

Module Handbook of Microbial Ecology

Module designation	The Microbial Ecology is a course specifically for students of the Agricultural Microbiology study program, Department of Agricultural Microbiology, Faculty of Agriculture. This course studies matters related to microbial ecosystems and various environmental factors that affect microbial growth. This course also studies the interactions between microbes and other organisms or microbes as well as the abiotic interactions between microbes and the environment.
Semester(s) in which the module is taught	Third Semester
Person responsible for the module	Ir. Jaka Widada, M.P., Ph.D.
Language	Bahasa Indonesia/Indonesian Language
Relation to curriculum	<i>Compulsory Course</i>
Teaching methods	<p>This course is organised into one class and planned to have 14 learning weeks exclude final examination. 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"> 1. Lectures 2. Assignment (Individual and Group) 3. Discussion 4. Midterm 5. Final Exam
Workload (incl. contact hours, self-study hours)	Working hour: 2 credits of theory. Total Workload = 2 SCU (Semester Credit Unit) = 2 x 45 hours within 1 semester = 3.34 ECTS.
Credit points	<i>2/0 Credit Points</i>
Required and recommended prerequisites for joining the module	<i>Biology of Microorganisms</i>

<p>Module objectives/intended learning outcomes</p>	<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: Able to explain the interaction of microbes with their environment and how they affect these microbes.</i></p> <p><i>CLO2: Able to identify various factors that influence microbial growth and how to utilize and overcome environmental conditions to obtain ideal microbial growth in microbial utilization activities.</i></p> <p><i>CLO3: Able to elaborate the influence of microbes on the environment, such as the cycle of elements, biodegradation processes, and other influences involving microbes on the environment.</i></p>
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<p>Content</p>	<ol style="list-style-type: none"> 1. <i>Introduction: Definition and scope of Microbial Ecology; The role of microbes in processes that occur in nature (1 meeting)</i> 2. <i>Cell Ecology: Pure and mixed cultures; Principles in microbial isolation techniques (1 meeting)</i> 3. <i>Interaction of Microbes with the Environment: Micro and macro abiotic environment (micro and macro environments), effect of microbial activity on changes in environmental conditions (1 meeting)</i> 4. <i>Abiotic Environmental Factors: Abiotic environment and its influence on microbial growth (1 meeting)</i> 5. <i>Biotic Environmental Factors: Interactions between microbial populations, single and complex interactions between microbial populations, interactions between microbes and plants, interactions that take place in plant root tissue, interactions that take place in tuber tissue (2 meetings)</i> 6. <i>Microbial Distribution and Adaptation in the Natural Environment: Mechanisms and means of microbial dispersal in nature, structural and physiological changes for deployment and adaptation (2 meetings)</i> 7. <i>Microbial Ecosystem: Various ecosystem models, Microbial development in various ecosystems (1 meeting)</i> 8. <i>The Cycle of Elements in Nature and Its Application in Pollutant Biodegradation: The role of microbes in the cycle of various macro and micro elements in nature (1 meeting)</i> 9. <i>Microbial applications in nature are viewed from an ecological angle: The role of microbes in zero waste agriculture/fisheries (clean production in agriculture and fisheries), microbial ecological aspects in food preservation and disease germ control (1 meeting)</i> 10. <i>Student Seminar (2 meetings)</i> 11. <i>Materials review (1 meeting)</i> 																																			
<p>Examination forms</p>	<table border="1"> <thead> <tr> <th><i>Evaluation Basis</i></th> <th><i>Evaluation Components</i></th> <th><i>Percentages</i></th> <th><i>CLO1</i></th> <th><i>CLO2</i></th> <th><i>CLO3</i></th> </tr> </thead> <tbody> <tr> <td><i>Participatory Activity</i></td> <td><i>Quiz</i></td> <td><i>20%</i></td> <td style="text-align: center;"><i>√</i></td> <td></td> <td></td> </tr> <tr> <td><i>Project results/case study results</i></td> <td><i>Group Assignment</i></td> <td><i>30%</i></td> <td></td> <td></td> <td style="text-align: center;"><i>√</i></td> </tr> <tr> <td rowspan="2"><i>Cognitive</i></td> <td><i>Mid Exam</i></td> <td><i>25%</i></td> <td></td> <td style="text-align: center;"><i>√</i></td> <td></td> </tr> <tr> <td><i>Final Exam</i></td> <td><i>25%</i></td> <td></td> <td></td> <td style="text-align: center;"><i>√</i></td> </tr> <tr> <td></td> <td><i>Total</i></td> <td><i>100%</i></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p><i>The total percentage of participatory activities and project results/case studies/PBL results is at least 50%.</i></p>	<i>Evaluation Basis</i>	<i>Evaluation Components</i>	<i>Percentages</i>	<i>CLO1</i>	<i>CLO2</i>	<i>CLO3</i>	<i>Participatory Activity</i>	<i>Quiz</i>	<i>20%</i>	<i>√</i>			<i>Project results/case study results</i>	<i>Group Assignment</i>	<i>30%</i>			<i>√</i>	<i>Cognitive</i>	<i>Mid Exam</i>	<i>25%</i>		<i>√</i>		<i>Final Exam</i>	<i>25%</i>			<i>√</i>		<i>Total</i>	<i>100%</i>			
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<p>Study and examination requirements</p>	<p>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.</p>
<p>Reading list</p>	<p><i>Main References:</i></p> <ol style="list-style-type: none"> 1. Barton, L.L., McLean, R.J.C. 2019. <i>Environmental Microbiology and Microbial Ecology</i>. John Wiley & Sons, Inc. 2. Bharti, P.K., Singh, N., Bhardwaj, V. 2014. <i>Microbial Ecology and Habitat</i>. Discovery Publishing House PVT. Ltd. New Delhi. 3. Eldor A. Paul. 2015. <i>Soil Microbiology, Ecology and Biochemistry</i>. Elsevier. London, UK. 4. Hogg, S. 2013. <i>Essential Microbiology Second Edition</i>. John Wiley and Sons Ltd. New York. United State of America 5. Kumar, S. 2016. <i>Essentials of Microbiology</i>. Jaypee Brothers Medical Publisher. 6. Madigan, M.T., Bender, K.S., Buckley, D.H., Sattley, W.M., Stahl, D.A. 2021. <i>Brock Biology of Microorganisms. Sixteenth Edition</i>. Pearson Education Limited. (e-book available) 7. Saxena, S. 2016. <i>Applied Microbiology</i>. Springer. 8. Slonczewski, J.L. 2023. <i>Microbiology: An Evolving Science 6th Edition</i>. W W Norton & Co Inc. <p><i>Additional References:</i></p> <p>Scientific journal references on microbial ecology and its use for the environment</p> <p>Baskara, G., Gofar, N., Harun, U., Widada, J., Hardini, P.A., Wandri, R. Asmono, D. 2024. Profiling of rhizobacteria to alleviate drought stress in oil palm using ribosomal intergenic spacer analysis. <i>IOP Conf. Ser.: Earth Environ. Sci.</i> 1308 012035. DOI 10.1088/1755-1315/1308/1/012035</p> <p>Larekang, S.H., Ngadiman, Khairina, Y., Simarmata, R., Christita, M. 2024. Unraveling the potential of ACC Deaminase-producing microbes in various agricultural stresses: current status, limitations, and recommendations. <i>Pakistan Journal of Botany</i>. 56(2): 791-805. DOI: http://dx.doi.org/10.30848/PJB2024-2(34).</p> <p>Simarmata, R., D. C. Dewi, and Ngadiman. 2020. Isolation and identification of ACC Deaminase producing bacteria from rhizosfer and plant roots of maize, cowpea, and groundnut growing under saline stress. <i>IOP Conference Series: Earth and Environmental Science</i> 439.</p>