

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



Agricultural Microbiology Major
Department of Agricultural Microbiology
Aquatic Microbiology
PNM20192211

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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>
PNM20192211	Mikrobiologi Akuatik <i>Aquatic Microbiology</i>	T: 2	P: 1	IV	Wajib <i>Compulsory</i>	Biologi Mikroorganisme <i>Biology of Microorganisms</i>
Deskripsi Singkat Mata Kuliah <i>Course Overview</i>	Mata kuliah Mikrobiologi Akuatik merupakan mata kuliah yang dikhususkan bagi mahasiswa program studi Mikrobiologi Pertanian, Departemen Mikrobiologi Pertanian, Fakultas Pertanian. Mata Kuliah ini menguraikan berbagai jenis, aktivitas, daur unsur dalam perairan, dan peran mikrobia di ekosistem perairan termasuk kolam, sungai, danau, air bawah tanah, dan laut. Analisis peran mikroba dalam perairan, meliputi: pemanfaatan biofilm dalam pengelolaan limbah, interaksi mikroba dengan flora-fauna air, pemanfaatan agensia biologi/mikrobia sebagai indikator kualitas air dan industri. <i>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.</i>					
Capaian Pembelajaran Lulusan Program Studi (CPL) <i>Program Learning Outcome (PLO)</i>	CPL1 PLO1	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>				
	CPL2 PLO2	Mampu menguraikan metodologi mutakhir di bidang mikrobiologi untuk mewujudkan pembangunan pertanian yang ramah lingkungan dan berkelanjutan (P3) <i>Able to describe the latest methodology in the field of microbiology to create environmentally friendly and sustainable agricultural development (K3).</i>				
	CPL3 PLO3	Mampu memilih, memanfaatkan, dan mengelola potensi mikroba dan mikrobioma untuk membangun sistem industri dan pertanian (KK3) <i>Able to select, utilize and manage the potential of microbes and microbiomes to build industrial and agricultural systems (S3).</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 mengenai konsep dasar mikrobiologi akuatik serta peranan dan dampaknya pada lingkungan [CPL 1]		
	CLO1	<i>Students can explain the basic concept of Aquatic Microbiology as well as their role and impact on the environment [PLO 1] □ K2</i>		
	CPMK2	Mahasiswa mampu mengidentifikasi keragaman mikrobia serta menguasai metode deteksinya [CPL 2]		
	CLO2	<i>Students can identify the microbial diversity and master the method of detection [PLO 2] □ K3</i>		
Kaitan CPMK dengan Materi dan Bentuk Pembelajaran, serta Alokasi Waktu <i>Correlation among CLO, the material, learning method and estimated time</i>	CPMK 3	Mahasiswa mampu menjelaskan teknologi yang digunakan dalam pengelolaan limbah cair dalam skala kecil hingga skala industri [CPL 3]		
	CLO3	<i>Students can explain about the technologies used for liquid waste management on a small scale to industrial scale [PLO 3] □ S3</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. Pendahuluan: Definisi dan ruang lingkup mikrobiologi akuatik <i>1. Introduction: definiton and scope of aquatic microbiology</i>	Kuliah Interaktif Praktikum <i>Interactive lectures</i> <i>Labwork</i>	2 x 50 menit kuliah sinkron 2 x 50 menit praktikum <i>2 x 50 minutes of synchronous lectures</i> <i>2 x 50 minutes labwork</i>
	CPMK1 CLO1	2. Ekosistem Perairan <i>2. Aquatic Ecosystem</i>	Kuliah Interaktif Praktikum <i>Interactive lectures</i> <i>Labwork</i>	2 x 50 menit kuliah sinkron 2 x 50 menit praktikum <i>2 x 50 minutes of synchronous lectures</i> <i>2 x 50 minutes labwork</i>
	CPMK1	3. Daur Hara Pada Lingkungan Perairan dan <i>Anammox</i>	Kuliah Interaktif dan kuis	2 x 45 menit kuliah sinkron

	CLO1	3. <i>Nutrient Cycle in Aquatic Environment and Anammox</i>	Praktikum <i>Interactive lectures and quiz</i> <i>Labwork</i>	10 menit kuis 2 x 50 menit praktikum <i>2 x 45 minutes of synchronous lectures</i> <i>10 minutes quiz</i> <i>2 x 50 minutes labwork</i>
	CPMK2 CLO2	4. Distribusi dan Keragaman Mikrobia pada Lingkungan Perairan 4. <i>Distribution and diversity of microbes in the Aquatic Environment</i>	Kuliah Interaktif Praktik dilakukan pada kegiatan praktikum <i>Interactive lectures</i> <i>Labwork</i>	2 x 50 menit kuliah sinkron 2 x 50 menit praktikum <i>2 x 50 minutes of synchronous lectures</i> <i>2 x 50 minutes labwork</i>
	CPMK2 CLO2	5. Biofilm dan <i>Quorum Sensing</i> 5. <i>Biofilm and Quorum Sensing</i>	Kuliah Interaktif Praktik dilakukan pada kegiatan praktikum <i>Interactive lectures</i> <i>Labwork</i>	2 x 50 menit kuliah sinkron 2 x 50 menit praktikum <i>2 x 50 minutes of synchronous lectures</i> <i>2 x 50 minutes labwork</i>
	CPMK2 CLO2	6. Mikrobioma pada Lingkungan Perairan	Kuliah Interaktif Praktik dilakukan pada kegiatan praktikum	2 x 50 menit kuliah sinkron 2 x 50 menit praktikum

		6. <i>Microbiomes in the Aquatic Environment</i>	<i>Interactive lectures</i> <i>Labwork</i>	<i>2 x 50 minutes of synchronous lectures</i> <i>50 menit labwork</i>
	CPMK2 CLO2	7. Teknik <i>Sampling</i> dan Pendekatan Molekuler dalam Mikrobiologi Perairan 7. <i>Sampling Techniques and Molecular Approaches in Aquatic Microbiology</i>	Kuliah Interaktif Praktik dilakukan pada kegiatan praktikum <i>Interactive lectures</i> <i>Labwork</i>	2 x 50 menit kuliah sinkron 2 x 50 menit praktikum <i>2 x 50 minutes of synchronous lectures</i> <i>2 x 50 minutes labwork</i>
UTS/Hasil Tugas Project/Hasil Analisis Kasus Mid Exam/Project Results/Case Study Results				
	CPMK3 CLO3	8. Mikrobia Indikator 8. <i>Microbial Indicator</i>	Kuliah Interaktif <i>Interactive lectures</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes of synchronous lectures</i>
	CPMK3 CLO3	9. Deteksi dan Kuantifikasi Mikroba Indikator 9. <i>Detection and Quantification of Microbial Indicator</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. Pengelolaan Air Minum, Rekreasi dan Pertanian 10. <i>Management of Water for Drinking, Recreation and Agriculture</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. Pengolahan Limbah Cair I 11. <i>Liquid Waste Management I</i>	Kuliah Interaktif <i>Interactive lectures and group assignment</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes of synchronous lectures</i>
	CPMK3 CLO3	12. Pengelolaan Limbah Cair II 12. <i>Liquid Waste Management II</i>	Kuliah Interaktif dan tugas kelompok <i>Interactive lectures and group assignment</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes of synchronous lectures</i>
	UAS/ Hasil Tugas Project/Hasil Analisis Kasus <i>Final Exam/Project Results/Case Study Results</i>			
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: 1. Mendapatkan informasi mengenai identifikasi mikroorganisme pada lingkungan akuatik 2. Mendapatkan keterampilan dalam penggunaan alat laboratorium yang dibutuhkan dalam kegiatan mikrobiologi akuatik 3. Memperoleh pengalaman dalam kerja sama tim melalui tugas kelompok 4. 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 information regarding the use of microorganisms in aquatic activities</i> 2. <i>Acquiring laboratory equipment skills required in aquatic microbiology activities</i> 3. <i>Gain teamwork experiences through group assignments</i> 4. <i>Obtain techniques on how to present data through presentation assignments.</i>			
Akses Media Pembelajaran / LMS dan Persentase Luring & Daring	https://elok.ugm.ac.id Luring 100% <i>(Offline 100%)</i>			

<i>Learning Media and Course Method Percentage</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>Percentage</i>	CPMK 1 <i>CLO1</i>	CPMK 2 <i>CLO2</i>	CPMK 3 <i>CLO3</i>
	A. Aktivitas Partisipatif ^{*)} <i>Participatory Activity</i>	Tugas Kelompok <i>Group Assignment</i>	10%			V
		Kuis <i>Quiz</i>	10%	v		
	B. Hasil Project/Hasil Studi Kasus/Hasil PBL ^{*)} <i>Project results/case study results</i>	Praktikum <i>Labwork</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. 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. 5. Hurst, C. J. 2019. The Structure and Function of Aquatic Microbial Communities. Springer Nature Switzerland, Switzerland. Tambahan:					

	1. Referensi jurnal ilmiah mengenai mikrobiologi akuatik 2. Buku Panduan Praktikum Mikrobiologi Akuatik <i>Additional references:</i> 1. <i>Scientific journals related to aquatic microbiology</i> 2. <i>Laboratory Classes in Aquatic Microbiology Handbook</i>			
Nama Dosen Pengampu <i>Team Teaching</i>	1. Ir. Jaka Widada, M.P. Ph.D. 2. Prof. Dr. Ir. Sebastian Margino 3. Nur Akbar Arofathullah, S.P., M.Biotech., Ph.D.			
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	Nur Akbar Arofathullah, Ph.D.	Signature and name	Ir. Ngadiman, M.Si., Ph.D.