Module Handbook of Automation in Microbiological Processes

Module designation	Automation in Microbiological Processes is an elective course aimed for students from Agricultural Microbiology study program, Department of Agricultural Microbiology, Faculty of Agriculture. This course is designed to provide an in-depth introduction to automation in microbiological processes. In general, this course provides an overview of microbiological processes, development of detection methods in microbiological processes, and the application of automation in microbiological processes.
Semester(s) in which the module is taught	Fourth/Sixth Semester
Person responsible for the module	Ir. Donny Widianto, Ph.D.
Language	Bahasa Indonesia/Indonesian Language
Relation to curriculum	*Elective Course*
Teaching methods	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. Details: 1. Lectures 2. Assignment (Individual and Group) 3. Discussion 4. Midterm 5. Final Exam

Workload (incl. contact hours, self-study hours)	- Lectures = 2 SKS x 50 minutes x 16 meetings = 1.600 minutes
	   = 26,67 hours
	   = 26,67 hours/27,1 hours
	   = 0,98 ECTS
	- Assignment = 2 SKS x 60 minutes x 16 meetings = 1.920 minutes
	   = 32 hours
	   = 32 hours/27,1 hours
	   = 1,18 ECTS
	- Self Study = 2 SKS x 60 minutes x 16 meetings = 1.920 minutes
	   = 32 hours
	   = 32 hours/27,1 hours
	   = 1,18 ECTS
	Total Workload = 3,34 ECTS

Credit points	*2/0 Credit Points*
Required and recommended prerequisites for joining the module	*Biology of Microorganisms, Biomass Production Technology*

Module objectives/intended learning outcomes	*Program Learning Outcomes (PLO):*
	PLO1: Able to explain theoretical concepts regarding plant production technology by giving attention to economic and social-humanitarian aspects to achieve quality, sustainable and profitable agriculture.
	PLO2: Able to explain theoretical concepts of biology microorganism and develop microbial-based technology to increase plant production and environmental services.
	PLO3: Able to identify, design, implement and solve problems that arise in the field of microbiology to provide suggestions for solutions in the industrial and agricultural fields.
	Course Learning Outcomes (CLO):
	CLO1: Capable to explain various microbiological processes and detection methods in microbiological processes.
	CLO2: Students can explain about automation in microbiological process and various application used for microbiological processes.
	CLO3: Capable to solve various issues and provide solutions related to microbiological processes through automation processes.
Content	1. *Types of Microbial Activity, Monitoring Methods and Automatable Items (1 meeting)* 2. *Definition of Fermentation and Types of Fermentation for Biomass and Metabolites Production Processes (1 meeting)* 3. *Definition, Design and Types of Bioreactors (1 meeting)* 4. *Monitoring Methods for Bioreactor Process (1 meeting)* 5. *Methods for Monitoring Microbial Activity in the Environment (1 meeting)* 6. *Definition, Types, and Principles of Sensor Utilization (1 meeting)* 7. *Definition, Types, and Principles of Logger Utilization (1 meeting)* 8. *Micro Sensor Technology (1 meeting)* 9. *Development of Logger Open-Source Data (1 meeting)* 10. *IOT System for Online Monitoring (1 meeting)* 11. *Sensor Application for Offline Temperature Changes Measurement (1 meeting)* 12. *Sensor Application for Online Air Pressure Measurement (1 meeting)* 13. *Applications of Microbiology Automation in the Microbiology Art Field (1 meeting)* 14. *Materials Review (1 meeting)*

| Examination forms | *High Order Thinking Skills Examination* |

	Grade and Score			
	Grade	**Score**	**Grade**	**Score**
	A	≥ 85	C+	64,0-66,9
	A-	82,0-84,9	C	61,0-63,9
	A/B	79,0-81,9	C-	58,0-60,9
	B+	76,0-78,9	C/D	55,0-57,9
	B	73,0-75,9	D+	52,0-54,9
	B-	70,0-72,9	D	49,0-51,9
	B/C	67,0-69,9	E	<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. *Kumara Behera, B., Varma, A. 2017. Microbial Biomass Process Technologies And Management. Springer Nature.* 2. *Satinder K. Brar (Ed), Ratul K. Das (Ed), Saurabh J. Sarma (Ed). 2018. Microbial Sensing In Fermentation. Wiley-Blackwell.* 3. *Janani, S. 2021. Learn Arduino Sensors Complete Hand Guide Beginner To Core Advance: Example Sensor Code, Specification, Dimensions, Connecting Method.* 4. *Ali C., Satish J.P., Cenk U., Gulnur B. 2003. Batch Fermentation Modeling, Monitoring, And Control. Taylor & Francis Group, Llc.*