

**SEMESTER COURSE OUTLINE
& LESSON PLANS
SECOND SEMESTER
2022/2023**



Agricultural Microbiology Major
Department of Agricultural Microbiology
Automation in Microbiological Processes
PNM20193225

Team Teaching:

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**UNIVERSITAS GADJAH MADA
FACULTY OF AGRICULTURE
2023**

		Universitas Gadjah Mada Faculty of Agriculture Department of Agricultural Microbiology Second Semester of 2022/2023				Document Code:
RENCANA PROGRAM DAN KEGIATAN PEMBELAJARAN SEMESTER (RPKPS) SEMESTER COURSE OUTLINE & LESSON PLANS						
Kode Mata Kuliah <i>Course Code</i>	Nama Mata Kuliah <i>Course Name</i>	Bobot (sks) <i>Credits</i>		Semester <i>Semester</i>	Status Mata Kuliah <i>Course Status</i>	Mata Kuliah Prasyarat <i>Prerequisite Courses</i>
PNU20193225	Otomatisasi dalam Proses Mikrobiologi <i>s Automation in Microbiological Processes</i>	T: 2	P: 0	Second semester	Pilihan <i>Elective</i>	Biologi Mikroorganisme, Teknologi Produksi Biomassa <i>Biology of Microorganisms, Biomass Production Technology</i>
Deskripsi Singkat Mata Kuliah <i>Course Overview</i>	Mata kuliah Otomatisasi dalam Proses Mikrobiologis merupakan mata kuliah pilihan yang ditujukan bagi mahasiswa program studi Mikrobiologi Pertanian, Fakultas Pertanian. Matakuliah ini dirancang untuk memberi pengenalan tentang otomatisasi dalam proses mikrobiologi secara mendalam. Secara garis besar materi kuliah memberi gambaran tentang proses mikrobiologi, macam dan perkembangan metode deteksi pada proses mikrobiologi, serta aplikasi otomatisasi dalam proses mikrobiologi. <i>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.</i>					
Capaian Pembelajaran Lulusan Program Studi (CPL) <i>Program Learning Outcome (PLO)</i>	CPL1 PLO1	Mampu menerangkan konsep teoritis mengenai teknologi produksi tanaman dengan memperhatikan aspek ekonomi dan sosial-humaniora untuk mencapai pertanian yang berkualitas, berkelanjutan, dan menguntungkan (<i>profitable</i>) (P1). <i>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 (K1).</i>				
	CPL2 PLO2	Mampu menjelaskan konsep teoritis biologi mikroorganisme serta mengembangkan teknologi berbasis mikroba untuk meningkatkan produksi tanaman dan layanan lingkungan (P2) <i>Able to explain theoretical concepts of biology microorganism and develop microbial-based technology to increase plant production and environmental services (K2).</i>				

	CPL3	Mampu mengidentifikasi, merancang, melaksanakan, serta dapat memecahkan masalah yang timbul dalam bidang mikrobiologi untuk memberikan saran penyelesaian pada bidang industri dan pertanian (KK2).		
	PLO3	<i>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 (S2).</i>		
Capaian Pembelajaran Mata Kuliah (CPMK) <i>Course Learning Outcomes (CLO)</i>	Setelah menyelesaikan pembelajaran mata kuliah ini, mahasiswa diharapkan mampu: <i>After completing this course, students are expected to be able:</i>			
	CPMK1	Mahasiswa mampu menjelaskan ragam proses mikrobiologis serta metode deteksi pada proses mikrobiologis [CPL 2]		
	CLO1	<i>Capable to explain various microbiological processes and detection methods in microbiological processes [PLO 2] □ K2</i>		
	CPMK2	Mahasiswa mampu menjelaskan mengenai otomatisasi dalam proses mikrobiologi serta ragam aplikasi yang digunakan [CPL 1]		
	CLO2	<i>Students can explain about automation in microbiological process and various application used for microbiological processes [PLO 1] □ K1</i>		
	CPMK 3	Mahasiswa mampu memecahkan berbagai permasalahan yang timbul dan memberikan solusi terkait proses mikrobiologis melalui proses otomatisasi [CPL 3]		
	CLO3	<i>Capable to solve various issues and provide solutions related to microbiological processes through automation processes [PLO 3] □ S2</i>		
Kaitan CPMK dengan Materi dan Bentuk Pembelajaran, serta Alokasi Waktu <i>Correlation among CLO, the material, learning method and estimated time</i>		Materi Pembelajaran <i>Course Materials</i>	Bentuk Pembelajaran (Luring/Daring) <i>Course Methos (Offline/Online)</i>	Alokasi Waktu <i>Estimated Time</i>
	CPMK1 CLO1	1. Macam Aktivitas Mikrobia dan Metode-Metode Pemantauannya serta Hal-Hal yang dapat di Otomatisasi. <i>1. Types of Microbial Activity, Monitoring Methods and Automatable Items</i>	Kuliah Interaktif <i>Interactive lectures</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes of synchronous lectures</i>
	CPMK1 CLO1	2. Definisi Fermentasi dan Ragam Fermentasi untuk Proses Produksi Biomassa dan Metabolit	Kuliah Interaktif, diskusi dan <i>hands-on</i>	2 x 50 menit kuliah sinkron <i>Hands-on dilakukan diluar jam</i>

		2. <i>Definition of Fermentation and Types of Fermentation for Biomass and Metabolites Production Processes</i>	<i>Interactive lectures, discussion and hands-on</i>	kuliah oleh narasumber 2 x 50 minutes of synchronous lectures <i>Hands-on is carried out outside the class by guest lecture</i>
	CPMK1 CLO1	3. Definisi, Desain dan Macam Bioreaktor 3. <i>Definition, Design and Types of Bioreactor</i>	Kuliah Interaktif <i>Interactive lectures</i>	2 x 50 menit kuliah sinkron 2 x 50 minutes of synchronous lectures
	CPMK1 CLO1	4. Metode Pemantauan Proses Bioreaktor 4. <i>Monitoring Methods for Bioreactor Process</i>	Kuliah Interaktif dan diskusi <i>Interactive lectures and discussion</i>	2 x 50 menit kuliah sinkron 2 x 50 minutes of synchronous lectures
	CPMK2 CLO2	5. Metode Pemantauan Aktivitas Mikrobial di Lingkungan 5. <i>Methods for Monitoring Microbial Activity in the Environment</i>	Kuliah Interaktif dan tugas kelompok <i>Interactive lectures and group assignment</i>	2 x 50 menit kuliah sinkron 2 x 50 minutes of synchronous lectures

	CPMK 2 CLO2	6. Definisi, Jenis, dan Prinsip Penggunaan Sensor 6. <i>Definition, Types, and Principles of Sensor Utilization</i>	Kuliah Interaktif dan <i>hands-on</i> <i>Interactive lectures and hands-on</i>	2 x 50 menit kuliah sinkron <i>Hands-on dilakukan diluar jam kuliah oleh narasumber</i> <i>2 x 50 minutes of synchronous lectures</i> <i>Hands-on is carried out outside the class by guest lecture</i>
	CPMK 2 CLO2	7. Definisi, Jenis, dan Prinsip Penggunaan Logger 7. <i>Definition, Types, and Principles of Logger Utilization</i>	Kuliah Interaktif <i>Interactive lectures</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes of synchronous lectures</i>
UTS/Hasil Tugas Project/Hasil Analisis Kasus Mid Exam/Project Results/Case Study Results				
	CPMK2 CLO2	8. Teknologi Mikro Sensor 8. <i>Micro Sensor Technology</i>	Kuliah Interaktif, tugas kelompok dan <i>hands-on</i> <i>Interactive lectures, group assignment and hands-on</i>	2 x 50 menit kuliah sinkron <i>Hands-on dilakukan diluar jam kuliah oleh narasumber</i> <i>2 x 50 minutes of synchronous lectures</i> <i>Hands-on is carried out outside the</i>

				<i>class by guest lecture</i>
	CPMK3 CLO3	9. Perkembangan Data Logger Open Source 9. <i>Development of Logger Open Source Data</i>	Kuliah Interaktif <i>Interactive lectures</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes of synchronous lectures</i>
	CPMK3 CLO3	10. Sistem IOT untuk Pemantauan Secara Daring 10. <i>IOT System for Online Monitoring</i>	Kuliah Interaktif <i>Interactive lectures</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes of synchronous lectures</i>
	CPMK3 CLO3	11. Aplikasi Sensor untuk Mengukur Perubahan Suhu Secara Offline 11. <i>Sensor Application for Offline Temperature Changes Measurement</i>	Kuliah Interaktif dan <i>hands-on</i> <i>Interactive lectures and hands-on</i>	2 x 50 menit kuliah sinkron <i>Hands-on dilakukan diluar jam kuliah oleh narasumber</i> <i>2 x 50 minutes of synchronous lectures</i> <i>Hands-on is carried out outside the class by guest lecture</i>
	CPMK3 CLO3	12. Aplikasi Sensor untuk Mengukur Tekanan Udara Secara Online	Kuliah Interaktif dan <i>hands-on</i>	2 x 50 menit kuliah sinkron

		12. <i>Sensor Application for Online Air Pressure Measurement</i>	<i>Interactive lectures and hands-on</i>	<i>Hands-on dilakukan diluar jam kuliah oleh narasumber</i> <i>2 x 50 minutes of synchronous lectures</i> <i>Hands-on is carried out outside the class by guest lecture</i>
	CPMK3 CLO3	13. Aplikasi Otomatisasi Mikrobiologi di Bidang Seni Mikrobiologi <i>13. Applications of Microbiology Automation in the Microbiology Art Field</i>	Kuliah Interaktif <i>Interactive lectures</i>	2 x 50 menit kuliah sinkron <i>50 minutes of synchronous lectures</i>
	UAS/ Hasil Tugas Project/Hasil Analisis Kasus Final Exam/Project Results/Case Study Results			
Metode Pembelajaran <i>Learning Method</i>	SCL: Pembelajaran berbasis <i>Case based</i> dan <i>Project based</i> <i>SCL (Student Center Learning): Case based and Project based learning</i>			
Pengalaman Belajar Mahasiswa <i>Student Learning Experience</i>	Saat Sinkron : Melakukan diskusi terkait dengan topik kuliah serta kaitan dan potensi penerapannya dalam bidang mikrobiologi pertanian atau pertanian secara umum Saat Asinkron: - Memperoleh keterampilan dalam mengoperasikan berbagai peralatan serta merakit sistem otomatisasi dalam proses mikrobiologis - Memperoleh pengalaman dalam kerja sama tim melalui tugas kelompok - Mendapatkan teknik mengenai cara mempresentasikan data melalui tugas presentasi <i>Synchronous lectures: conducting discussions related to lecture topics and their relationships and potential applications in the field of agricultural microbiology or agriculture in general</i> <i>Asynchronous lectures:</i>			

	1. <i>Obtain skills in operating various equipment as well as assembling automation systems in microbiological processes</i> 2. <i>Gain teamwork experiences through group assignments</i> 3. <i>Obtain techniques on how to present data through presentation assignments.</i>					
Akses Media Pembelajaran / LMS dan Persentase Luring & Daring <i>Learning Media and Course Method Percentage</i>	https://elok.ugm.ac.id Luring 100% <i>(Offline 100%)</i>					
Metode Penilaian dan Keselarasan dengan CPMK <i>Methods of assessment in accordance with course learning outcome</i>	Basis Evaluasi <i>Evaluation Basis</i>	Komponen Evaluasi <i>Evaluation Components</i>	Bobot <i>Percentages</i>	CPMK 1 <i>CLO1</i>	CPMK 2 <i>CLO2</i>	CPMK 3 <i>CLO3</i>
	A. Aktivitas Partisipatif^{*)} <i>Participatory Activity</i>	Diskusi <i>Discussion</i>	20%	v		
	B. Hasil Project/Hasil Studi Kasus/ Hasil PBL^{*)} <i>Project results/case study results</i>	Tugas Kelompok <i>Group Assignments</i>	30%		v	
	C. Kognitif <i>Cognitive</i>	UTS <i>Mid Exam</i>	25%		v	
		UAS <i>Final Exam</i>	25%			v
		Total <i>Total</i>	100%			
^{*)} Sesuai IKU 7, jumlah persentase aktivitas partisipatif (A) dan hasil project/studi kasus/hasil PBL (B) adalah minimal 50%. ^{*)} <i>In accordance with IKU 7, the total percentage of participatory activities (A) and project results/case studies/PBL results (B) is at least 50%.</i>						
Daftar Referensi <i>References</i>	Utama: 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. 5. Pandey, C. M. and B. D. Malhotra. 2019. Biosensors: Fundamentals and Applications. Walter de Gruyter, Berlin. 6. Berenjian, A (Ed). 2020. Essentials in Fermentation Technology. Springer Nature, Switzerland.			
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Otorisasi <i>Authorization</i>	Tanggal Penyusunan <i>Date of Authorization</i>	Koordinator Mata Kuliah <i>Course Coordinator</i>	Koordinator Bidang Keahlian (Jika Ada) <i>Expertise Coordinator (if any)</i>	Ketua Program Studi <i>Head of the Study Program</i>
	January 24, 2023	Ir. Donny Widiyanto, Ph.D.		Ir. Ngadiman, M.Si., Ph.D.