UNIVERSITAS INDONESIA

Veritas, Probitas, Iustitia

FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM

Department of Physics

Master of Physics

MODULE HANDBOOK

http://physics.ui.ac.id

UNIVERSITAS INDONESIA
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Email: sekretariat@fisika.ui.ac.id, website: www.physics.ui.ac.id

MODULE HANDBOOK

Module name	*Relativistic Quantum Field Theory*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCPH802204*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Dr. rer. nat. Agus Salam S.Si., M.Si.*
Lecturer	*Dr. rer. nat. Agus Salam S.Si., M.Si.*
Language	*Indonesian*
Relation to curriculum	*Elective course*
Type of teaching, contact hours	*Flipped class and problem based learning*
Teaching methods	*Problem-based Learning/Project-based Learning/Collaborative Learning/Active Learning*
Workload (incl. contact hours, self-study hours)	*Lectures: 4x50 minutes per week* *Exercise and assignments: 4x60=240 minutes per week* *Independent study: 4x60=240 minutes per week*
Credit points	*4*

Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	1. *Analyzing quantum phenomenon at high energy and the quantization of fundamental fields in order to be applied in solving nuclear and particle physics' problems.* 2. *Identifying and analyzing the quantization of non-relativistic String, electromagnetic field, interaction between radiation and matter, Klein-Gordon equation, Dirac equation, Second Quantization, and Interacting Field Theory.*
Content	● *Preliminary* ● *Quantization of the Nonrelativistic String* ● *Quantization of the Electromagnetic Field* ● *Interaction of Radiation with Matter* ● *The Klein-Gordon Equation* ● *The Dirac Equation* ● *Second Quantization* ● *Interacting Field Theories*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Mid-test : 30 %* *Final test : 30 %* *Assignment : 40 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A*

	80—<85	*A*
	75—<80	*B+*
	70—<75	*B*
	65—<70	*B*
	60—<65	*C+*
	55—<60	*C*
	40—<55	*D*
	<40	*E*
Media employed	*EMAS/EMAS2*	
Reading List	• *W. Greiner, Relativistic Quantum Mechanics: Wave Equations, Springer, 3rd edition, 2000.* • *L. Maiani and O. Benhar, Relativistic Quantum Mechanics, Routledge, 1 edition, 2015.* • *D. Bjorken and S.D. Drell, Relativistic Quantum Mechanics, McGraw-Hill, 1964.* • *Halzen and A. D. Martin, Quarks and Leptons, John Wiley & Sons, 1984.* • *Gross, Relativistic Quantum Mechanics and Field Theory, John Wiley & Sons, 1993.* • *J. R. Aitchison, Relativistic Quantum Mechanics, Macmillan, 1982.* • *J. R. Aitchison and A. J. G. Hey, Gauge Theories in Particle Physics, Adam Hilger, 1989.* • *Lahiri and P.B. Pal, A First Book of Quantum Field Theory, 2nd Ed., Alpha Science International Ltd., 2005.* • *Guidry, Gauge Field Theory: An Introduction with Applications, Wiley VCH Verlag GmbH, 2004.* • *Maggiore, A Modern Introduction to Quantum Field Theory, Oxford University Press, 2005.*	

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MODULE HANDBOOK

Module name	*General Relativity and Introduction to Astrophysics*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCPH802205*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Prof. Dr. Drs. Anto Sulaksono M.Si.*
Lecturer	*Prof. Dr. Drs. Anto Sulaksono M.Si.*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Collaborative Learning/Active Learning*
Workload (incl. contact hours, self-study hours)	*Lectures: 3x50=150 minutes per week* *Exercise and assignments: 3x60=180 minutes per week*
Credit points	*3*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*

Recommended prerequisties	-
Module objectives/intended learning outcomes	1. *Analyze spacetime based on General Relativity, Einstein field equations, interior and exterior solutions for spherically symmetric objects, and effects of slow rotation in compact objects.* 2. *Analyze interior and exterior properties of white dwarfs, neutron stars, black holes and its constituent matter.*
Content	● *Lorentz invariance* ● *Tensors in curvilinear coordinates* ● *Gravity* ● *Covariance* ● *Riemann tensor* ● *Einstein field equations* ● *Relativistic star* ● *Slow rotation* ● *Properties and composition of white dwarfs, neutron stars and black holes*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Assignment : 40 %* *Mid-test : 30 %* *Final test : 30 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A* *75—<80* — *B+* *70—<75* — *B*

	65—<70	*B*
	60—<65	*C+*
	55—<60	*C*
	40—<55	*D*
	<40	*E*
Media employed	*Learning Management System (LMS), Microsoft Teams*	
Reading List	1. *Norman K Glendenning, Compact Stars: Nuclear Physics, Particle Physics, and General Relativity, Springer International Publishing (1997)* 2. *P. Haensel, Neutron Stars 1: Equation of State and Structure, Springer International Publishing (2020)* 3. *Stuart L. Shapiro, Saul A. Teukolsky, Black Holes, White Dwarfs, and Neutron Stars, WILEY-VCH Verlag GmbH & Co. KGaA (2004)* 4. *Luciano Rezzolla, Pierre Pizzochero, David Ian Jones, Nanda Rea, Isaac Vidana, The Physics and Astrophysics of Neutron Stars. Springer International Publishing (2018)* 5. *Max Camenzind, Compact Objects in Astrophysics, Springer International Publishing (2007)*	

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MODULE HANDBOOK

Module	*Measurement Methods and Sensor Technology*
Module level, if applicable	*Postgraduate program*
Code, if applicable	*SCPH802311*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Dr. Santoso*
Lecturer	*Dr. Santoso*
Language	*Indonesian*
Relation to curriculum	*Compulsory course*
Type of teaching, contact hours	*Flipped Class and Problem-based learning*
Teaching methods	*Lecture and group discussion*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week* *Independent study: 2x60=120 minutes per week*
Credit points	*2 credit points*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>After receiving this course, students are expected to be able to analyze and apply concepts and principles of the subject in the experiment and design instrumentation measurement system</td></tr>
<tr><td>Content</td><td>

Instrumentation measurement system
Noise and coherence in measurement
Physics principles in detecting stimulus
Measurement methods
Sensor technology
Actuator technology
Signal conditioning
Digital technique in measurement mechanism
Display and data processing

</td></tr>
<tr><td>Study and examination requirements and form of examination</td><td>The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
LTM-PK: 15 %
LTM-PPT : 15%
LTM-PK : 15%
LTP-PPT : 15%
Final-Test : 50%
Total : 100 %

<table>
<tr><th>Mark</th><th>Grade</th></tr>
<tr><td>85—100</td><td>A</td></tr>
<tr><td>80—<85</td><td>A</td></tr>
<tr><td>75—<80</td><td>B+</td></tr>
<tr><td>70—<75</td><td>B</td></tr>
<tr><td>65—<70</td><td>B</td></tr>
</table>
</td></tr>
</table>

	60—<65 *C+* *55—<60* *C* *40—<55* *D* <*40* *E*
Media employed	*Powerpoint presentation (PPT), Microsoft Teams, e-Learning Management System (EMAS)*
Reading List	1. *Robert B. Northrop, Introduction to Instrumentation and Measurements, CRC Press, Taylor Francis Group, 2ed ,2005* 2. *Clarence W. De Silva., Sensors and Actuators - Control Systems Instrumentation, CRC Press, 2007.* 3. *Alan S Morris, Measurement and Instrumentation Principles, Butterworth-Heinemann, 2001.* 4. *Webster, John G., Measurement, Instrumentation and Sensors Handbook, CRC Press, 2ed 2014.* 5. *Fraden, J., GAIP Handbook of Modern Sensors, Physics, Designs and Applications, J American Institute of Physics, 2004.* 6. *Nathan Ida, Sensors, Actuators, and Their Interfaces, The Institution of Engineering and Technology, London, UK, 2ed , 2020* 7. *Beckwith, T. G. , Marangoni, R. D. dan J. H. Lienhard V, Mechanical Malan easurements (I. Fundamentals of Mechanical Measurement, II. Applied Mechanical Measurements), Addison-Wesley Publishing Company, 6ed , 2006.*

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MODULE HANDBOOK

Module name	*Instrumentation System*

Module level, if applicable	*Postgraduate program*
Code, if applicable	*SCPH802313*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Dr. Santoso*
Lecturer	*Dr. Santoso*
Language	*Indonesian*
Relation to curriculum	*Compulsory course*
Type of teaching, contact hours	*Flipped Class and Problem-based learning*
Teaching methods	*Lecture and forum discussion*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week* *Independent study: 2x60=120 minutes per week*
Credit points	*2 credit points*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-

Module objectives/intended learning outcomes	*After receiving this course, students are expected to be able to analyze concepts and principles needed in one instrumentation system which applied on analytical instrument and recent lab on chips and lab in a phone technology through literature and scientific studies, critical analysis, and design development.*
Content	● *Elements of instrument system* ● *Analytical instruments* ● *Calibration techniques and instrument validation* ● *Instruments system and analytical intelligence* ● *Pc based analytical system instruments* ● *MEMs based analytical system instruments* ● *Optical instruments in spectrophotometer* ● *Mass spectrometer* ● *Radiation methods for spectrometry* ● *Thermonalytics instruments* ● *Microscopy instruments* ● *Electrochemical instruments* ● *Lab on chips technology* ● *Lab on chips design* ● *Smartphone instruments* ● *Lab in a phone*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *LTM-PK: 15 %* *LTM-PPT : 15%* *LTM-PK : 15%* *LTP-PPT : 15%* *Final-Test : 50%*

	Total : 100 % ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A* *75—<80* — *B+* *70—<75* — *B* *65—<70* — *B* *60—<65* — *C+* *55—<60* — *C* *40—<55* — *D* <*40* — *E*
Media employed	*Powerpoint presentation (PPT), Microsoft Teams, e-Learning Management System (EMAS)*
Reading List	1. *Khandpur RS, Handbook of Analytical Instruments, Third Edition, McGraw Hill Education (India) Private Limited, 2015.* 2. *Eugenio Iannone, Lab on Chips: Principle, Design and Technology, CRC Press, Taylor & Francis Group, 2015.* 3. *Abbas Jamalipour and Md Arafat Hossain, Smartphone Instrumentations for Public Health Safety, Springer Nature Switzerland AG, 2019*

Module name	*Embedded Instrumentation*
Module level, if applicable	*Postgraduate program*
Code, if applicable	*SCPH802314*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Dr. Prawito Prajitno*
Lecturer	*Dr. Prawito Prajitno*
Language	*Indonesia*
Relation to curriculum	*Compulsory coursea*
Type of teaching, contact hours	*Problem-based learning*
Teaching methods	*Group discussion*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week* *Independent study: 2x60=120 minutes per week*
Credit points	*2 credit points*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>After receiving this course, students are expected to be able to apply embedded system concept as the main component in data acquisition and control system</td></tr>
<tr><td>Content</td><td>Introduction to embedded system
FPGA architecture in microcontrollers
Basic VHDL commands
Applied Finite State Machine(FSM) in FPGA
ARM32 microcontroller's architecture and programming
GPIO : Timer/Counter, RTC, Interrupt, and Power Management
ADC and DAC
Serial communication : UART, SPI, I2C</td></tr>
<tr><td>Study and examination requirements and form of examination</td><td>The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Project presentation : 35 %
Mid-test : 30%
Final-test : 35 %
Total : 100 %

<table><tr><th>Mark</th><th>Grade</th></tr><tr><td>85—100</td><td>A</td></tr><tr><td>80—<85</td><td>A</td></tr><tr><td>75—<80</td><td>B+</td></tr><tr><td>70—<75</td><td>B</td></tr><tr><td>65—<70</td><td>B</td></tr><tr><td>60—<65</td><td>C+</td></tr></table></td></tr>
</table>

	55—<60	*C*
	40—<55	*D*
	<40	*E*
Media employed	*Powerpoint presentation (PPT), Microsoft Teams, e-Learning Management System (EMAS)*	
Reading List	*1. Kleitz, W., Digital Electronics, A Practical Approach with VHDL 9th ed, Pearson Publishing, 2012.* *2. Pedroni,V.A., Circuit Design with VHDL, 3rd Ed, MIT Press, 2020.* *3. Ünsalan,C., Gürhan,H.D, and Yücel,M.E., Embedded System Design with ARM Cortex-M Microcontroller, Springer, 2022.* *4. Pakdel, M., Advanced Programming with STM32 Microcontrollers, Elektor International Media,*	

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MODULE HANDBOOK

Module name	*Virtual Instruments*
Module level, if applicable	*Postgraduate program*
Code, if applicable	*SCPH802314*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Drs. Sastra Kusuma Wijaya, Ph.D*
Lecturer	*Drs. Sastra Kusuma Wijaya, Ph.D*
Language	*Indonesian*
Relation to curriculum	*Compulsory course*
Type of teaching, contact hours	*Flipped Class and Problem-based learning*
Teaching methods	*Group discussion*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week* *Independent study: 2x60=120 minutes per week*
Credit points	*2 credit points*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>After receiving this course, students are expected to be able to devise virtual instruments</td></tr>
<tr><td>Content</td><td>Introduction to LabVIEW : subVI, loop structure, charts and graphs, IO files, mathscript RT, and measurement system analysis
Data acquisition in USB6008/9, myDAQ, ELVIS III, myRIO
Linx on arduino and raspberry PI
Capacitance tomography with LabVIEW</td></tr>
<tr><td>Study and examination requirements and form of examination</td><td>The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Project presentation : 35 %
Mid-test : 30%
Final-test : 35 %
Total : 100 %

<table><tr><th>Mark</th><th>Grade</th></tr><tr><td>85—100</td><td>A</td></tr><tr><td>80—<85</td><td>A</td></tr><tr><td>75—<80</td><td>B+</td></tr><tr><td>70—<75</td><td>B</td></tr><tr><td>65—<70</td><td>B</td></tr><tr><td>60—<65</td><td>C+</td></tr><tr><td>55—<60</td><td>C</td></tr><tr><td>40—<55</td><td>D</td></tr></table></td></tr>
</table>

	<40 *E*
Media employed	*Powerpoint presentation (PPT), Microsoft Teams, e-Learning Management System (EMAS)*
Reading List	*1. Bishop, R. H. (2015). Learning with LabVIEW. Upper Saddle River, New Jersey, Pearson.* *2. Doering, E. (2016). NI myRIO Project Essentials Guide, National Instruments..* *3. Singh, R., et al. (2017). Arduino-based embedded systems: interfacing, simulation, and LabVIEW GUI, CRC Press.* *4. Silviu, F., Ed. (2011). LabVIEW-Practical Applications and Solutions. Rijeka, Croatia, InTech*

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MODULE HANDBOOK

Module name	*Intelligence Instruments*
Module level, if applicable	*Postgraduate program*
Code, if applicable	*SCPH802315*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Adhi Harmoko Saputro, Ph.D*
Lecturer	*Adhi Harmoko Saputro, Ph.D*
Language	*Indonesian*
Relation to curriculum	*Compulsory course*
Type of teaching, contact hours	*Flipped Class and Problem-based learning*
Teaching methods	*Student centered learning and group discussion*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week* *Independent study: 2x60=120 minutes per week*
Credit points	*2 credit points*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-

Module objectives/intended learning outcomes	*After receiving this course, students are expected to be able to identify AI based instrument systems and analyze intelligence system components on latest technologies*
Content	• *Introduction of Intelligence Instrument* • *Machine Learning for Regression* • *Machine Learning for Classification* • *Shallow Neural Network* • *Deep Neural Network* • *Expert System* • *Pattern Recognition* • *Application of AI in Intelligent Agents, Machine Vision and RoboticsSmart & Soft Sensing* • *Self-Correction* • *Indirect Sensing* • *Multidimensional Intelligent Sensors* • *Prognostic Instrumentation using AI* • *Fault Detection using AI* • *Linearization using AI* • *Smart Calibration*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Collaborative learning : 30 %* *Individual project : 20%* *Mid-test : 25%* *Final-test : 25 %*

	Total : 100 % ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A* *75—<80* — *B+* *70—<75* — *B* *65—<70* — *B* *60—<65* — *C+* *55—<60* — *C* *40—<55* — *D* <*40* — *E*
Media employed	*Powerpoint presentation (PPT), Microsoft Teams, e-Learning Management System (EMAS)*
Reading List	1. *Bhuyan, Manabendra, Intelligent Instrumentation: Principles and Applications, CRC Press (2010)* 1. *Ameet V Joshi, Machine Learning and Artificial Intelligence, Springer International Publishing (2020)* 2. *Stuart J. Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Global Edition, Pearson (2021)* 3. *Charu C. Aggarwal, Neural Networks and Deep Learning, Springer International Publishing (2018)* 4. *Ethem Alpaydin, Introduction to Machine Learning, The MIT Press (2009)* 5. *K. R. Chowdhary, Fundamentals of Artificial Intelligence, Springer-Nature New York Inc (2020)* 6. *Ulisses Braga-Neto, Fundamentals of Pattern Recognition and Machine Learning, Springer (2020)*

	7. *Ranjan Parekh, Fundamentals of Image, Audio, and Video Processing Using MATLAB With Applications to Pattern Recognition, CRC Press (2021)*

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MODULE HANDBOOK

Module name	*Signal Processing*
Module level, if applicable	*Postgraduate program*
Code, if applicable	*SCPH802314*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Adhi Harmoko Saputro, Ph.D*
Lecturer	*Drs. Sastra Kusuma Wijaya, Ph.D*
Language	*Indonesian*
Relation to curriculum	*Compulsory course*
Type of teaching, contact hours	*Flipped Class and Problem-based learning*
Teaching methods	*Student centered learning and group discussion*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week* *Independent study: 2x60=120 minutes per week*
Credit points	*2 credit points*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>After receiving this course, students are expected ti be able to identify signal processing on instrument systems and analyze signal processing components on latest technologies</td></tr>
<tr><td>Content</td><td>Discrete signal transformation
Z-transformation
Signal filtering
Designing FIR and IIR system
Adaptive filter
Quantization and compression
2D signal processing
Software and hardware signal processing</td></tr>
<tr><td>Study and examination requirements and form of examination</td><td>The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Collaborative learning : 30 %
Individual project : 20%
Mid-test : 25%
Final-test : 25 %
Total : 100 %

<table><tr><th>Mark</th><th>Grade</th></tr><tr><td>85—100</td><td>A</td></tr><tr><td>80—<85</td><td>A</td></tr><tr><td>75—<80</td><td>B+</td></tr><tr><td>70—<75</td><td>B</td></tr><tr><td>65—<70</td><td>B</td></tr><tr><td>60—<65</td><td>C+</td></tr><tr><td>55—<60</td><td>C</td></tr></table></td></tr>
</table>

	40—<55 *D* *<40* *E*
Media employed	*Powerpoint presentation (PPT), Microsoft Teams, e-Learning Management System (EMAS)*
Reading List	1. *Lizhe Tan, Jean Jiang, Digital Signal Processing, Fundamentals and Applications 3 rd, Academic Press, 2019* 2. *Robert J. Schilling and Sandra L. Harris, Digital Signal Processing Using MATLAB® Third Edition, Cengage Learning, 2017* 3. *Vinay K. Ingle, John G. Proakis, Digital Signal Processing Using MATLAB® 4th Edition, Cengage Learning, 2015* 4. *Dimitris G. Manolakis, Vinay K. Ingle, Applied Digital Signal Processing, Cambridge University Press, 2011* 5. *Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using MATLAB, Gatesmark Publishing, 2009*

Module name	*Image Processing*
Module level, if applicable	*Postgraduate program*
Code, if applicable	*SCPH802316*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Adhi Harmoko Saputro, Ph.D*
Lecturer	
Language	*Indonesian*
Relation to curriculum	*Compulsory course*
Type of teaching, contact hours	*Flipped Class and Problem-based learning*
Teaching methods	*Student centered learning and group discussion*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week* *Independent study: 2x60=120 minutes per week*
Credit points	*2 credit points*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>After receiving this course, students are expected to be able to identify image processing on instrument systems and analyze algorithms and components on latest technologies</td></tr>
<tr><td>Content</td><td>Image Representations and Pre-processing
Segmentation
Shape Representation and Description
Object Recognition
Image Understanding
3D Geometry and Vision
Texture Analysis
Motion Analysis
Camera Systems in Machine Vision
Machine Vision Algorithms
Machine Vision Application</td></tr>
<tr><td>Study and examination requirements and form of examination</td><td>The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Collaborative learning : 30 %
Individual project : 20%
Mid-test : 25%
Final-test : 25 %
Total : 100 %

<table><tr><th>Mark</th><th>Grade</th></tr><tr><td>85—100</td><td>A</td></tr><tr><td>80—<85</td><td>A</td></tr><tr><td>75—<80</td><td>B+</td></tr><tr><td>70—<75</td><td>B</td></tr></table></td></tr>
</table>

	65—<70	*B*
	60—<65	*C+*
	55—<60	*C*
	40—<55	*D*
	<40	*E*
Media employed	*Powerpoint presentation (PPT), Microsoft Teams, e-Learning Management System (EMAS)*	
Reading List	1. *Milan Sonka, Vaclav Hlavac, Roger Boyle, Image Processing, Analysis, and Machine Vision, CL Engineering (2014)* 2. *Johan Pehcevski, Machine Vision and Image Recognition, Arcler Press (2020)* 3. *Hornberg, Alexander, Handbook of machine and computer vision; the guide for developers and users, Wiley VCH (2017)* 4. *Muthukumaran Malarvel, Machine Vision Inspection Systems, Machine Learning-Based Approaches, John Wiley & Sons (2021)*	

MODULE HANDBOOK

Module name	*Reservoir Engineering*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCPH802503*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*1st Semester*
Person responsible for the module	*Dr. Ir. I Nengah Suabdi MT.*
Lecturer	*Dr. Ir. I Nengah Suabdi MT.*
Language	*Indonesian*
Relation to curriculum	*Elective course*
Type of teaching, contact hours	*Flipped class and problem based learning*
Teaching methods	
Workload (incl. contact hours, self-study hours)	*Lectures: 3x50 = 150 minutes per week* *Exercise and assignments: 3x60 = 180 minutes per week* *Independent study: 3x60 = 180 minutes per week*
Credit points	*3*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	*Basic Chemistry* *Basic Physics*

	Mathematical Petrophysics
Module objectives/intended learning outcomes	1. *Knowing how to calculate custom to get variables that are used to calculate reserves such as Area (A), thickness (h), initial water saturation (Swi) and oil or gas formation volume factor (Boi, Bgi).* 2. *Summarizes basic knowledge of reservoir science, fluid flow science in porous media.* 3. *Using these reservoir variables to calculate volumetric reserves and material balance.* 4. *Able to calculate the amount of oil and gas reserves from an exploration drilling result.*
Content	● *Studying the fluid properties of rocks such as how to calculate, and getting the variables such as: HC composition, specific gravity, viscosity, oil and gas formation volume factor, etc.* ● *Knowing how to take fluid samples in exploration and exploitation wells.* ● *Determine the amount of fluid properties.* ● *Rock properties.* ● *DST/Well Testing.* ● *Gas Well Testing.* ● *Forecast and Production Decline Analysis.* ● *Acidizing and fracturing.* ● *Production optimization.* ● *Economics aspect.*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Assignment : 20 %* *Paper reviews : 20 %* *Mid-test : 30 %*

	Final test : 30 % *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A* *75—<80* — *B+* *70—<75* — *B* *65—<70* — *B* *60—<65* — *C+* *55—<60* — *C* *40—<55* — *D* <40 — *E*
Media employed	-
Reading List	● *L.P. Dake : Fundamental Reservoir Engineering* ● *John Lee : Gas Reservoir Engineering* ● *John Lee : Well Testing* ● *Mc Cain : The Properties of Petroleum Fluids* ● *B.C Craft and M. Hawkins : Applied Petroleum Reservoir Engineering* ● *Boyun Gao : Petroleum Production Engineering_Elsevier 2007* ● *Amyx : Petroleum Reservoir Engineering* ● *Economides M and Hills A : Petroleum Production System* ● *Heriot Watt University : Production Technology I and II* ● *Petro Skill : Well Test Design and Analysis.*

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MODULE HANDBOOK

Module name	*Petroleum Geology*
Module level, if applicable	*Graduate Program*

Code, if applicable	*SCPH802504*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Dr. Waluyo* *Dr. Syahrizal*
Lecturer	*Dr. Waluyo* *Dr. Syahrizal*
Language	*Indonesian*
Relation to curriculum	*Elective course*
Type of teaching, contact hours	*Flipped class and problem based learning*
Teaching methods	*Problem-based learning/Project-based learning, Collaborative learning/Active learning*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50 = 100 minutes per week* *Exercise and assignments: 2x60 = 120 minutes per week* *Independent study: 2x60 = 120 minutes per week*
Credit points	*2*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>1. Applying physics or its application in solving work problems.
2. Analyzing petroleum system problems which include reservoir characterization, source rock types and maturity processes, overburden, trapping systems and dynamic processes that occur as a condition for the accumulation of oil and gas in the reservoir.</td></tr>
<tr><td>Content</td><td>● Petroleum System
● Reservoir Migas
● Source Rocks/Batuan Sumber
● Oil print analysis and Seal Rocks
● Trapping Mechanism
● Structural and Stratigraphic traps
● Dynamic and Migration</td></tr>
<tr><td>Study and examination requirements and form of examination</td><td>The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Assignment : 33.3 %
Mid-test : 33.3 %
Final test : 33.4%
Total : 100 %

Mark — Grade
85—100 — A
80—<85 — A
75—<80 — B+
70—<75 — B
65—<70 — B
60—<65 — C+
55—<60 — C
40—<55 — D
<40 — E</td></tr>
</table>

Media employed	*Microsoft Teams, Zoom Meeting, Google Meet*
Reading List	• *Selley, R.C., Elements of Petroleum Geology, Academic Press inc., 1997.* • *North, F.K., Petroleum Geology, Routledge, 1985.* • *Journal and Proceeding Seminars.*

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MODULE HANDBOOK

Module name	*Seismic Stratigraphy and Sequence*

Module level, if applicable	*Postgraduate program*
Code, if applicable	*SCPH802505*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Dr. Ir. Agus Guntoro, M.Si*
Lecturer	*Dr. Ir. Agus Guntoro, M.Si*
Language	*Indonesian*
Relation to curriculum	*Compulsory course*
Type of teaching, contact hours	*Flipped Class and Problem-based learning*
Teaching methods	*Lecture and group discussion*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week* *Independent study: 2x60=120 minutes per week*
Credit points	*2 credit points*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	

Module objectives/intended learning outcomes	*After receiving this course, students are expected to be able to analyze vertical and lateral sediment changes in space and time coordinates and identify the applications in geologic exploration and development*
Content	● *Seismic stratigraphy and sequence* ● *Tectonic developments* ● *Fundamental of stratigraphy* ● *Applied stratigraphy in oil and gas industry* ● *Stratigraphy genetics, depositional stratigraphy, and TR Stratigraphy* ● *Sequence Stratigraphy applications in log-well analysis* ● *Sequence Stratigraphy applications in system tracks analysis* ● *Seismic principles and wave characteristics in Stratigraphy interpretation* ● *Seismic cross section analysis* ● *Seismic integration, well and Stratigraphy sequence* ● *Facies seismic analysis in sedimentation model system* ● *Seismic sequence analysis implementation in sedimentation model system* ● *Seismic Stratigraphy application and implementation in hydrocarbon exploration* ● *Integration, analysis, and seismic interpretation based on data and stratigraphy sequence*

<table>
<tr>
<td>Study and examination requirements and form of examination</td>
<td>
The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Quiz : 5 %
Assignment : 15%
Mid-test : 30%
Final-test : 50 %
Total : 100 %

<table>
<tr><th>Mark</th><th>Grade</th></tr>
<tr><td>85—100</td><td>A</td></tr>
<tr><td>80—<85</td><td>A</td></tr>
<tr><td>75—<80</td><td>B+</td></tr>
<tr><td>70—<75</td><td>B</td></tr>
<tr><td>65—<70</td><td>B</td></tr>
<tr><td>60—<65</td><td>C+</td></tr>
<tr><td>55—<60</td><td>C</td></tr>
<tr><td>40—<55</td><td>D</td></tr>
<tr><td><40</td><td>E</td></tr>
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<tr>
<td>Media employed</td>
<td>Powerpoint presentation (PPT), Microsoft Teams, e-Learning Management System (EMAS)</td>
</tr>
<tr>
<td>Reading List</td>
<td>

Bally, A.W., 1987: Atlas of Seismic Stratigraphy. AAPG Studies in Geology # 27, V1
Galloway, W.E., 1989: Genetic Stratigraphic Sequences in Basin Analysis I: Architecture and Genesis of Flooding-Surface Bounded Depositional. AAPG Bulletin 73(2)
Embry, A., 2009; Practical Sequence Stratigraphy
Embry, A., Johannessen, E., Owen, Donald, Beauchamp, B., Gianolla, P., 2007: Sequence Stratigraphy as a “Concrete” Stratigraphic. Report of the ISSC Task Group on Sequence Stratigraphy
Hunt, D., Tucker, M.E., 1992, Stranded

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</tr>
</table>

	parasequences and the forced regressive wedge systems tract: deposition during base-level fall. Sedimentary Geology 81, 1–9 6. *Kendal, C, G, C., 2008: Sequence Stratigraphy – Introduction.* 7. *Matenco, L.C., and Haq, B.U., 2020: Multi-scale depositional successions in tectonic settings. Earth-Science Reviews 200 (2020) 102991* 8. *Posamentier, H.W., Allen, P.G., James, D.P and Tesson, M., 1992: Force Regressions in a Sequence Stratigraphic* 9. *Framework: Concept, Example and Exploration Significance. AAPG Bulletin, V 6, No. 11* 10. *SEPM. 2002, Sequence Stratigraphic Framework.* 11. *Octavian, C., 2017: Sequence Stratigraphy: Guidelines for a Standard Methodology. University of Alberta, Edmonton, AB, Canada* 12. *Veeken, P.C.H., 2007: Seismic Stratigraphy, Basin Analyses and Reservoir Characterization. Handbook of geophysical Exploration. Volume 37*

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MODULE HANDBOOK

Module name	*Sedimentology*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCPH802506*
Subtitle, if applicable	
Courses, if applicable	

Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Dr. Nanang Muksin Halik*
Lecturer	*Dr. Nanang Muksin Halik*
Language	*Indonesian*
Relation to curriculum	*Elective course*
Type of teaching, contact hours	*Flipped class and problem based learning*
Teaching methods	*Flipped classroom, interactive lecture, think pair share, self-study*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50 = 100 minutes per week* *Exercise and assignments: 2x60 = 120 minutes per week* *Independent study: 2x60 = 120 minutes per week*
Credit points	*2*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	1. *Applying physics or its application in solving work problems.* 2. *After completing this course, students are expected to be able to correlate the basic concepts of sedimentology, the process of sedimentary rock formation, as well as analyzing and applying the interpretations of geophysical*

	modeling.
Content	• *Preliminary which covers the understanding of sedimentary rocks, the importance of sedimentary rocks, the cycle of rock formation, weathering and types of weathering.* • *Sediment transport which includes rocks cycle, hydrologic cycle, rock-forming minerals, rock types, genesis of sedimentary rock classification, sedimentation aspect, and mass movement fluid dynamic.* • *Sedimentary rock textures which include grain size, grain shape, grain fabric, roundness, provenance, textural maturity, grain size distribution, and textural components.* • *Sandstone reservoir and porosity which includes reservoir rock types, porosity types, sedimentary rock permeability, the relationship between porosity, permeability, and texture, diagenetic process effects, reservoir continuity, and petroleum system.* • *Sedimentary structure which includes current flow structure, deformational structure, biogenic structure, chemical structure.* • *Depositional environment which includes continental environment, marginal marine environment, marine environment, sedimentary facies, facies model.*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Group assignment : 20 %* *Individual assignment : 25 %* *Mid-test : 30 %*

	Final test : 30% *Total* : 100 % ***Mark*** ***Grade*** *85—100* *A* *80—<85* *A* *75—<80* *B+* *70—<75* *B* *65—<70* *B* *60—<65* *C+* *55—<60* *C* *40—<55* *D* <40 *E*
Media employed	*Video conference application.*
Reading List	• *Boggs, S., Jr 1995, Principles of Sedimentology and Stratigraphy 2nd., Prentice hall, Inc.* • *Selley, R. C., 1992, Applied Sedimentology, Academic Press, 2nd printing.* • *Scholle, P. A., and Spearing, 1982, Sandstone Depositional Environment, The American Association of Petroleum Geologist.*

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MODULE HANDBOOK

Module name	*Geostatistic*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCPH802507*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Chia-Hsin Charlie Wu, M.Sc., Ph.D.*
Lecturer	*Chia-Hsin Charlie Wu, M.Sc., Ph.D.*

Language	*Indonesian*
Relation to curriculum	*Compolsury Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Lecturer Presentation, Demo, and Discussion*
Workload (incl. contact hours, self-study hours)	*1. Lectures: 2 x 50 minutes per week* *2. Exercises and assignments: 2 x 60 = 120 minutes per week* *3. Independent study: 2 x 60 = 120 minutes per week*
Credit points	*2*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	
Module objectives/intended learning outcomes	1. *Explain the geostatistic konsep for oil reservoir characterization with dynamics and statics data integration.*
Content	● *Introduction & Regression Analysis* ● *Descriptive Statistics & Uncertainties* ● *Simple Statistical Methods for Reservoir Correlation* ● *Inferential Statistical Method: T and F Tests for Reservoir Correlations*

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

- *Monte Carlo Simulation*
- *Markov Chains & Applications*
- *Geostatistics & Reserves Booking*
- *Spatial Interpretation*
- *Semivariogram*
- *Kriging*
- *Ordinary and Indicator Kriging*
- *Sequential Gaussian Simulation*
- *Sequential Indicator Simulation*

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<tr><td>Study and examination requirements and form of examination</td><td>

The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:

Homework : 50 %
Mid-test : 25 %
Final test : 25 %
Total : 100 %

Mark	***Grade***
85—100	*A*
80—<85	*A*
75—<80	*B+*
70—<75	*B*
65—<70	*B*
60—<65	*C+*
55—<60	*C*
40—<55	*D*
<40	*E*

</td></tr>
<tr><td>Media employed</td><td></td></tr>
<tr><td>Reading List</td><td>

1. *Isaak, E. H. and R. M. Srivastava, An Introduction to Applied Geostatistics, Oxford University Press, New York, 1989.*
2. *Chiles J. and P. Delfiner, Geostatistics : Modeling Spatial Uncertainty, John Wiley & Sons, New*

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</table>

	York, 1999.

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MODULE HANDBOOK

Module name	*Seismic Data Processing and Interpretation*
Module level, if applicable	*Graduate Program*
Code, if applicable	
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*1st semester*
Person responsible for the module	*Dr. Teguh Suroso*
Lecturer	*Dr. Teguh Suroso*
Language	*Indonesian*
Relation to curriculum	*Compulsory Course*

Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Using MS Teams*
Workload (incl. contact hours, self-study hours)	*1. Lectures: 2 x 50 minutes per week* *2. Exercises and assignments: 2 x 60 = 120 minutes per week* *3. Independent study: 2 x 60 = 120 minutes per week*
Credit points	*2*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	
Module objectives/intended learning outcomes	1. *Applications of analytical tools in seismic data processing to ensure data is processed using the method and/or the right technique so that the final result can be used optimally for qualitative and quantitative interpretation purposes.*
Content	• *Seismic Wave Propagation* • *Seismic Data Recording* • *Factors that Affect Amplitude* • *Corrections* • *Noise* • *Frequency Filter* • *Wavenumber Filter* • *Tau-p* • *Radon* • *Anisotropy*

<table>
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- *Q*
- *Speed and Analysis of Speed*
- *Time Domain Imaging*
- *Depth Domain Imaging*

</td></tr>
<tr><td>Study and examination requirements and form of examination</td><td>

The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:

Individual Assignments : 25 %
Presentation : 25 %
Mid-test : 25 %
Final Test : 25 %
Total : 100 %

Mark	***Grade***
85—100	*A*
80—<85	*A*
75—<80	*B+*
70—<75	*B*
65—<70	*B*
60—<65	*C+*
55—<60	*C*
40—<55	*D*
<40	*E*

</td></tr>
<tr><td>Media employed</td><td></td></tr>
<tr><td>Reading List</td><td>

1. *Yilmaz, O., Seismic Data Analysis, Society of Exploration Geophysicsit, 2001*

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

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MODULE HANDBOOK

Module name	*Geopotential Method*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCPH802509*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*M. Syamsu Rosid Ph.D*
Lecturer	*M. Syamsu Rosid Ph.D*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*

Teaching methods	*Student Center Learning, Presentation and Discussion*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week*
Credit points	*2*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisites	-
Module objectives/intended learning outcomes	1. *Identify and analyze gravity method* 2. *Identify and analyze magnetotelluric (MT) method*
Content	● *Gravity method* ● *Gravity instrumentation and acquisition* ● *Gravity data analysis* ● *Gradiometry and microgravity* ● *Geomagnetic exploration* ● *Geomagnetic instrumentation and acquisition* ● *Data analysis and interpretation* ● *Seismic transmission* ● *Vp, Vs, Poisson ratio analysis* ● *Microseismic, ANT, RF* ● *Magnetotelluric (MT) method* ● *MT parameter physical interpretation* ● *Applications in exploration*

<table>
<tr>
<td>Study and examination requirements and form of examination</td>
<td>
The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Assignment : 25 %
Quiz : 15 %
Mid-test : 30 %
Final test : 30 %
Total : 100 %

<table>
<tr><th>Mark</th><th>Grade</th></tr>
<tr><td>85—100</td><td>A</td></tr>
<tr><td>80—<85</td><td>A</td></tr>
<tr><td>75—<80</td><td>B+</td></tr>
<tr><td>70—<75</td><td>B</td></tr>
<tr><td>65—<70</td><td>B</td></tr>
<tr><td>60—<65</td><td>C+</td></tr>
<tr><td>55—<60</td><td>C</td></tr>
<tr><td>40—<55</td><td>D</td></tr>
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</table>
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<tr>
<td>Media employed</td>
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</tr>
<tr>
<td>Reading List</td>
<td>

Blakely, R.J., 1995, Potential Theory in Gravity & Magnetic Application, Cambridge University Press.
Udias, Agustin, 1999, Principles of Seismology, Cambridge University Press, UK.
Telford, W.M., Geldart, L.P. and Sheriff, R.E., 1990, Applied Geophysics, Cambridge University Press, New York.
Mussett, A.E. and Khan, M.A., 2000, Looking Into the Earth: An Introduction to Geological Geophysics, Cambridge University Press, Oct 23, 2000.

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</tr>
</table>

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MODULE HANDBOOK

Module name	*Geological Structure and Seismic Interpretation*
Module level, if applicable	*Postgraduate program*
Code, if applicable	*SCPH802511*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd Semester`*
Person responsible for the module	*Dr. Ir. Agus Guntoro, M.Si*
Lecturer	*Dr. Ir. Agus Guntoro, M.Si*
Language	*Indonesian*
Relation to curriculum	*Compulsory course*
Type of teaching, contact hours	*Flipped Class and Problem-based learning*

Teaching methods	*Lecture and group discussion*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week* *Independent study: 2x60=120 minutes per week*
Credit points	*2 credit points*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	*After receiving this course, students are expected to be able to analyze basic concept of geologic structure and its relation to seismic reflection interpretation in oil and gas exploration.*
Content	● *Introduction to Some Basin Evolution & Structurisation.* ● *Basic Geological Structural Understanding* ● *Reconnaissance Deformation of The Earth Crust,* ● *Basic Method and Principle of Seismic Interpretation;* ● *Petroleum Systems Elements and Seismic Analyses;* ● *Plays Concepts and Structural Geology*

<table>
<tr>
<td>Study and examination requirements and form of examination</td>
<td>
The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Quiz : 5 %
Assignments : 15%
Mid-Test : 30%
Final-Test : 50%
Total : 100 %

<table>
<tr><th>Mark</th><th>Grade</th></tr>
<tr><td>85—100</td><td>A</td></tr>
<tr><td>80—<85</td><td>A</td></tr>
<tr><td>75—<80</td><td>B+</td></tr>
<tr><td>70—<75</td><td>B</td></tr>
<tr><td>65—<70</td><td>B</td></tr>
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<tr><td>40—<55</td><td>D</td></tr>
<tr><td><40</td><td>E</td></tr>
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</tr>
<tr>
<td>Media employed</td>
<td>Powerpoint presentation (PPT), Microsoft Teams, e-Learning Management System (EMAS)</td>
</tr>
<tr>
<td>Reading List</td>
<td>

Davis, G. H. and Reynolds, S. J., 1996, Structural Geology of Rock and Regions : 2nd edition, John and Wiley and Sons, Inc., 776 p.
Fossen, H.,2010: Structural Geology: CAMBRIDGE UNIVERSITY PRESS
Keary, P., and Vine, F. J., 1990, Global Tectonics; Blackwell Scientific Pub.
Lowell, J. D., 1985, Structural Styles in Petroleum Exploration : OGCI Publication, 480 p
Park, R. G., 1988, Geological Structures and Moving Plates : Blackie, Glasgow and London, 337 p
Sharma, PV, 1990, Geophysical Methods in Geology, 2nd, Elsevier

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</tr>
</table>

	7. *Sheriff, RE, 1995, Encyclopedic Dictionary of Exploration Geophysics, 3th ed, SEG* 8. *Suppe, J., 1985, Principles of Structural Geology : Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 537p* 9. *Telford, WM., Geldart, LPm, Sherriff, RE., 1990, Apllied Geophysics, 2nd ed, Cambridge University Press.* 10. *Twiss, R. J. and Moores, E. M., 1992, Structural Geology : W. H. Freeman and Company, New York, 532 p* 11. *Zhou, H.W.,2014. Practical Seismic Data Analysis. Cambridge University Press*

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MODULE HANDBOOK

Module name	*Geothermal Geology*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCPH802602*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*1st semester*
Person responsible for the module	*Dr. Raden Fajar Hendrasto, M. T.*
Lecturer	*Dr. Raden Fajar Hendrasto, M. T.*
Language	*Indonesian*
Relation to curriculum	*Compulsory Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Lecturer Presentation and Discussion*

Workload (incl. contact hours, self-study hours)	*1. Lectures: 2 x 50 minutes per week* *2. Exercises and assignments: 2 x 60 = 120 minutes per week* *3. Independent study: 2 x 60 = 120 minutes per week*
Credit points	*2*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	
Module objectives/intended learning outcomes	1. *Identify and analyse tectonic concept, volcanism, geothermal system formation, geological survey method for geothermal exploration: remote sensing analysis, field survey method, rock sample analysis, geological and structural maps, geothermal system geological modelling, and study case.*
Content	● *Concept of Tectonism and Vulcanism* ● *Geothermal System Formation* ● *Geological Survey Method for Geothermal Exploration* ● *Remote Sensing Method for Geothermal Exploration* ● *Geological Field Mapping Method (Structure and Lithology)* ● *Rock Sample Analyzing Methods in Geothermal Environment (XRD, Petrography, Fluid Inclusion, Age Dating)* ● *Geological and Structural Mapping*

<table>
<tr><td></td><td>Formation in Geothermal Environment
• Geothermal System Geological Modelling Formation
• Role of Geology in Geothermal Drilling</td></tr>
<tr><td>Study and examination requirements and form of examination</td><td>The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Assignments : 40 %
Mid-test : 30 %
Final Test : 30%
Total : 100 %

Mark — Grade
85—100 — A
80—<85 — A
75—<80 — B+
70—<75 — B
65—<70 — B
60—<65 — C+
55—<60 — C
40—<55 — D
<40 — E</td></tr>
<tr><td>Media employed</td><td></td></tr>
<tr><td>Reading List</td><td>1. Harvey, C. And Beardsmore, G., Geothermal Exploration – Global Strategies and Applications, IGA Academy Books, 2016.
2. Boden, D.R., Geologic Fundamentals of Geothermal Energy. CRC Press, 2017.
3. Chandrashekaram, D., Low-Enthalpy Geothermal Resources for Power Generation, Taylor and Francis Group, 2008.</td></tr>
</table>

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MODULE HANDBOOK

Module name	*Geothermal Geochemistry*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCPH802603*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Dr. Zainal Abidin*
Lecturer	*Dr. Zainal Abidin*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Lecturer Presentation and Discussion*
Workload (incl. contact hours, self-study hours)	*1. Lectures: 2 x 50 minutes per week* *2. Exercises and assignments: 2 x 60 = 120 minutes*

	per week *3. Independent study: 2 x 60 = 120 minutes per week*
Credit points	*2*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	
Module objectives/intended learning outcomes	1. *Identify and analyse the origin geothermal fluid, types and composition of geothermal fluids, liquid and gas sampling technique, and geochemical modelling of geothermal system.*
Content	● *Basic Chemistry* ● *Basic Geothermal Energy* ● *Surface Manifestation* ● *Liquid Geothermometer*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Paper and Homework : 60 %* *Final Test : 40 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A* *75—<80* — *B+*

	70—<75	*B*
	65—<70	*B*
	60—<65	*C+*
	55—<60	*C*
	40—<55	*D*
	<40	*E*
Media employed		
Reading List	1. *Atkins, Peter, Julio De Paula, and James Keeler. 2017. Physical Chemistry. 11th ed. London, England: Oxford University Press.* 2. *Ellis, A. J., and W. A. J. Mahon. 1977. Chemistry and geothermal systems. New York: Academic Press. Marini L. 2000. Geochemical techniques for the exploration and exploitation of geothermal energy. Italy: University of Genua.* 3. *Giggenbach, W. F., and R. L. Goguel. 1989. Collection and analysis of geothermal and volcanic water and gas discharges. Petone, N.Z.: Chemistry Division, Dept. of Scientific and Industrial Research.* 4. *R.O. Fournier, 1991, Water geothermometers applied to geothermal energy: Center on Small Energy Resources.*	

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MODULE HANDBOOK

Module name	*Geothermal Drilling*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCPH802604*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Dr. Eng. Yunus Dipl.Geotherm.Tech., M.Sc*
Lecturer	*Dr. Eng. Yunus Dipl.Geotherm.Tech., M.Sc*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Presentation and Discussion*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week*

Credit points	*2*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisites	
Module objectives/intended learning outcomes	*Identify and analyze geothermal drilling strategies, prognosis, methods, instruments, and data analysis*
Content	• *Geothermal drilling strategies* • *Drilling planning and prognosis* • *Drilling design (casing and cementing)* • *Drilling fluid* • *Drilling tools* • *Instrumentation and logging* • *Drilling problem-solving* • *Drilling data analysis*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Assignment : 25 %* *Mid-test : 35 %* *Final test : 40 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A*

	75—<80	*B+*
	70—<75	*B*
	65—<70	*B*
	60—<65	*C+*
	55—<60	*C*
	40—<55	*D*
	<40	*E*
Media employed		
Reading List	1. *Finger, J. and Blankenship, D., Handbook of Best Practices for Geothermal Drilling, Sandia National Laboratories, 2010.* 2. *DiPippo, R., Geothermal Power Plants (2nd edition): Principles, Applications, Case Studies and Environmental Impact. Amazon, 2008.* 3. *Watson, A., Geothermal Engineering: Fundamentals and Applications. Springer, 2014.*	

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MODULE HANDBOOK

Module name	*Geothermal Reservoir Engineering*
Module level, if applicable	*Postgraduate program*
Code, if applicable	*SCPH802605*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Dr. Jatmiko Prio Atmojo* *Ir. Riza Passiki, M.Si*
Lecturer	*Dr. Jatmiko Prio Atmojo* *Ir. Riza Passiki, M.Si*
Language	*Indonesian*
Relation to curriculum	*Compulsory course*
Type of teaching, contact hours	*Flipped Class and Problem-based learning*
Teaching methods	*Lecture and group discussion*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per*

	week *Independent study: 2x60=120 minutes per week*
Credit points	*2 credit points*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	*After receiving this course, students are expected to be able to identify model concept, character, and parameter of one geothermal reservoir along with its fluid thermodynamics' behavior*
Content	● *Overview of Geothermal System* ● *Fluid Flow in the Reservoir* ● *Estimation of Resource, Reserve and Electricity Potential* ● *Pressure Transient Analysis* ● *Reinjection* ● *Changes within the Reservoir Under Exploitation* ● *Reservoir Modelling & Simulation*

<table>
<tr>
<td>Study and examination requirements and form of examination</td>
<td>
The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Assignments : 20 %
Mid-test : 30%
Final-test : 50%
Total : 100 %

<table>
<tr><th>Mark</th><th>Grade</th></tr>
<tr><td>85—100</td><td>A</td></tr>
<tr><td>80—<85</td><td>A</td></tr>
<tr><td>75—<80</td><td>B+</td></tr>
<tr><td>70—<75</td><td>B</td></tr>
<tr><td>65—<70</td><td>B</td></tr>
<tr><td>60—<65</td><td>C+</td></tr>
<tr><td>55—<60</td><td>C</td></tr>
<tr><td>40—<55</td><td>D</td></tr>
<tr><td><40</td><td>E</td></tr>
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<tr>
<td>Media employed</td>
<td>Powerpoint presentation (PPT), Microsoft Teams, e-Learning Management System (EMAS)</td>
</tr>
<tr>
<td>Reading List</td>
<td>

Grant, M.A., Donaldson I.G., Bixley P.F (1982): Geothermal Reservoir Engineering, Academic Press, 369 pp.
D'Sullivan M.J & McKibbin R. (1989) : Geothermal Reservoir Engineering, a Manual for Geothermal Reservoir
Engineering Course at the Geothermal Institute – University of Auckland.
McGuinness, M. (1996): Interference Testing, Lecture Notes, Geothermal Institute - University of Auckland.
Grant, M. (1996): Geothermal Resource Management, Geothermal Energy New Zealand Limited, 131 pp
Handbook of Geothermal Energy,Editors:

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</table>

	Edwards, L.M., Chilingar, G.V. et al. , Gulf Publishing Company, 1982, 6 7. *Bodvarsson G.S. and Whiterspoon P.A. (1989): Geothermal Reservoir Engineering, Geotherm. Sci. & Tech., Volum2(1) pp. 1-68.* 8. *Sanyal, K.S. (2005): Geothermal Resource Characteristics, Development, Assessment and Management, Course Material of the 2005 World Geothermal Conference.* 9. *Nenny Miryani Saptadji (2001): Teknik Reservoir Panas Bumi, Diktat Kuliah TM-ITB* 10. *O'Sullivan, M.J. (1987) Geothermal Reservoir Simulation. Applied Geothermics, John Wiley & Sons, Ltd., 111124.* 11. *DiPippo, R. (2008):Geothermal Power Plants: Principles, Applications, Case Studies and Environmental Impact, Elsevier, Second Edition, 493 pp*

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MODULE HANDBOOK

Module name	*Geothermal Prospect Evaluation*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCPH802606*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Dr. Eng. Yunus Dipl.Geotherm.Tech., M.Sc*
Lecturer	*Dr. Eng. Yunus Dipl.Geotherm.Tech., M.Sc*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Lecturer presentation and discussion*

Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week*
Credit points	*2*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisites	
Module objectives/intended learning outcomes	*Identify and analyze geothermal prospects from technical (exploration technology and drilling strategy), economic and environmental aspects*
Content	• *Strategic concept of geothermal prospects evaluation* • *Technical aspects of geothermal prospects evaluation (geology, geochemistry, geophysics)* • *Development of conceptual model of geothermal system and delimitation of prospect area* • *Strategy for determining geothermal exploration drilling locations* • *Calculation of potential geothermal energy resources and reserves* • *Economic aspects in geothermal prospects evaluation* • *Environmental aspects in geothermal prospects*

<table>
<tr><td></td><td>evaluation</td></tr>
<tr><td>Study and examination requirements and form of examination</td><td>The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Assignment : 40 %
Mid-test : 30 %
Final test : 30 %
Total : 100 %

Mark — Grade
85—100 — A
80—<85 — A
75—<80 — B+
70—<75 — B
65—<70 — B
60—<65 — C+
55—<60 — C
40—<55 — D
<40 — E</td></tr>
<tr><td>Media employed</td><td></td></tr>
<tr><td>Reading List</td><td>1. Harvey, C. And Beardsmore, G., Best Practices Guide for Geothermal Exploration, Sandia IGA Academy Book, 2014.
2. DiPippo, R., Geothermal Power Plants (2nd edition): Principles, Applications, Case Studies and Environmental Impact. Amazon, 2008.
3. Harvey, C. And Beardsmore, G., Geothermal Exploration – Global Strategies and Applications, IGA Academy Books, 2016.</td></tr>
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MODULE HANDBOOK

Module name	*Geothermal Economics and Management*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCPH802607*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Surya Darma, Ph.D., Dipl. Geotherm. Tech.*
Lecturer	*Surya Darma, Ph.D., Dipl. Geotherm. Tech.*
Language	*Indonesian*
Relation to curriculum	*Elective course*
Type of teaching, contact hours	*Flipped class and problem based learning*
Teaching methods	*Student center learning, case study learning*

Workload (incl. contact hours, self-study hours)	*Lectures: 2x50 = 100 minutes per week* *Exercise and assignments: 2x60 = 120 minutes per week* *Independent study: 2x60 = 120 minutes per week*
Credit points	*2*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	1. *Able to apply management science and engineering economics as well as the application of analysis in carrying out activities and business development and utilization of geothermal energy in the work environment in the geothermal field.* 2. *Able to identify geothermal business systems based on project management and analyze the economics of geothermal businesses on various geothermal systems and technologies.*
Content	● *Preliminary: Teaching concept* ● *Business, regulation, and management concepts.* ● *Management.* ● *Decision making process in management.* ● *Organization and organizational work relations.* ● *Project management in the form of Gant Chart—Bar Chart.* ● *Managing projects.*

<table>
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- *Engineering economics.*
- *Geothermal economic analysis.*
- *Project feasibility analysis (feasibility study).*
- *Analysis method.*
- *Functions of project financing components (direct costs, overhead, etc.).*
- *What is the geothermal investment climate?*
- *Geothermal investment risk analysis.*
- *Analysis and key determinants of geothermal electricity prices.*
- *Calculating geothermal economics.*
- *Effect of risk factors on geothermal economy.*

</td></tr>
<tr><td>Study and examination requirements and form of examination</td><td>

The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:

Collaborative learning : 10 %
Individual project : 15 %
Mid-test : 35 %
Final test : 40%
Total : 100 %

Mark	***Grade***
85—100	*A*
80—<85	*A*
75—<80	*B+*
70—<75	*B*
65—<70	*B*
60—<65	*C+*
55—<60	*C*
40—<55	*D*
<40	*E*

</td></tr>
<tr><td>Media employed</td><td>-</td></tr>
</table>

Reading List	*Required:* ● *Mary H. Dickson and Mario Fanelli, 2004: What is Geothermal Energy, Istituto di Geoscienze e Georisorse, CNR , Pisa, Italy.* ● *ARMSTEAD, H.C.H., 1983. Geothermal Energy. E. & F. N. Spon, London, 404 pp.* ● *BROWN, K. L., 2000. Impacts on the physical environment. In: Brown, K.L., ed., Environmental Safety and Health Issues in Geothermal Development, WGC 2000 Short Courses, Japan, 43—56.* ● *Widjajono Partowidagdo, 2009: Migas dan Energi di Indonesia, Permasalahan dan Analisis Kebijakan, Development Studies Foundation, Pertamina, Jakarta.* ● *Panasbumi: Energi Kini dan Masa Depan, Asosiasi Panas Bumi Indonesia – 2004, 232 hal.* ● *Iman Soeharto (1995): Manajemen Proyek: Dari konseptual sampai Operasional, Penerbit Erlangga, 755 hal.* ● *Ministry of Planning, 2014: Geothermal Handbook, for Indonesia* ● *GeothermEx Inc., 2010. An Assessment Of Geothermal Resource Risks in Indonesia,* ● *[Online], www.ppiaf.org/.../REPORT_Risk_Mitigation_Options_Indonesia.pdf.* ● *Mansyur, 2010: Manajemen Pembiayaan Proyek, LaksBang Pressindo, Yogyakarta.* ● *UU No.27 Tahun 2003 dan UU No.21/2014 tentang Panas bumi, PP59 Tahun 2007 serta UU No. 30 Tahun 2007 tentang Energi.* ● *DiPippo, R. (2016): Geothermal Power Generation: Development and Innovation, Elsevier, First Edition, 822 pp* ● *Surya Darma, (2022): Manajemen Proyek dan Keekonomian Geotermal – Best Practice Dalam Pengusahaan Panas bumi, Jakarta.*

	Addition: • *AXELSSON, G. and GUNNLAUGSSON, E., 2000. Background: Geothermal utilization, management and monitoring. In: Long-term monitoring of high- and low enthalpy fields under exploitation, WGC 2000 Short Courses, Japan, 3-10* • *2. Amin Widjaja Tunggal, 2009: Pokok-pokok Manajemen Operasi, Meningkatkan Produktivitas dan Daya Saing Organisasi, Harvarindo, Jakarta.* • *DiPippo, R. (2008): Geothermal Power Plants: Principles, Applications, Case Studies and Environmental Impact, Elsevier, Second Edition, 493 pp* • *Bromley, C.J. (2005): Advances in Environmental Management of Geothermal Developments, Proc. of 2005 , World Geothermal Congress 2005, Paper No. 0236, International Geothermal Association, Antalya-Turkey.* • *Geothermal Energy Association (GEA), 2009. Geothermal Energy and Induced Seismicity, Issue Brief.* • *Hidayat, S. dan Maranatha Wijayanigtyas (2019). Manajemen Konstruksi Dalam Perspektif Administrasi Pembangunan dan Pemasaran (PDF). Surabaya: PT Muara Karya. hlm. 36. ISBN 978-602-53690-9-4.* • *Husnan, S., & Muhammad, S., 2000: Studi Kelayakan Proyek, UPP STIM YKPN, Yogyakarta, Edisi Keempat.* • *www.geoenergy.org/pdf/Geothermal_Energy_and_Induced_Seismicity_Issue_Brief.pdf.* • *U.S. Department of Energy, 2005. Factors Affecting Costs of Geothermal Power Development* • *Wahjosoedibjo, Anton, et al, 2012. Geothermal Fund for Hastening the Development of Indonesia's Geothermal Resources, Proceedings,*

	Thirty-Seventh Workshop on Geothermal Reservoir Engineering Stanford University, Stanford, California, January 30 – February 1, 2012. ● *https://www.blj.co.id/2015/04/15/lima-pendapat-peter-drucker-untuk-manajemen/.* ● *Peter Drucker - Wikipedia* ● *https://www.shortform.com/summary/the-7-habits-of-highly-effective-people-summary-stephen-covey?gclid=CjwKCAjwi6WSBhA-EiwA6Niok9ZmT5vqg43-o4GEQF4-S-UoIEZwa27HmxOz-IhlLPfQawVHnsl8uBoCGWEQAvD_BwE.* ● *https://tomps.id/gantt-chart-manajemen-proyek-pengertian-manfaat-dan-cara-termudah-membuatnya/.*

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MODULE HANDBOOK

Module name	*Geothermal Geophysics 1*
Module level, if applicable	*Graduate program*
Code, if applicable	*SCPH802608*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*1st semester*
Person responsible for the module	*Dr. Eng. Yunus Dipl.Geotherm.Tech., M.Sc*
Lecturer	*Dr. Eng. Yunus Dipl.Geotherm.Tech., M.Sc*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Lecturer Presentation and Discussion*

Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week*
Credit points	*2*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisites	
Module objectives/intended learning outcomes	1. *Identify and analyze electrical properties of rocks, fundamental concepts of EM and MT technology* 2. *Explain MT data processing, modeling and interpretation*
Content	● *Introduction to Geothermal Geophysics 1* ● *Electrical properties of rocks* ● *Fundamental concept of EM* ● *Fundamental concept of MT technology* ● *MT Data Processing* ● *MT Data Modelling* ● *MT Data Interpretation*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Assignment : 25 %* *Mid-test : 35 %* *Final test : 40 %* *Total : 100 %*

	Mark	***Grade***
	85—100	*A*
	80—<85	*A*
	75—<80	*B+*
	70—<75	*B*
	65—<70	*B*
	60—<65	*C+*
	55—<60	*C*
	40—<55	*D*
	<40	*E*
Media employed	*Powerpoint presentation (PPT), Microsoft Teams, e-Learning Management System (EMAS)*	
Reading List	-	

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MODULE HANDBOOK

Module name	*Geothermal Geophysics 2*
Module level, if applicable	*Graduate program*
Code, if applicable	*SCPH802609*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*M. Syamsu Rosid Ph.D*
Lecturer	*M. Syamsu Rosid Ph.D*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Lecturer Presentation and Discussion*

Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week*
Credit points	*2*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisites	-
Module objectives/intended learning outcomes	*Usage of gravity method and MEQ (microearthquake) in geothermal exploration*
Content	● *Introduction* ● *Concept of gravity exploration* ● *Gravity instrument and acquisition* ● *Gravity data processing* ● *Gravity data analysis* ● *Gradiometry and microgravity* ● *Concept of seismic transmission/earthquake* ● *Vp, Vs, Poisson Ratio analysis* ● *Hypocenter, epicenter and magnitude of earthquake* ● *b-Value analysis* ● *Seismic tomography* ● *Applications in exploration*

<table>
<tr>
<td>Study and examination requirements and form of examination</td>
<td>
The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Assignment : 25 %
Quiz : 15 %
Mid-test : 30 %
Final test : 30 %
Total : 100 %

<table>
<tr><th>Mark</th><th>Grade</th></tr>
<tr><td>85—100</td><td>A</td></tr>
<tr><td>80—<85</td><td>A</td></tr>
<tr><td>75—<80</td><td>B+</td></tr>
<tr><td>70—<75</td><td>B</td></tr>
<tr><td>65—<70</td><td>B</td></tr>
<tr><td>60—<65</td><td>C+</td></tr>
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<tr>
<td>Media employed</td>
<td>Powerpoint presentation (PPT), Microsoft Teams, e-Learning Management System (EMAS)</td>
</tr>
<tr>
<td>Reading List</td>
<td>

Blakely, R.J., 1995, Potential Theory in Gravity & Magnetic Application, Cambridge University Press.
Udias, Agustin, 1999, Principles of Seismology, Cambridge University Press, UK.
Telford, W.M., Geldart, L.P. and Sheriff, R.E., 1990, Applied Geophysics, Cambridge University Press, New York.
Mussett, A.E. and Khan, M.A., 2000, Looking Into the Earth: An Introduction to Geological Geophysics, Cambridge University Press, Oct 23, 2000.

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MODULE HANDBOOK

Module name	*Geothermal Systems and Technology*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCOH802611*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Dr. Eng. Yunus Dipl.Geotherm.Tech., MSc*
Lecturer	*Dr. Eng. Yunus Dipl.Geotherm.Tech., MSc*
Language	*Indonesian*
Relation to curriculum	*Compulsory Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Lecturer Presentation and discussion*

Workload (incl. contact hours, self-study hours)	*1. Lectures: 3 x 50 minutes per week* *2. Exercises and assignments: 3 x 60 = 180 minutes per week* *3. Independent study: 3 x 60 = 180 minutes per week*
Credit points	*3*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	
Module objectives/intended learning outcomes	1. *Identify and analyse geothermal systems, system type, manifestation, geothermal resources in Indonesia, exploration and exploitation technology, environmental aspects, and geothermal development regulation in Indonesia*
Content	● *Definition of Geothermal Systems* ● *Tectonic Plate and Geothermal Systems Formations* ● *Types of Surface Manifestation of Geothermal Systems* ● *Geothermal Energy Development Stages* ● *Introduction to Geothermal Technology (Exploration, Production, Monitoring)* ● *Introduction to Environmental Aspects in Geothermal Energy Development* ● *Introduction to Regulation Aspects in Geothermal Energy Development*

<table>
<tr>
<td>Study and examination requirements and form of examination</td>
<td>
The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Assignments : 25 %
Mid-test : 35 %
Final Test : 40 %
Total : 100 %

<table>
<tr><th>Mark</th><th>Grade</th></tr>
<tr><td>85—100</td><td>A</td></tr>
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<td>Media employed</td>
<td>Powerpoint presentation (PPT), Microsoft Teams, e-Learning Management System (EMAS)</td>
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<tr>
<td>Reading List</td>
<td>

Harvey, C. And Beardsmore, G., Geothermal Exploration – Global Strategies and Applications, IGA Academy Books, 2016.
DiPippo, R., Geothermal Power Plants (2nd edition): Principles, Applications, Case Studies and Environmental Impact. Amazon, 2008.
Saptadji, N., Teknik Geotermal. Penerbit ITB, 2019.

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MODULE HANDBOOK

Module name	*Computational Methods*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCPH802802*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*1st semester*
Person responsible for the module	*Dr. rer. nat. Imam Fachruddin S.Si., M.Si.*
Lecturer	*Dr. rer. nat. Imam Fachruddin S.Si., M.Si.*
Language	*Indonesian*
Relation to curriculum	*Compulsory Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Lecture and discussion*

Workload (incl. contact hours, self-study hours)	*Lectures: 3x50=150 minutes per week* *Exercise and assignments: 3x60=180 minutes per week*
Credit points	*3*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisites	-
Module objectives/intended learning outcomes	1. *Apply numerical methods to solve Physics problems* 2. *Utilize Fortran programming language or equivalent to perform numerical calculations*
Content	● *Introduction to programming in Fortran language or equivalent* ● *Root-finding* ● *Solving system of linear equations* ● *Least-square fitting; interpolation* ● *Numerical integration* ● *Solving ordinary and partial differential equations* ● *Solving eigenvalue problem with power method* ● *Matrix characteristic polynomial*

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Assignment : 40 %
Mid-test : 30 %
Final test : 30 %
Total : 100 %

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<tr><td>Reading List</td><td>P. L. DeVries, A First Course in Computational Physics, John Wiley &Sons, Inc., New York, 1994.
W. H. Press, et. al., Numerical Recipes in Fortran 77, 2nd Ed., CambridgeUniversity Press, New York, 1992.
M. Metcalf & J. Reid, Fortran 90/95 Explained, Oxford University Press, New York, 1998.</td></tr>
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MODULE HANDBOOK

Module name	*Seminar*
Module level, if applicable	*Postgraduate program*
Code, if applicable	*SCPH802805*
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	*1st Semester*
Person responsible for the module	*Dr. Djati Handoko, S.Si, M.Si*
Lecturer	*Dr. Djati Handoko, S.Si, M.Si*
Language	*Indonesian*
Relation to curriculum	*Compulsory course*

Type of teaching, contact hours	*Flipped Class and Problem-based learning*
Teaching methods	*Group discussion*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week* *Independent study: 2x60=120 minutes per week*
Credit points	*2 credit points*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	*After receiving this course, students are expected to be able to write scientific papers and present findings from a research*
Content	● *Introduction to science philosophy* ● *Research proposal presentation* ● *Research report presentation* ● *Scientific discussions*

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The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Thesis proposal : 40 %
Article review presentation : 40%
Seminar summaries : 20%
Total : 100 %

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Nazir, Moh., Metode Penelitian, Ghalia Indonesia, Jakarta, 2003.
Young, Felina C., Fundamentals of Research Writing, IPWI Publishing Co., Jakarta, 1999
Surat Keputusan Rektor UI nomor 628/SK/R/UI/2008, tentang Pedoman Teknis Penulisan Tugas Akhir Mahasiswa Universitas Indonesia, 16 June 2008.
Format dokumen Naskah Ringkas Tugas Akhir, Perpustakaan Universitas Indonesia, Desember 2012
R. Weissberg dan S. Buker, Writing Up Research; Experimental Research, Report Writing for Students of
English, Prentice-Hall, Inc, 1990.

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	7. *R. A. Day, How to Write and Publish a Scientific Paper, 3rd ed., Cambridge Univeristy Press, 1991.* 8. *Examples of scientific paper and the procedures* 9. *Various source from internet about scientific presentation technique.*

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Veritas, Probitas, Iustitia

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