

## Module Handbook of Aquatic Microbiology

Module designation	Aquatic Microbiology is a course intended for students from Agricultural Microbiology study program, Department of Agricultural Microbiology, Faculty of Agriculture. The focus of this study is the various kinds of aquatic ecosystems, such as ponds, rivers, lakes, underground water, and the ocean, as well as their activities and element cycles. Analysis of the role of microbes in the aquatic environments including the use of biofilm in waste management, the interaction of microbes with aquatic flora and fauna, and the use of biological/microbial agents as indicators of water quality and industry also discussed in this course.
Semester(s) in which the module is taught	Fourth Semester
Person responsible for the module	Ir. Jaka Widada, M.P. Ph.D.
Language	Bahasa Indonesia/Indonesian Language
Relation to curriculum	<i>Elective Course</i>
Teaching methods	<p>Lecture are conducted in the class with 30-40 students. In every meeting, there will be delivered interactive lecture and discussion. In some topics there will be quizzes, individual and/or group assignment.</p> <p>Details:</p> <ol style="list-style-type: none"> <li>1. Lectures</li> <li>2. Assignment (Individual and Group)</li> <li>3. Discussion</li> <li>4. Midterm</li> <li>5. Final Exam</li> <li>6. Laboratory Work</li> </ol>
Workload (incl. contact hours, self-study hours)	<ul style="list-style-type: none"> <li>- Lectures = 2 SKS x 50 minutes x 16 meetings = 1.600 minutes = 26,67 hours = 26,67 hours/27,1 hours = 0,98 ECTS</li> <li>- Assignment = 2 SKS x 60 minutes x 16 meetings = 1.920 minutes = 32 hours = 32 hours/27,1 hours = 1,18 ECTS</li> <li>- Self Study = 2 SKS x 60 minutes x 16 meetings = 1.920 minutes = 32 hours = 32 hours/27,1 hours = 1,18 ECTS</li> <li>- Practicum = 1 SKS x 170 minutes x 16 meetings = 2.720 minutes = 45,33 hours = 45,33 hours/27,1 hours = 1,67 ECTS</li> </ul> <p>Total Workload = 5,01 ECTS</p>
Credit points	<i>2/1 Credit Points</i>

Required and recommended prerequisites for joining the module	<i>Biology of Microorganisms</i>
Module objectives/intended learning outcomes	<p><i>Program Learning Outcomes (PLO):</i></p> <p><i>PLO1: Able to explain theoretical concepts of biology microorganism and develop microbial-based technology to increase plant production and environmental services.</i></p> <p><i>PLO2: Able to describe the latest methodology in the field of microbiology to create environmentally friendly and sustainable agricultural development.</i></p> <p><i>PLO3: Able to select, utilize and manage the potential of microbes and microbiomes to build industrial and agricultural systems.</i></p> <p><i>Course Learning Outcomes (CLO):</i></p> <p><i>CLO1: Students can explain the basic concept of Aquatic Microbiology as well as their role and impact on the environment</i></p> <p><i>CLO2: Students can identify the microbial diversity and master the method of detection</i></p> <p><i>CLO3: Students can explain about the technologies used for liquid waste management on a small scale to industrial scale</i></p>
Content	<ol style="list-style-type: none"> <li><i>1. Introduction: Definition and scope of aquatic microbiology (1 meeting)</i></li> <li><i>2. Aquatic Ecosystem (1 meeting)</i></li> <li><i>3. Nutrient Cycle in Aquatic Environment and Anammox (1 meeting)</i></li> <li><i>4. Distribution and diversity of microbes in the Aquatic Environment (1 meeting)</i></li> <li><i>5. Biofilm and Quorum Sensing (1 meeting)</i></li> <li><i>6. Microbiomes in the Aquatic Environment (1 meeting)</i></li> <li><i>7. Sampling Techniques and Molecular Approaches in Aquatic Microbiology (1 meeting)</i></li> <li><i>8. Microbial Indicator (1 meeting)</i></li> <li><i>9. Detection and Quantification of Microbial Indicator (1 meeting)</i></li> <li><i>10. Management of Water for Drinking, Recreation and Agriculture (1 meeting)</i></li> <li><i>11. Liquid Waste Management (2 meeting)</i></li> <li><i>12. Group presentation (1 meeting)</i></li> <li><i>13. Materials Review (1 meeting)</i></li> </ol>

Examination forms	High Order Thinking Skills Examination
	Grade and Score
	GradeScoreGradeScore
	A≥ 85C+64,0-66,9
	A-82,0-84,9C61,0-63,9
	A/B79,0-81,9C-58,0-60,9
	B+76,0-78,9C/D55,0-57,9
	B73,0-75,9D+52,0-54,9
	B-70,0-72,9D49,0-51,9
B/C67,0-69,9E<49	
Study and examination requirements	To be able to take the final exams, the minimum of student attendance is 70% out of effective meetings. From 14 meetings, students must take a minimum of 10 meetings to take the exam.
Reading list	Main References: 1. Madigan, T.M., J.M. Martinko, and J. Parker. 2019. Brock: Biology of Microorganisms. Prentice Hall International. New Jersey, USA. 2. Hogg. S. 2005. Essential Microbiology. John Wiley and Sons Ltd. New York, USA. 3. Olga, S. 2016. Bioremediation of Wastewater: Factor and Treatments. CRC Press. Florida, USA. 4. Gabriel, B. 2011. Wastewater Microbiology Fourth Edition. John Wiley & Sons, Inc. New Jersey, USA.  Additional references: 1. Scientific journals related to aquatic microbiology 2. Laboratory Classes in Aquatic Microbiology Handbook