

Module Name	Limnology
Module level, if applicable	
Code, if applicable	GEL 3208
Semester(s) in which the module	Fifth (5 <sup>th</sup> ) Semester
Person responsible for the module	Prof. Dr. Sudarmadji, M.Eng.Sc
Lecturer	Prof. Dr. Ig.L. Setyawan Purnama, M.Si Prof. Dr. Sudarmadji, M.Eng.Sc
Language	Bahasa Indonesia
Relation to curriculum	For Geography and Environmental Science students only, specialize the limnology, and one of elective class to be taken. This class available for third semester or higher.
Type of teaching, contact hours	STAR ( <i>Student Teacher Aesthetic Role-Sharing</i> ) is an optimal combination between SCL ( <i>Student Centered Learning</i> ) and TCL ( <i>Teacher Centered Learning</i> ). Lecture: 1400 minutes Mid Semester Examination: 100 minutes Final Semester Examination: 120 minutes
Workload	Lecturer, including homework and discussion = 14 meetings x 100 minutes each Mid Semester Examination: 100 minutes Final Semester Examination: 120 minutes Total workload = 1620 minutes
Credit points	2
Requirements according to the examination regulations	Must attend lecture for more than 70%
Recommended prerequisites	-
Module objectives/intended learning aoutcomes	<ol style="list-style-type: none"> <li>After following the lecture topic <b>Definition of Lake</b>, students are able to: <ol style="list-style-type: none"> <li>Explain the position of Lake Hydrology in Hydrological Studies</li> <li>Explain the definition of lake</li> <li>Explain the lakes in Indonesia</li> <li>Explain the themes of research that relate with lake</li> </ol> </li> <li>After following the lecture topic <b>Classification of Lake</b>, students are able to: <ol style="list-style-type: none"> <li>Explain the classification of lake based on how it forms</li> <li>Explain the classification of lake based on the stratification and circulation of water</li> <li>Explain the classification of lake based on the shape of shore line</li> <li>Explain the classification of lake based on the flow of water</li> <li>Explain the classification of lake based on the location</li> <li>Explain the classification of lake based on CO<sub>2</sub> content</li> </ol> </li> </ol>

	<ul style="list-style-type: none"> <li>g. Explain the classification of lake based on the ages</li> <li>h. Explain the typical of lake</li> </ul> <p>3. After following the lecture topic <b>Morphology and Morphometry of Lake</b>, students are able to:</p> <ul style="list-style-type: none"> <li>a. Explain the morphology of lake</li> <li>b. Explain the dynamics of shore</li> <li>c. Explain the shoreline</li> <li>d. Explain the tidal of lake</li> <li>e. Explain the bottom of lake</li> <li>f. Calculate the maximum length of lake</li> <li>g. Calculate the effective maximum length of lake</li> <li>h. Calculate the maximum width of lake</li> <li>i. Calculate the average width</li> <li>j. Calculate the maximum depth</li> <li>k. Calculate the periphery of lake</li> <li>l. Calculate the volume of lake</li> <li>m. Calculate the length of water to stay in the lake</li> <li>n. Calculate the volume development</li> <li>o. Calculate the shore development</li> <li>p. Calculate the slope of basin</li> </ul> <p>4. After following the lecture topic <b>Ecosystem of Lake</b>, students are able to:</p> <ul style="list-style-type: none"> <li>a. Explain the concept of ecosystem</li> <li>b. Explain the ecosystem of lake</li> </ul> <p>5. After following the lecture topic <b>The Movement of Water Lake</b>, students are able to:</p> <ul style="list-style-type: none"> <li>a. Explain the definition of waves</li> <li>b. Explain the definition of current</li> <li>c. Explain the definition of seiches</li> <li>d. Explain the definition of molar agent</li> </ul> <p>6. After following the lecture topic <b>Hydrology of Lake</b>, students are able to:</p> <ul style="list-style-type: none"> <li>a. Explain the source of water in lake</li> <li>b. Explain the evaporation in lake</li> <li>c. Calculate the evaporation in lake</li> <li>d. Calculate the estimated inflow discharge of lake</li> </ul> <p>7. After following the lecture topic <b>The Physical Condition of Lake</b>, students are able to:</p> <ul style="list-style-type: none"> <li>a. Explain the water density of lake</li> <li>b. Explain the viscosity of lake</li> <li>c. Explain the water temperature of lake</li> <li>d. Explain the presence of oxygen in lake water</li> <li>e. Explain the presence of carbondioxide in lake water</li> </ul> <p>8. After following the lecture topic <b>Water Quality of Lake</b>, students are able to:</p> <ul style="list-style-type: none"> <li>a. Do lake water sampling</li> <li>b. Explain the technique of lake water sampling</li> <li>c. Do the handling and preservation of lake water samples</li> <li>d. Do water sample analysis</li> <li>e. Present and analyze the quality of lake water</li> </ul>
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	<p>f. Explain the common elements in lake</p> <p>9. After following the lecture topic <b>Head Budget of Lake</b>, students are able to:</p> <ol style="list-style-type: none"> <li>Explain the cause of changes in lake water temperature</li> <li>Calculate the head budget aspects according to Birge</li> <li>Calculate the flux radiation</li> <li>Calculate the surplus radiation</li> <li>Calculate the total energy</li> <li>Calculate the bowen ratio</li> <li>Calculate the available wind data</li> </ol> <p>10. After following the lecture topic <b>Lake Water Balance and Its Use</b>, students are able to:</p> <ol style="list-style-type: none"> <li>Explain the water balance of lake</li> <li>Explain the use of lake water</li> <li>Calculate the use of lake water for non-agricultural purposes</li> <li>Calculate the use of lake water for agricultural purposes</li> </ol> <p>11. After following the lecture topic <b>Lake Sediment</b>, students are able to:</p> <ol style="list-style-type: none"> <li>Explain the sediment of lake</li> <li>Explain the source of the lake base materials</li> <li>Explain the types of the lake base materials</li> <li>Explain the settling suspended matters</li> </ol> <p>12. After following the lecture topic <b>Organism in Lake</b>, students are able to:</p> <ol style="list-style-type: none"> <li>Explain the organism in lake</li> <li>Explain the classification of planktons</li> <li>Explain the distribution of plankton</li> <li>Explain the distribution of nekton</li> <li>Explain the distribution of benthos</li> </ol>
Content	<ol style="list-style-type: none"> <li>Lake Definition (contract teaching, definition of hydrology, definition of lake, lake in Indonesia, research about lake)</li> <li>Lake Classification (based on how it forms, based on stratification and circulation of water, based on the shape of shore line, based on the flow of water)</li> <li>Lake Classification (based on its location, based on carbondioxide content, based on its age, types of typical lake)</li> <li>Lake Morphology (lake morphology, the dynamics of lake, shoreline, tidal lake, the bottom of lake)</li> <li>Lake Morphometry (maximum length, effective maximum length, maximum width, maximum depth, periphery of lake, volume of lake, the length of water stay in the lake, volume development, shore development, slope of basin)</li> <li>Ecosystem of Lake (concept of ecosystem, ecosystem of lake)</li> </ol>

	<ol style="list-style-type: none"> <li>7. The Movement of Lake Water (waves, currents, seiches, molar agent)</li> <li>8. Hydrology of Lake (source of lake water, evaporation of lake, calculation of evaporation, lake inflow discharge estimation)</li> <li>9. The Physical Condition of Lake (density, viscosity, water temperature, oxygen content, carbondioxide content)</li> <li>10. Water Quality of Lake (lake water sampling, technique of water sampling, handling and preservation of water samples, method of analysis of water sample, presentation and anaylisis of water quality in lake, description of common element in lake)</li> <li>11. Head Budget of Lake (lake water temperature, some aspects of head budget according to Birge, flux radiation, surplus radiation, total energy, bowen ratio, available wind data)</li> <li>12. Lake Water Balance and Its Use (lake water balance, the use of lake water, the calculation of lake water for non agricultural purposes, the calculation of lake water for agricultural purposes)</li> <li>13. Lake Sediment (lake sediment, source of lake base materials, base material of lake, settling suspended maters)</li> <li>14. Organism in Lake (organism in water, classification of planktons, distribution of planktons, distribution of nekton, distribution of bentos)</li> </ol>
Study and examination requirements and forms of examination	Quiz (5 %), participation (5 %), assignment (20 %), discussion (10 %), mid-semester examination (30 %) dan final examination (30 %). Examination is formed in written test.
Media employed	<ul style="list-style-type: none"> <li>- ELISA website</li> <li>- Internet</li> <li>- Computers</li> <li>- Interactive video</li> <li>- LCD projector</li> </ul>
Reading list	<p>Odum, E.P. 1996. <i>Dasar-Dasar Ekologi</i>. Gadjah Mada University Press, Yogyakarta.</p> <p>Resosoedarmo, R.S., Kartawinata, K dan Soegiarto, A. 1984. <i>Pengantar Ekologi</i>. Penerbit PT. Remaja Rosdakarya, Bandung.</p> <p>Rutner, F. 1952. <i>Fundamental of Limnology</i>. University of Toronto.</p> <p>Saeni, M. S. 1989. <i>Kimia Lingkungan</i>. PAU Ilmu Hayat IPB, Bogor.</p> <p>Sprong, D. 1979. <i>Lake in Humid Tropical Area of the World</i>.</p> <p>Thornthwaite C.W and Mather J.R. 1957. <i>Instruction and Tables for Computing Potential Evapotranspiration, The Water Balance</i>. Publication in Climatology Volume X No. 3. Certerton, New Jersey.</p> <p>Wantasen, S. 2011. Sebaran Spasial Ekologi Nitrogen di Danau Tondano. <i>Disertasi</i>. Sekolah Pascasarjana UGM, Yogyakarta.</p>

	<p>Welch, P.S. 1952. <i>Limnology</i>. McGraw-Hill Book Company, Inc., New York.</p> <p>Welch, P.S. 1948. <i>Limnological Method</i>. McGraw-Hill Book Company, Inc., New York.</p>
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