16. Fluid Dynamics in Geophysics

Module Name	:	Fluid Dynamics in Geophysics
Module Level	:	Bachelor
Code, if applicable	:	23H06120703
Subtitle, if applicable	:	-
Courses, if applicable	:	Fluid Dynamics in Geophysics
Semester(s) in which the module is taught	:	III (Third Semester)
Module coordinator(s)	:	Dr. Sakka, M.Si
Lecturer(s)	:	Dr. Sakka, M.Si, Dr. Eng. Amiruddin, S.Si., M.Si., Drs. Erfan, M.Si.
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	:	Assessment in this course is conducted entirely through case studies. The case study is conducted in a group or individually and requires students to apply theoretical concepts to analyze and solve a problem. This work is developed over several weeks under instructor guidance, culminating in a written report and an oral presentation of results.
Module objectives/intended learning outcomes	:	After completion of this module, students will be able to:

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CLO 1. Students are able to analyze fluid flow and its characteristics;

CLO 2. Students are able to solve fluid dynamics equations;

CLO 3. Students are able to solve dynamic fluid modeling problems using a CFD approach;

The following is the mapping of the ILO and the CLO of this course:
<table>
<tr><th></th><th>ILO 5</th><th>ILO 10</th><th>ILO 11</th></tr>
<tr><td>CLO 1</td><td>✓</td><td></td><td></td></tr>
<tr><td>CLO 2</td><td></td><td>✓</td><td></td></tr>
<tr><td>CLO 3</td><td></td><td></td><td>✓</td></tr>
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<tr>
<td>Content</td>
<td>:</td>
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1. Various Types of Density and Mass Density, and Viscosity
2. Compressibility and Elasticity, and Surface Tension
3. Fluid Statics: Hydrostatic Equation, Hypsometric Equation, Stability of Air Columns, and Hydrostatic Pressure on Flat Surfaces
4. Stability of Objects, Archimedes' Principle, and Specific Gravity
5. Fluid Kinematics: Definitions for Describing Fluid Motion, Total Derivative (Material Derivative), Mass Conservation, and Rotational Motion
6. Vortex Field, Velocity Potential, Stream Function, and Deformation
7. Fluid Dynamics: Frictionless Flow, Euler's Equation, and Applications of Euler's Equation to Fluids around Moving Solid Objects
8. Bernoulli's Equation, Applications of Bernoulli's Equation to Pitot Tube Problems, and Bernoulli's Equation for Steady, Irrotational, and Compressible Flows
9. Viscous Fluids and Equations of Motion for Viscous Fluids (Navier–Stokes Equations)
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<td>Study and examination requirements</td>
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<td>Participants are marked based on their performance in theory: Case Study (100%)

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>
<td></td>
<td>Assessment in this course is conducted entirely through case studies. The case study is conducted in a group or individually and requires students to apply theoretical concepts to analyze and solve a problem. This work is developed over several weeks under instructor guidance, culminating in a written report and an oral presentation of results.</td>
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<td>Reading list</td>
<td></td>
<td>Main references:

1. von Schwind, (1980), Dinamika Fluida Geofisika untuk Ahli Kelautan, Prentice-Hall, Inc, AS

2. White,F.,M., (1986), Fluid Mechanics, McGraw-Hill International Editions

3. Daugherty, R.L., (1985), Fluid Mechanics with Engineering Applications, McGraw-Hill Book Company.

Additional references:

1. Djojodihardjo, H., (1983), Mekanika Fluida, Erlangga, Jakarta

2. Tjasyono, B., (2001), Sains Atmosfer, Penerbit ITB. Bandung</td>
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