17. Geophysical Computation Methods II

Module Name	:	Geophysical Computation Methods II
Module Level	:	Bachelor
Code, if applicable	:	23H06120803
Subtitle, if applicable	:	-
Courses, if applicable	:	Geophysics
Semester(s) in which the module is taught	:	4 (Fourth Semester)
Module coordinator(s)	:	Dr. Muhammad Alimuddin, Eng.
Lecturer(s)	:	Dr. Muhammad Alimuddin, Eng.
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 identify the basic concepts of neural networks (NN); CLO 2. Able to apply NN to geophysical data analysis; CLO 3. Able to produce application programs for analyzing geophysical data The following is the mapping of the ILO and the CLO of this course:

		<table><tr><th></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></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></table>
Content	:	1. Perceptron Learning Rules 2. Supervised Hebbian Learning 3. Widrow-Hoff Learning 4. Backpropagation 5. Dynamic Networks 6. Associative Learning 7. Competitive Networks 8. Radial Basis Networks 9. Grossberg Networks 10. Hopfield Networks
Study and examination requirements		Participants are marked based on their performance in theory: Project/Case Study (88%), Written Examination (12%). Students are marked based on their percentage of points obtained and based on the following grade scale:

Percentage of Achievement	Grade	Conversion Value
85 – 100	A	4.00
80 - <85	A-	3.75
75 - < 80	B+	3.5
70 - < 75	B	3.0
65 - < 70	B-	2.75
60 - < 65	C+	2.5
50 - < 60	C	2.00
40 - < 50	D	1.00
< 40	E	0.00

Exams and assessment formats		The course assessment combines case-based tasks with a written examination to measure both theoretical mastery and practical application skills. In the case-based component, students work on open-ended problems requiring them to identify fundamental concepts of neural networks (NN), apply NN techniques to geophysical data analysis, and develop application programs for such analyses. This project is carried out over several weeks with continuous guidance from the instructor, and the outcomes are disseminated through a written report and an oral presentation. The written examination, conducted in a closed-book format, evaluates students' ability to implement NN for function approximation and probability estimation, focusing on accuracy, reasoning, and conceptual understanding. The written examination, also closed-book, tests students' competence in applying NN to pattern recognition, clustering, and prediction tasks, demonstrating their ability to extend NN methodologies to diverse geophysical contexts.
Reading list		References: Hagan, T. M., et.al., Neural Network Design (free e-book)
Last revision date		July 1st, 2025