11. Potential Field and Wave in Geophysics

Module Name	:	Potential field and wave in Geophysics
Module Level	:	Bachelor
Code, if applicable	:	23H06120203
Subtitle, if applicable	:	-
Courses, if applicable	:	Potential field and wave in Geophysics
Semester(s) in which the module is taught	:	III (Third Semester)
Module coordinator(s)	:	Dra. Maria, M.Si.
Lecturer(s)	:	Dr. Muhammad Hamzah S., S.Si.,MT., Dra. Maria, M.Si., Muhammad Fawzy Ismullah Massinai, S.Si, M.T,
Language	:	Bahasa (Indonesian language)
Relation to curriculum	:	Compulsory course in the second year for Bachelor Degree in Geophysics
Type of teaching, contact hours	:	This course is delivered through Lectures (i.e., Project/Case-based learning), complemented by structured assignments (paper review, project/case evaluation) and independent study. Contact hours consist of 150 minutes lectures per week, plus 180 minutes per week for each of the following: structured assignments and independent study
Workload	:	Total workload is 135 hours per semester, consisting of 38 hours for lectures, and 48.5 hours each for structured assignments and independent study.
Credit points	:	3 SKS (4.8 ECTS)
Requirements according to the examination regulations	:	Students are eligible to attend the examination if their absences are less than 20% of the lectures
Recommended prerequisites	:	-
Module objectives/intended learning outcomes	:	After completion of this module, students will be able to: CLO 1. Able to understand the basic principles of fields (gravity, electric, magnetic), potentials (gravity, electric, magnetic), Faraday's law in integral and differential forms and its applications, as well as Ampère–Maxwell's law in integral and differential forms and its applications;

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<td>CLO 2. Able to understand the general properties of waves and the wave equation and its solutions, the power and intensity of mechanical waves, two-dimensional (2-D) waves on the water surface, three-dimensional (3-D) waves in sound, properties of electromagnetic (EM) waves, EM waves in conductive media, and the reflection and transmission of EM waves;

The following is the mapping of the ILO and the CLO of this course:
<table>
<tr><th></th><th>ILO 1</th><th>ILO 5</th><th>ILO 8</th><th>ILO 11</th></tr>
<tr><td>CLO 1</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>CLO 2</td><td></td><td></td><td>✓</td><td>✓</td></tr>
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<tr>
<td>Content</td>
<td>:</td>
<td>1. Gravitational field and gravitational potential
2. Electric field and electric potential
3. Magnetic field and magnetic potential
4. Faraday’s law in integral and differential forms and its applications
5. Ampère–Maxwell’s law in integral and differential forms and its applications
6. General properties of waves and the mechanical wave equation
7. Power and intensity of mechanical waves
8. Two-dimensional and three-dimensional waves
9. Electromagnetic waves</td>
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<td>Study and examination requirements</td>
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<td>Participants are marked based on their performance in theory: Quiz (10%), Case Study (60%), Written Examination (30%).

Students are marked based on their percentage of points obtained and based on the following grade scale:
<table>
<tr><th>Percentage of Achievement</th><th>Grade</th><th>Conversion Value</th></tr>
<tr><td>85 – 100</td><td>A</td><td>4.00</td></tr>
<tr><td>80 - <85</td><td>A-</td><td>3.75</td></tr>
<tr><td>75 - < 80</td><td>B+</td><td>3.5</td></tr>
<tr><td>70 - < 75</td><td>B</td><td>3.0</td></tr>
<tr><td>65 - < 70</td><td>B-</td><td>2.75</td></tr>
<tr><td>60 - < 65</td><td>C+</td><td>2.5</td></tr>
<tr><td>50 - < 60</td><td>C</td><td>2.00</td></tr>
<tr><td>40 - < 50</td><td>D</td><td>1.00</td></tr>
<tr><td>< 40</td><td>E</td><td>0.00</td></tr>
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<td>Exams and assessment formats</td>
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<td>Assessment in this course consists of a case study, quizzes, a written examination. The case study is conducted individually or in groups and requires students to apply theoretical concepts to analyze and solve a problem, culminating in a written report that is evaluated and may be revised after feedback. Assignments are completed individually and may include problem-solving tasks, data processing, or short essays; these are submitted in written form and may involve graphical or computational outputs. Quizzes are administered in a closed-book written format, typically consisting of short-answer and multiple-choice questions, to monitor students' ongoing understanding and provide early feedback on learning progress. The written examination (closed-book, written) evaluates students' understanding of fundamental concepts covered in CLO 1, assesses comprehension of CLO 2.</td>
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<tr>
<td>Reading list</td>
<td></td>
<td>Main references:

1. Alexander A. Kaufman, 1992, Geophysical Field Theory and Method Part A; Gravitational, Electric, and Magnetic Fields, Academic Press, Inc.

2. Alexander A. Kaufman, 1994, Geophysical Field Theory and Method Part B; Electromagnetic Fields I, Academic Press, Inc.</td>
</tr>
</table>

		3. Daniel_Fleisch, A Student's Guide to Maxwell's Equation, Cambridge University Press. 4. Afnimar, 2018, Gelombang dalam Geofisika, ITB Bandung. 5. Alonso-Fin 1992 "Fundamental University Physics II: Waves" Addison Wesley 6. William CronkElmore, Mark A. Heald, 1985, Physics of Waves, Dover Edition, McgrawHill, New York. Additional references: 1. Michael S. Zhdanov, 2009, Geophysical Electromagnetic Theory and Methods, Elsevier. 2. Pain, H. J., 1989, The Physics of Vibration and Waves, John Wiley, London 3. M. O. Tjia 1994 "Gelombang "Dabara Publisher Solo