding how to interpret seismic inversion results and pitfalls.</td>
<td>• Able to given the log data, able to find the reservoirs and the most sensitive impedance parameters that describe those reservoirs.
• Able to given the log and seismic data, able to do well-to-seismic tie and to do the seismic interpretation appropriately.
• Able to given point 1 and point 2 ready, able to choose, perform and deliver the most appropriate seismic inversion.
• Able to given point 3 ready, able to interpret them in terms of reservoir properties.</td>
<td>• Possess find the most sensitive impedance parameters for characterizing the reservoir.
• Possess choose the best seismic inversion methodologies which will handle the reservoir characterization tasks appropriately.
• Possess deliver and interpret the seismic inversion results in terms of reservoir properties.</td>
</tr>
</table>
</td></tr>
<tr><td>Content</td><td>Integrated reservoir management, role of seismic in reservoir analysis, AI inversion, complex attributes , amplitude attributes and AVO attributes for reservoir characterization (reservoir geometry delineation, physical properties description and reservoir monitoring)</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>30%</td></tr>
<tr><td>Final Test</td><td>√</td><td>40%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>30%</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>1. Sukmono, S., Lithology, Facies, Porosity, Fracture and Fluids Analysis using Seismic data, Diktat Kuliah ITB, 2002.
2. Sheriff, Reservoir Geophysics, SEG, 1995</td></tr>
</table>

15. Advanced Gravity and Magnetic Method

Module designation	Advanced Gravity and Magnetic Method
Module level	Master
Code, if applicable	TG5161
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	First Semester / first Year
Module coordinator(s)	Prof.Dr. Wawan Gunawan A. Kadir, MS
Lecturer(s)	Prof.Dr. Wawan Gunawan A. Kadir, MS
Language	Bahasa Indonesia
Relation to curriculum	Major Subject / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	√

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>3 hours</td></tr>
<tr><td>Tutorial session</td><td>2 hours</td></tr>
<tr><td>Supervision and consultation</td><td>2 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>9 hours</td></tr>
<tr><td>Total workload per week</td><td>15 hours</td></tr>
<tr><td>Presentation</td><td>2 hours</td></tr>
<tr><td>Class project</td><td>20 hours</td></tr>
<tr><td>Field trip</td><td>8 hours</td></tr>
<tr><td>Total workload per semester</td><td>240 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>3</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr>
<td>• Understand basic concept and background of gravity and magnetic methods.
• Understand density and susceptibility distribution in the subsurface based on geological structure and topography.
• Understand the concept of gravity and magnetic anomalies trough convolutional process between green function and density/susceptibility contrast.
• Understand on design of gravity and magnetic data survey based on objective of the survey and its spectral anomalies response.
• Understand gravity and magnetic anomaly decomposition through regional and residual separation process.
• Understand basic concept of qualitative and quantitative interpretation through forward and inversion modeling, and its application on exploration activity.</td>
<td>• Able to apply gravity and magnetic methods in order to solve the problem of exploration, environmental and hazard mitigation.
• Familiar in designing gravity and magnetic surveys based on objective of the survey and its spectral anomalies response
• Understand to do regional and residual gravity and magnetic anomalies separation using some methods, and its characteristic relating with objective of the survey
• Familiar on qualitative and quantitative interpretation of gravity and magnetic anomalies using the scheme of forward and inversion modeling.
• Able to analysis the exploration problem using gravity and magnetic methods.</td>
<td>• Take possession of capability for problem solving in the case of gravity and magnetic exploration, environmental and geological hazard.
• Has capability to design gravity and magnetic surveys for exploration, environmental and geological hazard.
• Familiar in analysis of residual-regional gravity and magnetic anomalies because of its decomposition processes.
• Capable to do qualitative and quantitative interpretation of gravity and magnetic anomalies using the scheme of forward and inversion modeling.
• Has capability to apply gravity and magnetic method to optimize the result of exploration, environmental and geological hazard.</td>
</tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Content</td><td>Historical perspective of gravity and magnetic methods, Concept of gravity and magnetic method in natural resources exploration and its example, density and susceptibility of rocks, basics theory, gravity anomaly, gravity corrections, gravimeter, main and outer magnetic field, magnetic corrections, magnetometer, gravity and magnetic design survey, field operation of gravity and magnetic survey, estimation of density from gravity data, separation of regional-residual anomaly, qualitative interpretation, quantitative interpretation through forward and inversion modeling, cases of gravity and magnetic application for exploration and tectonic setting analysis</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td rowspan="3">equal</td></tr>
<tr><td>Final Test</td><td>√</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>1. Grant & West, Interpretation Theory in Applied Geophysics. Mc. Graw-Hill, 1969.
2. W.M Telford, L.P Geldart, R.E Sheriff, and D.A Keys, Applied Geophysics, Cambridge University Press, 1988.</td></tr>
</table>

16. Advanced Geoelectrical Method

Module designation	Advanced Geoelectrical Method
Module level	Master
Code, if applicable	TG5162
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	first semester / first Year
Module coordinator(s)	Dr. Wahyudi Widyatmoko Parnadi
Lecturer(s)	Dr. Wahyudi Widyatmoko Parnadi, Dr. Widodo
Language	Bahasa Indonesia
Relation to curriculum	Major Subject / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	√
Field trip Visit field area or company which is related to course material.	√

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>1 hours</td></tr>
<tr><td>Supervision and consultation</td><td>1 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>2 hours</td></tr>
<tr><td>Individual studies</td><td>4 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>8 hours</td></tr>
<tr><td>Class project</td><td>2 hours</td></tr>
<tr><td>Field trip</td><td>10 hours</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understand basic knowledge of four geoelectrical methods (D-resistivity, Self-Potential, Induced Polarization, and Electromagnetic methods)
• Understand electric (resistivity, permittivity) and magnetic (magnetic permeability) properties of soils and rocks in-depth
• Understand how to measure electric and magnetic properties in a laboratory
• Understand how to conduct and develop geoelectrical measurement in a field
• Understand how to process, analyze, and interpret complex geoelectrical data
• Understand how to convert a multiple geoelectrical section/map into a geological section/map</td><td>• Able to measure soil/rock samples in a laboratory
• Able to conduct and develop single or multiple
• geoelectrical methods in the field
• Able to process, analyze and interpret complex geoelectrical data
• Able to convert multiple geoelectrical section/map into geological section/map</td><td>• Familiar in conducting electrical and magnetic properties in a laboratory
• Familiar in planning and designing complex geoelectrical surveys
• Familiar in leading conducting processing, analysis, and interpreting complex geoelectrical dataset
• Familiar in converting multiple geoelectrical section/map into geology section/map</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The role of DC-resistivity, Self-Potential (SP) & Induced Polarization (IP) in exploration; advantages & limitation of the methods; depth of penetration; resistivity anisotropy concepts; Dar Zarrouck parameters; coefficient anisotropy; lateral and vertical resistivity; principles of exploration using DC-resistivity, SP & IP; misse a la masse technique, azimuthal resistivity survey (ARS), geoelectrical tomography; application of DC-resistivity, SP and IP methods in environmental conservation; geothermal, geotechnical applications; hydrogeology studies; practical works of DC-resistivity method with 4 electrodes, of SP and IP with multi-electode; seminar/presentation about techniques to solve problems by using resistivity, SP and IP methods through case studies apperde in latest papers.</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>35%</td></tr>
<tr><td>Final Test</td><td>√</td><td>35%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20%</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>10%</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>

1. Bhattacharya, P. N., and Patra, H. P., 1968, SEGJ, Direct Current Geoelectric Sounding: Elsevier, 135pp.
2. Binley, A., and Slater, L., 2020, Resistivity and Induced Polarization: Theory and Applications to the Near-Surface Earth: Cambridge Univ. Press, 334pp.
3. Nabighian M.N., (ed.), 1989, Electromagnetic Methods in Applied Geophysics, Vol.1. Theory, Vol.2 Application, Society of Exploration Geophysicists.
4. Parnadi, W. W., 2008, Metode Geolistrik: diktat kuliah.
5. Sheriff, R. E., 2002, Encyclopedic Dictionary of Applied Geophysics: SEG, 4th ed., 429pp.
6. Strack, K.-M., 1992, Exploration with Deep Transient Electromagnetics: Elsevier, 373pp.
7. Telford, W. M., L. P. Geldart, and R. E. Sheriff, 1990, Applied Geophysics, Cambridge University Press, 2ed.
8. Parnadi, W. W., 2008, Diktat kuliah TG5146 Eksplorasi Geolistrik
9. Kelly W. E. and S. Mares, 1993, Applied Geophysics in Hydrogeological and Engineering Practice.
10. latest papers in international journals in the last five years

</td></tr>
</table>

17. Mining Geophysics

Module designation	Mining Geophysics
Module level	Master
Code, if applicable	TG5042
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Second Semester / first Year
Module coordinator(s)	Dr.Ir. Agus Laesanpura, MS
Lecturer(s)	Dr.Ir. Agus Laesanpura, MS Dr.rer.nat. Widodo
Language	Bahasa Indonesia
Relation to curriculum	Major Subject / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	-
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	-
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>3 hours</td></tr>
<tr><td>Tutorial session</td><td>3 hours</td></tr>
<tr><td>Supervision and consultation</td><td>-</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>9 hours</td></tr>
<tr><td>Total workload per week</td><td>15 hours</td></tr>
<tr><td>Presentation</td><td>-</td></tr>
<tr><td>Class project</td><td>15 hours</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>240 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>3</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understand mining methods (surface and underground methods)
• Understand geophysical method used in ore exploration.
• Understand geophysical responses to ore trap
• Understand geophysical modeling and interpretation in the exploration of ore mining.</td><td>• Able to apply geophysical methods in the cases of mining exploration.
• Familiar in the modeling of geophysical data in order to explore of earth mineral resources.
• Familiar in interpretation of geophysical data in the scheme of exploration earth and mineral resources.</td><td>• Able to apply geophysical methods in the cases of mining exploration.
• Familiar in the modeling of geophysical data in order to explore of earth mineral resources.
• Familiar in interpretation of geophysical data in the scheme of exploration earth and mineral resources.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>Providing concept mining methods, and (rock & mineral) genetic as well as its model in nature, metalogenic province, geophysical responses to ore traps, Geophysical interpretation and modelling in practice. Several common geophysical method used in ore finding such as gravimetry, magnetic, geoelectric, electromagnetisme and intro. to petrophysics.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>40 %</td></tr>
<tr><td>Final Test</td><td>√</td><td>40 %</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
</table>

Reading list	1. Introductory mining Engineering, H.L. Hartman 2. Edwin S. Robinson, Cahit Coryh. Basic Exploration Geophysics. John Willey and Sons, 1988. 3. Evans, Anthony M. Ore Geology and Industrial Minerals : An Introduction. Blackwell Scientific Publications, 1993. 4. Hansen, Don Ed. Mining Geophysics. SEG, 1969. 5. Jensen, M. Alan M. Bateman. Economic Mineral Deposit. John Willey and Sons, 1981. 6. Gueguen, Yves. Introduction a'la Physique des roches. Herman Paris, 1992.

18. Geothermal Exploration

Module designation	Geothermal Exploration
Module level	Master
Code, if applicable	TG5043
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Second Semester / first Year
Module coordinator(s)	Prof.Dr. Hendra Grandis
Lecturer(s)	Prof.Dr. Hendra Grandis
Language	Bahasa Indonesia
Relation to curriculum	Major Subject / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	-
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

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<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>1 hour</td></tr>
<tr><td>Supervision and consultation</td><td>1 hour</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>-</td></tr>
<tr><td>Class project</td><td>30 hours</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
</table>

Learning Goals

Knowledge	Skill	Competence
• Geothermal system and inter-disciplinary context of geothermal exploration • Geophysical signatures of a geothermal prospect • Exploration strategy in general and geophysics in particular • The role of geophysical methods in geothermal exploration • Conceptual model of geothermal prospect • Case studies of well-known geothermal fields	• Elaboration of relationship between geothermal phenomena, surface manifestations etc. with regional geological setting • Design of geophysical survey both for preliminary and advanced surveys • Geophysical data processing and modelling • Interpretation of geophysical data and models	• Take possession of Identification of a geothermal prospect from desk study of available data • Planning and managing geophysical survey campaign, at least conceptually, given existing preliminary data • Integration of geophysical survey results both for preliminary and advanced stage of geothermal exploration • Building conceptual model of geothermal prospect

<table>
<tr><td>Content</td><td>Elements of a geothermal system, types of geothermal system, Brief review of geology and geochemistry of geothermal system.General exploration strategy (reconnaissance survey, detailed survey) and development. Geophysical signatures of a geothermal prospect:gross structure, reistivity and magetic property of cap rocks, desity of magmatic heat sources, thermal fluid flow, seismicity of hydrothermal activities. Review of geophysical exploration methods: gravity, magnetics, geo-electrics (Schlumberger, Mise-a-la-masse), magnetotellurics (MT, including CSAMT and transient EM), Self-Potential(SP), micro-seismics. Conceptual model, resource and reserve estimations. Discussion on case studies of geothermal exploration</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td><table>
<tr><td>Midterm test</td><td>√</td><td>30 %</td></tr>
<tr><td>Final Test</td><td>√</td><td>30 %</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>40 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>1. Gupta, H., Roy, S., Geothermal Energy: An Alternative Resource for 21st Century, Elsevier, 2007.
2. Long, L.T. and Kaufann, R.D., Acquisition and Analysis of Terrestrial Gravity Data, Cambridge University Press, 2013.
3. Fairhead, J.D., Advances in Gravity and Magnetic Processing and Inter¬pretation, EAGE Publishing, 2015.
4. Simpson, F. & Bahr, K., Practical Magnetotellurics, Chambridge
5. University Press, 2005.</td></tr>
</table>

19. Advanced Engineering and Environmental Geophysics

Module designation	Advanced Engineering and Environmental Geophysics
Module level	Master
Code, if applicable	TG6044
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Second Semester / first Year
Module coordinator(s)	Dr.rer.nat.Ir. Wahyudi Widyatmoko Parnadi, MS
Lecturer(s)	Dr.rer.nat.Ir. Wahyudi Widyatmoko Parnadi, MS
Language	Bahasa Indonesia
Relation to curriculum	Major Subject / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	-
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	-
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	√

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>2 hours</td></tr>
<tr><td>Supervision and consultation</td><td>-</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>8 hours</td></tr>
<tr><td>Class project</td><td>-</td></tr>
<tr><td>Field trip</td><td>12 hours</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td>-</td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understand basic knowledge of geophysical methods
• Understand engineering and physical properties of soil and rocks
• Understand problems in engineering and environment (EE)
• Understand to match geo-physical methods to appli-cation in EE
• Understand to conduct plan and design a EE geophysical survey
• Understand to process and interpret EE geophysical data</td><td>• Able to recognize problems in EE
• Know the basics of explo-ration methods in geotechnical engineering, geological engineering, and hydrology
• Able to select the appropri-ate geophysical methods suitable for distinct EE problems
• Able to plan and develop base survey design for engineering and environ-mental purposes
• Able to conduct basic processing& interpretation of EE geophysical data</td><td>• Planning and designing a EE geophysical survey
• Lead and conduct a EE geophysical survey
• Process and interpret EE geophysical data
• Providing basic conclusions and recommendations for a geophysical survey</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>Introduction: the meaning and role of geophysics for solving engineering and environmental problems, case examples of the application of engineering and environmental geophysics; physical and engineering properties; methodology of geotechnical investigation: sounding, boring etc.; engineering seismology: seismic reflection and refraction; earthquake risk analysis; seismic and non-seismic (gravity, magnetic, DC-resistivity, electromagnetics) investigation as well as well logging for hydrogeology, geotechnical engineering and environment; geohazards: landslide and other phenomenon; case studies.</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>35%</td></tr>
<tr><td>Final Test</td><td>√</td><td>35%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20%</td></tr>
<tr><td>Laboratory work</td><td>√</td><td>10%</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>

Beblo, M. (ed.); 1997; Umweltgeophysik, Ernst & Sohn, 465pp.
Burger, H. R., 1992, Exploration Geophysics of the Shallow Subsurface: Prentice Hall, 489pp. ISBN 0-13-296773-1.
Cheng, Y. M., Lau, C. K., 2014, Slope Stability Analysis and Stabilization: CRC Press, Taylor & Francis Group, 2nd ed., 426pp. ISBN 978-1-4665-8284-2.
Reynolds, J. M., 2011, An introduction to applied and environmental Geophysics: John Wiley & Sons, 2nd ed., 696pp. ISBN 978-0471-485360.
Fetter, C. W., 2001, Applied Hydrogeology: Prentica-Hall, Inc., 4th ed., 598pp. ISBN 0-13-088239-9.
Mavko, G., Mukerji, T., Dvorking, J., 2009, The Rock Physics Handbook: Cambridge University Press, 2nd ed., 511pp. ISBN 978-0-511-65062-8 eBook.
Derringh, E.; 1998; Computational Engineering Geology, Prentice-Hall, Inc., 322 pp.
Keys, W. S.; 1997; A Practical Guide to Borehole Geophysics in Environmental Investigations, SRC Press, Inc., 176 pp.
Sharma, P. V., 1997, Environmental and Engineering Geophysics: Cambridge University Press.
Rubin & Hubbard (Eds.); 2005; Hydrogeophysics: Elsevier.
Parnadi, W.W., 2008, Diktat Kuliah Geofisika Teknik dan Lingkungan.
Oliveira, Roca, Goula (Eds.), 2008, Assessing and Managing Earthquake Risk: Springer.
Srbulov, M.; 2009; Geotechnical Earthquake Engineering; Springer.
latest papers in international journals in the last five years

</td></tr>
</table>

20. Advanced Geophysical Inversion Method

Module designation	Advanced Geophysical Inversion Method
Module level	Master
Code, if applicable	TG5023
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	First Semester / first Year
Module coordinator(s)	Prof.Dr. Hendra Grandis
Lecturer(s)	Prof.Dr. Hendra Grandis
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	-
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>1 hours</td></tr>
<tr><td>Supervision and consultation</td><td>1 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>-</td></tr>
<tr><td>Class project</td><td>30 hours</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Basic concept of geophysical modelling
• Data and model parameter relationship in geophysical modelling
• Concept of forward modelling
• Concept of inverse modelling</td><td>• Formulation of general forward problem in geophysics
• Formulation of linear relationship between data and model parameters
• Resolving various linear inverse problem in geophysics
• Formulation of non-linear relationship between data and model parameters
• Resolving various non-linear inverse problem in geophysics</td><td>• Basic to intermediate programming in Matlab or Phyton
• Programming forward modelling in geophysics
• Programming inverse modelling in geophysics
• Implementation of several nature-inspired, population-based optimization algorithm for non-linear inverse problem resolution</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>Concept of geophysical modeling, concept of forward modeling and inverse modeling,solving linear regressionusing least-squares principle, formulation of linear inverse problems, solution of linear inversion, weighted linear inversion, damped linear inversion, formulation of nonlinear inverse problems, linearized approach of non-linear inversion, global approach of nonlinear inversion, systematic/grid search, random search, Monte-Carlo method, guided random search method, simulated annealing method, genetic algorithm.</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>30%</td></tr>
<tr><td>Final Test</td><td>√</td><td>30%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>40%</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>

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

</td></tr>
</table>

21. Geoscience Summer School

Module designation	Geoscience Summer School
Module level	Master
Code, if applicable	TG5025
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	First Semester / First Year
Module coordinator(s)	Dr. rer. nat. R. Mohammad Rachmat Sule, S.T, M.T.
Lecturer(s)	Dr. rer. nat. R. Mohammad Rachmat Sule, S.T, M.T.
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	-
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>2 hours</td></tr>
<tr><td>Supervision and consultation</td><td>2 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>3 hours</td></tr>
<tr><td>Total workload per week</td><td>9 hours</td></tr>
<tr><td>Presentation</td><td></td></tr>
<tr><td>Class project</td><td>16 hours</td></tr>
<tr><td>Field trip</td><td></td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understand some basics of the Petroleum geoscience in Indonesia
• Understand the reservoirs, resources, reserves in Indonesia
• characterizing the reservoir
• Explore geological sites in Bandung around campus
• Explore cultural and social activities of Bandung and surrounding</td><td>• To outline the principal methods of determining geological time and the development of geological thinking.
• To enjoy and socialize among geoscientists and social</td><td>• Able to explain the development of key concepts in geological thinking based on some cases presented in the course</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>This 10-days program offers a comprehensive introduction to the subject of petroleum geoscience – especially reservoirs, resources , reserves, and basic seismic and rock physics. The program will involve several excursions to Tangkuban Parahu volcano, Kamojang Geothermal field, and Kamojang crates. Cultural and social activities are included in the program. This program is suitable for the undergraduate students who have had some exposure to geoscience</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>40 %</td></tr>
<tr><td>Final Test</td><td>√</td><td>40 %</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td></td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td></td></tr>
</table>

22. Geomechanics in Geophysics

Module designation	Geomechanics in Geophysics
Module level	Master
Code, if applicable	TG5033
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	First Semester / first Year
Module coordinator(s)	Dr. Wahyu Triyoso, M.Sc.
Lecturer(s)	Dr. Wahyu Triyoso, M.Sc.; Dr. David Prambudi Sahara, ST. MT.
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	-
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>2 hours</td></tr>
<tr><td>Supervision and consultation</td><td></td></tr>
<tr><td>Practical or experimental laboratory work</td><td></td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>4 Hours</td></tr>
<tr><td>Class project</td><td>6 hours</td></tr>
<tr><td>Field trip</td><td></td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understanding the interplay between earth stresses, pressures, mechanical properties, and the geometry the act upon.
• Understanding, the linear stress-strain relationship, Rock failures criterion and fracture propagation
• Understanding the pore pressure and seismic, Pore pressure estimation from velocity, relations of velocity versus effective stress.
• Understanding wellbore stability.</td><td>• Able to describe interplay stress and pressure in the subsurface.
• Able to describe rock failure and fracture propagation.
• Able to describe pore pressure and seismic
• Able to characterize the wellbore stability.</td><td>• Have the ability on determining and analyzing stress and pressure in the subsurface.
• Have ability to determining rock failure and fracture propagation.
• Have ability to estimate pore pressure and effective stress using seismic data.
• Have ability to model the wellbore stability.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>1. Introduction: The interplay between earth stresses, pressures, mechanical properties, and the geometry the act upon; 2. Stress and strain: the stress tensor, the strain tensor, the linear stress-strain relationship; 3. Rock failures: introduction to rock experiment, elastic and plastic material, failure criterion, fracture propagation; 4. Sediment compaction and stress state in the earth: Vertical stress, Pore pressure and sediment compaction, estimation of Minimum and Maximum horizontal stress; 5. Pore pressure and seismic: Pore pressure estimation from velocity, relations of velocity versus effective stress; 6. Wellbore stability: Stress change near a borehole, compressional and tensile failures on the borehole wall; 7. Geotechnical aspect of rock mechanics: tunnelling, land slide, and underground mining activities. 8. Seismic anisotropy of shales: relation of shale anisotropy to microstructure, clay mineral anisotropy; 9. Student projects: wellbore stability, and seismic data analysis</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>40%</td></tr>
<tr><td>Final Test</td><td>√</td><td>40%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20%</td></tr>
<tr><td>Laboratory work</td><td>-</td><td></td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>1. Sayers, C. M., Geophysics under stress: Geomechanical applications of seismic and borehole acoustic waves, Society of Exploration Geophysicists, 2010
2. Zoback, M., Reservoir Geomechanics, Cambridge University Press, 2007</td></tr>
</table>

23. Exploration and Engineering Seismology

Module designation	Exploration and Engineering Seismology
Module level	Master
Code, if applicable	TG5113
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	First Semester / first Year
Module coordinator(s)	Prof.Dr.Ir. Sigit Sukmono, M.Sc.
Lecturer(s)	Prof.Dr.Ir. Sigit Sukmono, M.Sc.
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	-
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	-
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>2 hours</td></tr>
<tr><td>Supervision and consultation</td><td>-</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>-</td></tr>
<tr><td>Class project</td><td>-</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Knowledge about the application of reflection seismic methods in oil and gas exploration specifically evaluation of leads and prospects
• Knowledge of evaluation and development of oil and gas fields.</td><td>• Understand the acquisition technology, survey design, processing and interpretation of seismic reflection data
• Interpret the sequence analysis and seismic facies, depositional environmental analysis, system tract analysis)</td><td>• Understand some useful data processing methods and associated linear algebra which are transferable to other fields/applications.
• Understand the concept of value of information.
• Able to present orally and professionally all of the above topics at research level.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>This course provides knowledge about the application of reflection seismic methods in oil and gas exploration specifically evaluation of leads and prospects as well as evaluation and development of oil and gas fields. In this course we discuss acquisition technology, survey design, processing and interpretation of seismic reflection data (sequence analysis and seismic facies, depositional environmental analysis, system tract analysis), and modeling (seismic inversion) in the form of integrated studies. This lecture is project based. Each project has a specific objective in accordance with the stages of oil and gas exploration.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>40 %</td></tr>
<tr><td>Final Test</td><td>√</td><td>40 %</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td></td></tr>
</table>
</td></tr>
</table>

Media employed	Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.
Reading list	1. Sukmono, S.,, Diktat Kuliah Interpretasi Seismik Refleksi, , ITB, 2010 2. Yilmaz, O, Seismic Data Processing, Society of Exploration Geophysics, , , 1987 3. Sheriff, R.E. & Geldart, L.P, Exploration Seismology, , , 1987 4. Sukmono, S, Post and Prestack Seismik Inversion for Hydrocarbon Reservoir Characterization, , ITB, 2007 5. Russel, B.M, Introduction to Seismic Inversion Method, , SEG, 6. Sukmono, S, Fundamentals of Seismic Sequence Stratigraphy in Field Exploration & Developmeny, , ITB, 2011 7. Payton, CE (ed),, Seismic Stratigraphy, , , 1977 8. Brown, A.R, Interpretation of 3-Dimensional Seismic Data, , , 2009

24. Hidrogeophysics

Module designation	Hidrogeophysics
Module level	Master
Code, if applicable	TG5133
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	First Semester / first Year
Module coordinator(s)	Dr.Ir. Agus Laesanpura, MS
Lecturer(s)	Dr.Ir. Agus Laesanpura, MS
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	-
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	-
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>2 hours</td></tr>
<tr><td>Supervision and consultation</td><td>-</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>-</td></tr>
<tr><td>Class project</td><td>-</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understand water habitats in nature and their experience through simulations.
• Understand the hydrological cycle, and its aspects.
• Understand flow modeling and parameterization</td><td>• Able to decoding fluide with selected geophysical methods.
• Able to determinate parameterization in 1-D, 2-D modeling</td><td>• Able to sove some hydrogeophytic cases presented in the class</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>Fluide in natural setting and enginereed processes, have changed, additionally with domestic activity the problem becomes complexe. To overcome this problem, the course will introducing to knowledge and technique on water balance, detecting fluide and medium property with geophysical methods, paramerization model, simulation, and finally introducing to several case study</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>40 %</td></tr>
<tr><td>Final Test</td><td>√</td><td>40 %</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>1. Environmental Geophysics, Vogelslang
2. Solute Transport Modelling, Rausch, Wagner
3. Applied Hidrogeology, Fetter
4. Hidrogeophysics, Yoram et.al VSDI, USGS</td></tr>
</table>

25. Geophysical Modeling and Tomography

Module designation	Geophysical Modeling and Tomography
Module level	Master
Code, if applicable	TG5134
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	First Semester / first Year
Module coordinator(s)	Dr.Eng.Ir. T.A. Sanny, MT
Lecturer(s)	Dr.Eng.Ir. T.A. Sanny, MT , Prof.Dr. Andri Dian Nugraha S.Si.,M.Si.
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	
Class project and discussion Lecturer gives students a project which related to current issues and course material.	-
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	-
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>-</td></tr>
<tr><td>Supervision and consultation</td><td>-</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>7 hours</td></tr>
<tr><td>Total workload per week</td><td>9 hours</td></tr>
<tr><td>Presentation</td><td>16 hours</td></tr>
<tr><td>Class project</td><td>-</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understand the concepts and processing step of geotomography imaging technology
• Understand the state of the art of the geotomograhpy imaging technology
• Understand resolution test of tomographic inversion
• Understand application of geotomography</td><td>• Able to create program code of ray tracing from source to receiver
• Able to determine mathematical equation of delay time tomography
• Able to solve matrix equation of delay time tomography
• Familiar in delay time tomographic inversion
• Familiar in resolution test of tomographic inversion
• Familiar in application of geotomography</td><td>• Possesses in basic concepts of seismic geotomography technology
• Familiar in data acquisition of geotomography
• Able to implement tomography in imaging the subsurface condition</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The topics subject are focused into the following subtopics: recent development of tomography and its application of subsurface image reconstruction on multi-scale problem, data acquisition, step reconstruction of image, parameterization model, raytracing methodology, determining matrix of seismic tomography, tomographic inversion, damping application, resolution test and interpretation. This lecture emphasizes the recent development of tomography in earth science</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>40 %</td></tr>
<tr><td>Final Test</td><td>√</td><td>40 %</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
</table>

Media employed	Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.
Reading list	1. Nugraha, A. D. (2017). Tomografi Seismik, Penerbit ITB Press, ISBN 978-602-5417-48-1. 2. Zhao, D. (2019). Multiscale Seismic Tomography, Springer Geophysics, ISBN 978-4-431-55359-5. 3. Iyer H.M. and Hirahara, K. (Ed.), 1993. Seismic Tomography: Theory and Practice. Chapman & Hall, London. 4. Nolet, G. (Ed.), 1987. Seismic Tomography with applications in global seismology and exploration geophysics. D. Reidel Publishing Company, Dordrecht. 5. Press, W.H. et al., 1992, Numerical Recipes, Cambridge University Press, Cambridge. 6. Sanny, T. A., 2000, Geotomografi (diktat Kuliah), Jurusan Teknik Geofisika ITB.

26. Individual Project in Geophysics

Module designation	Individual Project in Geophysics
Module level	Master
Code, if applicable	TG5025
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	First Semester / first Year
Module coordinator(s)	Dr. rer. nat. R. Mohammad Rachmat Sule, S.T, M.T.
Lecturer(s)	Dr. rer. nat. R. Mohammad Rachmat Sule, S.T, M.T.
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	√
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>1 hours</td></tr>
<tr><td>Tutorial session</td><td>2 hours</td></tr>
<tr><td>Supervision and consultation</td><td>2 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>2 hours</td></tr>
<tr><td>Individual studies</td><td>2 hours</td></tr>
<tr><td>Total workload per week</td><td>9 hours</td></tr>
<tr><td>Presentation</td><td>3 hours</td></tr>
<tr><td>Class project</td><td>4 hours</td></tr>
<tr><td>Field trip</td><td></td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understand the concept and purposes of geophysical methods
• Understand the basic knowledge of geological and geophysical concepts in solving the real problems</td><td>• Able to identify the real geoscience problem in related with geophysical methods learned from the courses
• Able to implement the geophysical method for solving the geoscience problem approved by the supervisor</td><td>• Able to developing geophysical instrument, developing geophysical software, geophysical measurement, applying geophysical methods as solution to problem or other forms approved by the supervisor
• Able to report and presenting the project</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>In a group of 3-4, students carry out a particular project related to geophysics with a clear and measurable output under supervision of a particular faculty member. The projects might be in the form of developing geophysical instrument, developing geophysical software, geophysical measurement, applying geophysical methods as solution to problem or other forms approved by the supervisor. Apart from reporting the project in writing, the students should also present the instruments, software, data, or other evidences in open presentation attended by supervisor and examiner.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>40 %</td></tr>
<tr><td>Final Test</td><td>√</td><td>40 %</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>Based on Project topics</td></tr>
</table>

27. Microseismic

Module designation	Microseismic
Module level	Master
Code, if applicable	TG5149
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	First Semester / first Year
Module coordinator(s)	
Lecturer(s)	Prof.Dr. Andri Dian Nugraha S.Si.,M.Si, Dr. rer. nat. David Prambudi Sahara, ST,MT
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	-
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>-</td></tr>
<tr><td>Supervision and consultation</td><td>2 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>4 hours</td></tr>
<tr><td>Class project</td><td>6 hours</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understanding the concept of the microseismic monitoring in geothermal field, oil and gas field, and local fault</td><td>• Able to determine microseismic location, source mechcnism of microseismic, introduction of shear wave splitting and utilization of microseismic data in geophysics</td><td>• Possess an extensive knowledge of microseismic activity as a function of fluids injection in various field as well as the integration with other geoscience</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>Basic understanding and basic concept of the microseismic monitoring in geothermal field, oil and gas field, and local fault including basic concept of microseismic, identification of microseismic event (analysis of microseismic wave phases) , determining microseismic location, source mechcnism of microseismic, introduction of shear wave splitting and utilization of microseismic data in geophysics exploration and earthquake hazard mitigation.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>35%</td></tr>
<tr><td>Final Test</td><td>√</td><td>35%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>30%</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>
1. Shapiro, S.A, Microseismicity, , EAGE Publications, 2008
2. Ottemoller, L., Havskov, J, Routine Data Processing in Earthquake Seismology, , Springer, 2010
3. Huenges, E, Geothermal Energy Systems: Exploration, Development, and Utilization, , WILEY-VCH Verlag GmbH & Co. KgaA, 2010
4. Sharer, P.M., Introduction to Seismology, , Cambridge University Press, 2009
5. Lay, T., Wallace, T. C, Modern Global Seismology, , Academic Press,
</td></tr>
</table>

28. Advanced Geostatistics

Module designation	Advanced Geostatistics
Module level	Master
Code, if applicable	TG5213
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Second Semester / first Year
Module coordinator(s)	Dr. Darharta Dahrin, MS
Lecturer(s)	Dr. Darharta Dahrin, MS, Dr. Susanti Alawiyah, ST,MT
Language	Bahasa Indonesia
Relation to curriculum	
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>1 hour</td></tr>
<tr><td>Supervision and consultation</td><td>1 hour</td></tr>
<tr><td>Practical or experimental laboratory work</td><td></td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>4 hours</td></tr>
<tr><td>Class project</td><td>6 hours</td></tr>
<tr><td>Field trip</td><td></td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Students are able to explain the the application of geostatistics in geophysics</td><td>• Students are able to analyze the data and use the geostatistical methods to obtain the desired results.</td><td>• The student have the capabilities to design a projects, to process the data, and to find the optimal model and interpretation based on geostatistical methods.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>Introduction, Uni variable data analysis, Spatial correlation, Estimation and modleing, Kriging Estimation, Linear Kriging, Non Linear Kriging, Application, Conditional Simulation Technique, Grid Based Simulation, Object based simulation, Simulation Technique Based on Facies Geology, Geostatistics Invertion, Application.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>30%</td></tr>
<tr><td>Final Test</td><td>√</td><td>35%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>35%</td></tr>
<tr><td>Laboratory work</td><td>-</td><td></td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>
1. Christakos, G., Random Field Models in Earth Sciences, Academic Press, Inc., 1992.
2. Kelkar, M. And Perez, G., 2002, applied Geostatistics for Reservoir Characterization, SPE Inc. Richardson, Texas.
3. Dubrul, O., Geostatistics for seismic Data Integration in Earth Models, SEG, 2003
4. David, M., J. C., Geostatistical Ore Reserve Estimation, Elsevier Scientific Publishing Company, 1986.
5. Davis, J. C., Statistics and Data Analysis in Geology, John Wiley and Sons, 2nd ed., 1986.
6. Journel, A. G., and Ch. J. Huijbregts, Mining Geostatistics, Academic Press, 1978.
7. Geophysics, SEG Journal
</td></tr>
</table>

29. Disaster Mitigation

Module designation	Disaster Mitigation
Module level	Master
Code, if applicable	TG5232
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Second Semester / first Year
Module coordinator(s)	Prof.Dr. Antonius Nanang Tyasbudi P. M.Sc.
Lecturer(s)	Prof.Dr. Antonius Nanang Tyasbudi P. M.Sc.
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>-</td></tr>
<tr><td>Supervision and consultation</td><td>2 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>4 hours</td></tr>
<tr><td>Class project</td><td>6 hours</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understanding the basic concept of geological hazard, disaster mitigation, and disaster management.</td><td>• Able to classify the natural disaster and its spatial distribution, especially in Indonesia
• Able to solve problem related to disaster mitigation</td><td>• Possess an extensive knowledge and ability to solve problems related to disaster mitigation</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>Classification of natural disaster and its spatial distribution; basic concept of disaster management; key elements in the disaster management; basic concept of disaster mitigation and its key elements; disaster management act in Indonesia; state of the art disaster mitigation in Indonesia; earthquake hazard mitigation; tsunami hazard mitigation; landslide hazard mitigation; volcanic hazard mitigation; liquefaction mitigation.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>35 %</td></tr>
<tr><td>Final Test</td><td>√</td><td>35 %</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>30 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>1. Bryant, E., Natural Hazards, second edition, Cambridge University Press, 2005
2. Carter, W.N., Disaster Management: A Disaster Manager’s Handbook, Asian Development Bank, Manila, 2008
3. Smith, K. and Petley, D. N., Environmental Hazards: Assessing risk and reducing disaster, fifth edition, Routledge, 2009</td></tr>
</table>

30. Exploration Geophysics for Oil and Gas

Module designation	Exploration Geophysics for oil and gas
Module level	Master
Code, if applicable	TG5235
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Second Semester / first Year
Module coordinator(s)	Dr. rer. nat. R. Mohammad Rachmat Sule, S.T, M.T.
Lecturer(s)	Dr. rer. nat. R. Mohammad Rachmat Sule, S.T, M.T.
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	-
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	-
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	-
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>-</td></tr>
<tr><td>Supervision and consultation</td><td>-</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>8 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>-</td></tr>
<tr><td>Class project</td><td>-</td></tr>
<tr><td>Field trip</td><td></td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understanding sedimentary process in basin.
• Understanding basin distribution and their geological characterization in Indonesia region.
• Understanding oil and gas exploration activities using geological, and geophysical methods.</td><td>• Able to explain the reservoir systems.
• Able to explain reservoir geology in Indonesia, their geological conditions, structure, stratigraphy and status of their activity.
• Able to interpret seismic data for reserve allocation and calculation.</td><td>• Possess the competence to explain the reservoir characterization using seismic data.
• Possess the capability of interpreting geophysical data in oil and gas industry.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>This course explains all geophysical methods used in the oil and gas exploration, except reflection seismic method. In the beginning, exploration concept and the importance of geophysical methods integration will be given. Explaination about the theory, data acquisition, data processing and data interpretation will be taught for each method. Several case studies will be given in order to increase the inportance and understanding of each method. At the end of the course, each student is expected to give a presentation.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>40 %</td></tr>
<tr><td>Final Test</td><td>√</td><td>40 %</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>1. Grant & West, Interpretation Theory in Applied Geophysics, Mc. Graw-Hill Book Company, 1965.
2. Telford et al., Applied Geophysics, Cambridge Univ. Press, 1976
3. Reynolds, J.M., An Introduction to applied and environmental Geophysics. John Wiley and Sons, 1997.
4. Sheriff, R.E., dan L.P. Geldart, Exploration Seismology. Cambridge Univ. Press, 1995</td></tr>
</table>

31. Marine Geophysics

Module designation	Marine Geophysics
Module level	Master
Code, if applicable	TG6141
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Third Semester / second Year
Module coordinator(s)	Dr. Darharta Dahrin, MS
Lecturer(s)	Dr. Darharta Dahrin, MS; Dr. Alfian, MT
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>1 hours</td></tr>
<tr><td>Supervision and consultation</td><td>1 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>4 hours</td></tr>
<tr><td>Class project</td><td>16 hours</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understand the overview and application of marine geophysics
• Understand the application of marine geophysics in hydrocarbon and mining exploration, geodynamics
• Students are able to explain the marine data geophysics used in geodynamics and the application of marine geophysics for natural resources in the offshore area.</td><td>• Apply various geophysical methods, e.g. gravity, magnetic, electromagnetic, for analyzing geological features in marine area
• Students are able to explain the marine data geophysics used in geodynamics and the application of marine geophysics for natural resources in the offshore area.</td><td>• The student have the capabilities to design a projects, to process the marine data, and to find the optimal model and interpretation based on marine geophysics methods.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>Introduction, Hydrocarbon and mining Exploration, Geophysical and geological researches for geodynamics and Tectonics, Navigation System using electromagnetic wave, Acoustic and GPS. Gravity and cases studies, Geomagnetic and cases studies, Paleomagnetics and sea floor spreading,Seismology for lithosphere studies, seismic reflexion and refraction for hydrocarbon exploration and geodynamics studies, Heat Flow for volcanoc and tectonics studies, Geoelectric,and Electromagnetics for lithosphere studies.</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td rowspan="3">equal</td></tr>
<tr><td>Final Test</td><td>√</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>

1. Fowler, C.M.R. , 1990, The Solid Earth. Cambridge University Press.
2. Jones, E. J. , 1999, Marine Geophysics, John Wiley & Sons.
3. Kearey, P. &F.J. Vine., 1990, Global Tectonics. Blackwell Scientific Publ.
4. Richards, M.A., Gordon, R.G., and van der Hilst, R.D., The history and Dynamics of Global Plate Motion, AGU, Washington, DC, 2000.
5. Turcotte, D.L. , 1982, Geodynamics Application of continuum Physics to geological Problems, John Wiley & Sons
6. Libourtry, L. , 1999, Quantitative Geophysics and Geology, Springer.
7. Fu, L., and Cazenave, A., satellite altimetry and Earth sciences, Academic Press, 2001.
8. Journal of Geophysical Research.
9. Geophysics, SEG Journal
10. Fowler, C.M.R. , 1990, The Solid Earth. Cambridge University Press.
11. Jones, E. J. , 1999, Marine Geophysics, John Wiley & Sons.

</td></tr>
</table>

32. Capita of Selecta in Geophysics

Module designation	Capita of Selecta in Geophysics
Module level	Master
Code, if applicable	TG6142
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Third Semester / second Year
Module coordinator(s)	Dr.rer.nat. R. Mohammad Rachmat ST,MT
Lecturer(s)	Dr.rer.nat. R. Mohammad Rachmat ST,MT, Fernando Lawrens Hutapea, ST,MT
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	-
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	-
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	-
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>-</td></tr>
<tr><td>Supervision and consultation</td><td>-</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>8 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>-</td></tr>
<tr><td>Class project</td><td>-</td></tr>
<tr><td>Field trip</td><td></td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understand concepts and strategies by using Geophysical methods for exploration and research
• Understand data acquisition, process and interpretation of geophysical methods.</td><td>• Understand concept data acquisition, process and interpretation of geophysical methods typically used for exploration, e.g., Geoelectric and EM, Gravity, Magnetic Magnets, Seismic Refraction and Seismic Reflection.
• Understand concept of borehole geophysical methods, log response characterization</td><td>• Possess an extensive knowledge and ability to integrate geophysical methods and borehole data to characterize subsurface</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>Concepts and strategies by using Geophysical methods for exploration and research. Data acquisition, process and interpretation of geophysical methods. Geoelectric and EM, Gravity, Magnetic Magnets, Seismic Refraction and Seismic Reflection. Borehole geophysical methods, log response characterization. Rock properties, porosity, saturation, permeability and so on. Stratigraphic Model, Evaluation of prospects.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>40 %</td></tr>
<tr><td>Final Test</td><td>√</td><td>40 %</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
</table>

Reading list	1. Adi Harsono, Evaluasi Formasi dan Aplikasi Lo, , Schlumberger Oilfield Services, Sentra Mulia, Jakarta,, 1997 2. Brown, A.R, Interpretation of three-Dimensional seismic data, , AAPG memoir 42, AAPG, Tulsa-USA, 1986 3. Domenico, S.N, Modern Seismic Exploration Concepts, , Amoco prod Comp., Tulsa, Oklahoma, 1983 4. Dewan, J.T., dan Don J. Timko, Well Log Analisis for Geophysicist, , Geoquest International, Inc, 1983 5. Jain, Kamal, C.,, Concepts and Techniques in Oil and Gas Exploration, , Society of Exploration Geophysicists, 1982 6. Koesoemadinata, R.P.,, Geologi Eksplorasi,, , Diktat GL402, Jurusan Teknik Geologi, FTM-ITB, 1990

33. Advanced Engineering Seismology

Module designation	Advanced Engineering Seismology
Module level	Master
Code, if applicable	TG6243
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Fourth Semester / second Year
Module coordinator(s)	Dr. Wahyu Triyoso, M.Sc.
Lecturer(s)	Dr. Wahyu Triyoso, M.Sc.
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td></td></tr>
<tr><td>Supervision and consultation</td><td>2 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td></td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>4 hours</td></tr>
<tr><td>Class project</td><td>6 hours</td></tr>
<tr><td>Field trip</td><td></td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understanding strong ground motion due to earthquake.
• Understanding Ground Motion Prediction Equation (GMPE).
• Understanding Seismicity Rate Modeling.
• Understanding seismic hazard analysis and Seismic Hazard Function.
• Understanding local site effects.</td><td>• Able to proficient in basic analysis on strong ground motion and GMPE.
• Able to proficient in determining seismicity rate model.
• Able to proficient in basic analysis on deterministic and probabilistic.
• Able to proficient in basic analysis on amplification.</td><td>• Could construct the Seismic Hazard Function (SHF).
• could make a simple probabilistic and deterministic hazard map.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>Basic concept of seismology; waves propagation in unbounded media, semi-infinite body, layered body, attenuation; disasters due to earthquake; measurements, parameter, and estimation of parameters of strong ground motion; ground acceleration due to earthquake subduction and fault/crustal; local site effects on ground motion; seismic zoning based on ground acceleration and other earthquake parameters; probability of earthquake occurrence; probabilistic and deterministic seismic hazard analysis</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>40%</td></tr>
<tr><td>Final Test</td><td>√</td><td>40%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20%</td></tr>
<tr><td>Laboratory work</td><td>-</td><td></td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>1. S.L. Kramer, Geotechnical Earthquake Engineering, Prentice Hall, New Jersey, 1996
2. K. Ishihara, Manual for Zonation on Seismic Geotechnical Hazards, The Japanese Society of Soil Mechanics and Foundation Engineering, 1993
3. E.A. Keller, Environmental Geology, Charles E. Merrill Publishing Company, 1979 4. Bulletin of Seismological Society of America</td></tr>
</table>

34. Surface Wave Exploration

Module designation	Surface Wave Exploration
Module level	Master
Code, if applicable	TG6244
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Fourth Semester / second Year
Module coordinator(s)	Dr. Tedi Yudistira, S.Si.,M.Si.
Lecturer(s)	Dr. Tedi Yudistira, S.Si.,M.Si., Fernando Lawrens Hutapea, S.T.,M.T.
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>-</td></tr>
<tr><td>Supervision and consultation</td><td>2 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>4 hours</td></tr>
<tr><td>Class project</td><td>6 hours</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr>
<td>• Understand the basic characteristic of seismic surface waves based on physical formulation.
• Understand the dispersive characteristic of seismic surface waves for simple model.</td>
<td>• Able to calculate dispersive curve for simple model using computer programming.
• Capable to measure dispersive curve of real seismic data, both using manual and computerized program.
• Capable to implement inverse method on surface wave modelling.</td>
<td>• Posses the ability to connect between dispersive characteristic of the surface waves and seismic velocity distribution of subsurface.</td>
</tr>
</table>
</td></tr>
<tr><td>Content</td><td>Seismic wave review: elastic waves, body wave, surface wave; Dispersive waves: dispersive concept, wave superposition, concept of phase velocity and group velocity, surface wave for two layered model; Survey: noise interferometry, array microtremor; Signal processing concept: Fourier concept, correlation, convolution; Dispersive signal analysis: basic concept, spectrum method; Surface wave inversion: basic concept, model parameterization, ray tracing; Velocity structure inversion: model parameterization, Rayleigh wave forward modelling (basic).</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>35%</td></tr>
<tr><td>Final Test</td><td>√</td><td>35%</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>30%</td></tr>
<tr><td>Laboratory work</td><td>-</td><td></td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>1. Shearer, P.M., Introduction to Seismology, Cambridge University, 1999.
2. S. Stein & M. Wysession, An Introduction to Seismology, Earthquakes and Earth Structure, Blackwell Publishing, 2003.</td></tr>
</table>

35. Applied GeoEM in Earth Sciences and Technology

Module designation	Applied GeoEM in Earth Sciences and Technology
Module level	Master
Code, if applicable	TG5011
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Third Semester / second Year
Module coordinator(s)	Dr.rer.nat. Widodo, ST, MT
Lecturer(s)	Dr.rer.nat. Widodo, ST, MT
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	-
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>-</td></tr>
<tr><td>Supervision and consultation</td><td>2 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>-</td></tr>
<tr><td>Class project</td><td>80 hours</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understand basic background of geoelectric and electromagnetic Methods.
• Understand application of geoelectric and electromagnetic methods in many application of geosciences cases.
• Understand design surveys of geoelectric and electromagnetic methods.</td><td>• Able to apply geoelectric and electromagnetic methods in order to solve the problem of exploration, environmental and hazard mitigation.
• Understand to modeling the geoelectric and electromagnetic models in the scheme of forward and inversion models.
• Familiar in design survey of geoelectric and electromagnetic methods
• Able to analysis the exploration problem using geoelectric and electromagnetic methods</td><td>• Take possession of capability in order to solve the problem in the case of geophysical exploration.
• Familiar in the modeling of geoelectric and electromagnetic data in the scheme of forward and inversion model.
• Familiar in design survey of geoelectric and electromagnetic methods.
• Familiar to analysis the exploration problem using geoelectric and electromagnetic methods</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>Provide the application of GeoEM (Geoelectric and Electromagnetic Methods) in many cases of exploration including Magnetotelluric, Coastal Hydrology, Mineral Exploration, Marine EM /Airborne EM, Float EM, Electromagnetic Surveys in Geothermal and Volcano Studies, Instrumentation & Measurement of TDEM, Data Analytics Application for Electrical Submersible Pump, Forward Modelling of Time-Lapse Microgravity by Considering Water Table Flow, Soil Compaction and Subsidence Cause by Ground Water Extraction, Case Study Bandung Basin Area, Role of Geophysical Engineering in Reducing Hydrocarbon Emissions, The role of subsurface survey in slope stability analysis – A case study from the Jakarta-Bandung highspeed railway tunnel project, Predicting Metal Production Routes from Mineralogical Data, Rock Physics Modelling,</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>40 %</td></tr>
<tr><td>Final Test</td><td>√</td><td>40 %</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>

1. Hinze, W.J., Von Frese, R.R.B. & Saad, A.H., (2013). Gravity and Magnetic Exploration: Principles, Practices and Applications, Cambridge Univer-si-ty Press, , ,
2. Jensen, J.R. (2000) Remote Sensing of the Environment: An Earth Resource Perspective, , ,
3. Mavko, G., Mukerji, T. and Dvorkin, J. (2009). Rock Physics Handbook: Tools for Seismic Analysis in Porous Media. Cambridge University Press, Cambridge., , ,
4. Moon, C.J., Whateley., Michael K.G., Evans, A.M., (2009). Introduction to mineral exploration 2nd edition; John Wiley & Sons, Ltd., , ,
5. Reynolds, J.M., (1998). An Introduction to Applied and Environmental Geophysics, Wiley, , ,
6. Telford, W.M., Geldart, L.P. & Sheriff, R.E., Applied Geophysics 2nd edition, Cambridge University Press, 2004., , ,
7. Sharma, P. V., (1997). Environmental and Engineering Geophysics: Cambridge University Press, , ,
8. Zhdanov, M.S., Keller, G.V., (1994). The Geoelectrical Methods in Geophysical Exploration, Elsevier, , ,
9. M. Nabigian (ed.), Electromagnetic methods in Applied Geophysics, vol. 1 Theory, vol. 2 Application, Society of Exploration Geophysicists, 1989., , ,
10. Sun X, Zhan Y, Unsworth MJ, Egbert GD, Zhang H, Chen X, Zhao G, Sun J, Zhao L, Cui T, Liu Z, Han J, 3-D Magnetotelluric imaging of the easternmost Kunlun fault: insights into strain partitioning and the seismotectonics of the Jiuzhaigou Ms7.0 earthquake, Journal of Geophysical Research : Solid Earth, 125, https://doi.org/10.1029/2020JB019731, 2020, , ,
11. Widodo, An Innovation of Electromagnetic Methods (FLOAT EM), Research Report LPPM ITB, 2021.

</td></tr>
</table>

36. Thesis 1

Module designation	Thesis 1
Module level	Master
Code, if applicable	TG6091
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	third Semester / second Year
Module coordinator(s)	
Lecturer(s)	Dr.rer.nat. Andri Hendriyana, S.T., M.T., Dr. Zulfakriza, S.T., M.T.
Language	Bahasa Indonesia
Relation to curriculum	General Course / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	-
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>4 hours</td></tr>
<tr><td>Tutorial session</td><td>4 hours</td></tr>
<tr><td>Supervision and consultation</td><td></td></tr>
<tr><td>Practical or experimental laboratory work</td><td>12 hours</td></tr>
<tr><td>Individual studies</td><td>20 hours</td></tr>
<tr><td>Total workload per week</td><td>2 hours</td></tr>
<tr><td>Presentation</td><td>Depend on thesis project</td></tr>
<tr><td>Class project</td><td></td></tr>
<tr><td>Field trip</td><td>320 hours</td></tr>
<tr><td>Total workload per semester</td><td>4 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>4</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understand how to formulate a research topic and to choose a research methodology.</td><td>• Able to define a research topic and to determine a research methodology.</td><td>• Possess ability to write a thesis proposal.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>1. Study the existing research results for a particular research problem
2. Find a potential problem and its solution
3. Write a thesis proposal
4. Research including data processing and present preliminary results</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>-</td><td>-</td></tr>
<tr><td>Final Test</td><td>-</td><td>-</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>100 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>Based on Thesis topics</td></tr>
</table>

37. Thesis 2

Module designation	Tesis 2
Module level	Master
Code, if applicable	TG6092
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	fourth Semester / second Year
Module coordinator(s)	Dr.Ir. Fatkhan, MT
Lecturer(s)	Dr.Ir. Fatkhan, MT
Language	Bahasa Indonesia
Relation to curriculum	General Course / Compulsory Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	-
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	√
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	√
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tells main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td></td></tr>
<tr><td>Tutorial session</td><td>4 hours</td></tr>
<tr><td>Supervision and consultation</td><td>4 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td></td></tr>
<tr><td>Individual studies</td><td>12 hours</td></tr>
<tr><td>Total workload per week</td><td>20 hours</td></tr>
<tr><td>Presentation</td><td>2 hours</td></tr>
<tr><td>Class project</td><td>Depend on thesis project</td></tr>
<tr><td>Field trip</td><td></td></tr>
<tr><td>Total workload per semester</td><td>320 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>4</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understand how to analyze Geophysical data and to process</td><td>• Able to solve geophysical problems.</td><td>• Possess ability to write thesis and papers.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>Research for master degree including 1. Data processing 2. Interpretation 3. Method 4. Writing of thesis 5. Manuscript submitted to International Journal</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>-</td><td>-</td></tr>
<tr><td>Final Test</td><td>-</td><td>-</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>100 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, white boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>Based on Thesis topics</td></tr>
</table>

38. Advanced Electromagnetic Method

Module designation	Advanced Electromagnetic Method
Module level	Master
Code, if applicable	TG5264
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	
Semester(s) in which module is taught	Third Semester / second Year
Module coordinator(s)	Dr.rer.nat. Wahyudi P Parnadi, MS
Lecturer(s)	Dr.rer.nat. Wahyudi P Parnadi, MS, Dr.rer.nat. Widodo, ST, MT
Language	Bahasa Indonesia
Relation to curriculum	Elective Subject / Elective Course
Type of teaching, contact hours	

Class lectures Lecturer teaches students in class. There will be pop quizzes, task, or homework in some classes. Lecturer presents course material using media such as slide in LCD projector and whiteboard.	√
Presentation Students present course materials in front of class using slide in LCD projector, followed by discussion session. After presentation, they make report what they present before.	-
Tutorial session Lecturer gives students some problem beforehand. In class students explain how to solve the problem in groups. Lecturer checks how they solve the problem in turns.	-
Class project and discussion Lecturer gives students a project which related to current issues and course material.	√
Supervision and consultation This activity is continuation of class project. Students consults problem which they face and discuss together how to solve the problem.	√
Practical or experimental laboratory work Students do practical or experimental in the laboratory according to practical module. Firstly, laboratory assistant tell main idea of practical or experimental. They do the practical afterwards.	-
Field trip Visit field area or company which is related to course material.	-

<table>
<tr><td>Workload</td><td>
<table>
<tr><td>Class lectures</td><td>2 hours</td></tr>
<tr><td>Tutorial session</td><td>-</td></tr>
<tr><td>Supervision and consultation</td><td>2 hours</td></tr>
<tr><td>Practical or experimental laboratory work</td><td>-</td></tr>
<tr><td>Individual studies</td><td>6 hours</td></tr>
<tr><td>Total workload per week</td><td>10 hours</td></tr>
<tr><td>Presentation</td><td>-</td></tr>
<tr><td>Class project</td><td>80 hours</td></tr>
<tr><td>Field trip</td><td>-</td></tr>
<tr><td>Total workload per semester</td><td>160 hours</td></tr>
</table>
</td></tr>
<tr><td>Credit points</td><td>2</td></tr>
<tr><td>Requirements prerequisites</td><td></td></tr>
<tr><td colspan="2">Learning Goals
<table>
<tr><th>Knowledge</th><th>Skill</th><th>Competence</th></tr>
<tr><td>• Understand advanced background of electromagnetic Method.
• Understand design surveys electromagnetic method.
• Understand the innovation of electromagnetic method in the scheme to solve the problem of environmental and engineering geophysics.</td><td>• Able to apply electromagnetic method in order to solve the problem of exploration, environmental and hazard mitigation.
• Understand modelling of electromagnetic data in the scheme of forward and inversion models.
• Familiar in design survey of geoelectric and electromagnetic methods
• Able to analysis the exploration problem using electromagnetic method.</td><td>• Take possession of capability in order to solve the problem in the case of geophysical exploration.
• Familiar in the modeling of electromagnetic data in the scheme of forward and inversion model.
• Familiar in design survey of electromagnetic method.
• Familiar to analysis the exploration problem using electromagnetic method.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The role of electromagnetic (EM) method in searching for mineral, oil & gas as well as other earth resources; review of EM wave propagation; electric and magnetic properties of minerals and rocks; time domain EM, frequency domain EM; far field and near field; types of source/transmitter and receiver; low frequency EM: magnetotellurics (MT), controlled-source audio magnetotellurics (CSAMT), radio magnetotellurics (RMT), Very Low Frequency (VLF), Transient EM (TEM) etc.; high frequency EM: Ground-penetrating Radar (GPR), Radar; practical works with low-frequency EM (VLF, TEM), practical works with high-frequency EM (GPR); and its application in geotechnical engineering, mining engineering, hydrogeological studies, earth crust studies, oil & gas exploration; seminar/class presentation.</td></tr>
</table>

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>
<table>
<tr><td>Midterm test</td><td>√</td><td>40 %</td></tr>
<tr><td>Final Test</td><td>√</td><td>40 %</td></tr>
<tr><td>Presentation, quizzes, homework</td><td>√</td><td>20 %</td></tr>
<tr><td>Laboratory work</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Slides, beamer, boards, appropriate software, online communication, internet, exercises etc.</td></tr>
<tr><td>Reading list</td><td>

1. Reynolds, J.M., An Introduction to Applied and Environmental Geophysics, 2nd Edition, ISBN: 978-0-471-48535-3,2011.
2. Telford, W.M., Gelgard, L.P., Sheriff, R.E., Applied Geophysics, Cambridge University Press, 1990.
3. Zhdanov, M.S. and G. V. Keller, 1994, The Geoelectrical Methods in Geophysical Exploration, Elsevier.
4. W. M. Telford, L. P. Geldart, and R. E. Sheriff, 1990, Applied Geophysics, Cambridge University Press, 2nd ed.
5. Sullivan, D. M., 2000, Electromagnetic Simulation using the FDTD Method, IEEE Press.
6. Nabighian, M. N., 1991, Electromagnetic Methods in Applied Geophysics: Application/Parts A and B (Investigations in Geophysics, No. 3), SEG
7. Strack, K.-M., 1992, Exploration with Deep Transient Electromagnetics, Elsevier.
8. Annan, A. P., 2001, Workshop note GPR, Sensors & Software
9. Kelly W. E. and S. Mares, 1993, Applied Geophysics in Hydrogeological and Engineering Practice

</td></tr>
</table>