

**SEMESTER COURSE OUTLINE
& LESSON PLANS
FIRST SEMESTER
2023/2024**



Agricultural Microbiology Major
Department of Agricultural Microbiology
Microbial Physiology
PNM20192107

Team Teaching:
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**UNIVERSITAS GADJAH MADA
FACULTY OF AGRICULTURE
2023**

	Universitas Gadjah Mada Faculty of Agriculture Department of Agricultural Microbiology First Semester of 2023/2024					Document Code:
RENCANA PROGRAM DAN KEGIATAN PEMBELAJARAN SEMESTER (RPKPS) <i>SEMESTER COURSE OUTLINE & LESSON PLANS</i>						
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>
<i>PNM20192107</i>	<i>Fisiologi Mikrobia</i> <i>Microbial Physiology</i>	<i>T: 2</i>	<i>P: 1</i>	<i>First Semester (odd semester)</i>	<i>Wajib</i> <i>Compulsory</i>	<i>Biologi Mikroorganisme</i> <i>Biology of Microorganism</i>
Deskripsi Singkat Mata Kuliah <i>Course Overview</i>	Mata kuliah ini mempelajari seluk-beluk kehidupan, struktur dan fungsi beberapa organ sel mikrobia. Pada mata kuliah ini juga mempelajari mengenai jalur metabolisme dan penghasilan energi, nutrisi dan mekanisme transportnya, regulasi dan ekspresi gen, sintesis makromolekul serta pertumbuhan dan ketahanan mikrobia dalam perubahan lingkungan. Ilmu ini sangat mendukung perkembangan disiplin ilmu mikrobiologi dan mata kuliah yang berkaitan langsung dengan mata kuliah genetika mikrobia, mikrobiologi pangan, lingkungan, rekayasa genetika, dan teknologi fermentasi. <i>This course studies the intricacies of life, structure, and function of several microbial cell organs. This course also examines metabolic pathways and energy production, nutrition and their transport mechanisms, gene regulation and expression, macromolecule synthesis, microbial growth, and resistance to environmental changes. This knowledge strongly supports the development of microbiology disciplines and courses directly related to microbial genetics, food microbiology, environment, genetic engineering, and fermentation technology courses.</i>					
Capaian Pembelajaran Lulusan Program Studi (CPL) <i>Program Learning Outcome (PLO)</i>	<i>CPL1</i>	Mampu menjelaskan konsep teoritis biologi mikroorganisme serta mengembangkan teknologi berbasis mikroba untuk meningkatkan produksi tanaman dan layanan lingkungan. (P2)				
	<i>PLO1</i>	<i>Able to explain theoretical concepts of biology microorganism and develop microbial-based technology to increase plant production and environmental services. (K2)</i>				
	<i>CPL2</i>	Mampu menguraikan metodologi mutakhir di bidang mikrobiologi untuk mewujudkan pembangunan pertanian yang ramah lingkungan dan berkelanjutan. (P3)				
	<i>PLO2</i>	<i>Able to describe the latest methodology in the field of microbiology to create environmentally friendly and sustainable agricultural development. (K3)</i>				
	<i>CPL3</i>	Mampu memilih, memanfaatkan, dan mengelola potensi mikroba dan mikrobioma untuk membangun sistem industri dan pertanian. (KK3)				
	<i>PLO3</i>	<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 able:</i>			
	CPMK1	Mampu menjelaskan tentang struktur dan fungsi sel dalam fisiologi mikrobia, serta memahami metabolisme sel mikrobia [CPL 1]		
	CLO1	<i>Able to explain the structure and function of cells in microbial physiology, as well as understand microbial cell metabolism [PLO 1] □ K2</i>		
	CPMK2	Mampu membahas dan memberikan contoh proses fermentasi yang diakibatkan oleh keberadaan mikrobia serta pemanfaatannya dalam bidang mikrobiologi pertanian dan mikrobiologi industri [CPL 2]		
Kaitan CPMK dengan Materi dan Bentuk Pembelajaran, serta Alokasi Waktu <i>Correlation among CLO, the material, learning method and estimated time</i>	CLO2	<i>Able to discuss and provide examples of fermentation processes caused by the presence of microbes and their use in the fields of agricultural microbiology and industrial microbiology [PLO 2] □ K3</i>		
	CPMK 3	Mampu menguraikan materi sintesis makromolekuler, informasi genetik, dan pertumbuhan mikrobia serta pengaplikasiannya dalam bidang teknologi dan industri. [CPL 3]		
	CLO3	<i>Able to describe materials for macromolecular synthesis, genetic information, and microbial growth and their applications in the fields of technology and industry [PLO 3] □ S3</i>		
		Materi Pembelajaran <i>Course Materials</i>	Bentuk Pembelajaran (Luring/Daring) <i>Course Method (Offline/Online)</i>	Alokasi Waktu <i>Estimated Time</i>
	CPMK1	1. Introduksi fisiologi mikrobia, struktur dan fungsi sel dalam fisiologi mikrobia <i>1. Introduction to microbial physiology, cell structure and function in microbial physiology</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 of labwork</i>
	CLO1			
	CPMK1	2. Nutrisi, siklus unsur dan faktor lingkungan bagi mikrobia <i>2. Nutrition, element cycles and environmental factors for microbes</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 of labwork</i>
	CLO1			

				<i>2 x 50 minutes of labwork</i>
	CPMK3 CLO3	3. Prosesing nutrisi dan mekanisme transportnya 3. <i>Nutrient processing and transport mechanisms</i>	Kuliah Interaktif dan diskusi kasus Praktikum <i>Interactive lectures and case discussion</i> <i>Labwork</i>	2 x 45 menit kuliah sinkron 10 menit diskusi kasus 2 x 50 menit praktikum <i>2 x 45 minutes of synchronous lectures</i> <i>10 minutes of case discussion</i> <i>2 x 50 minutes labwork</i>
	CPMK1 CLO3	4. Metabolisme sentral dan penghasilan energi mikrobial 4. <i>Central metabolism and microbial energy production</i>	Kuliah Interaktif dan diskusi kasus Praktikum <i>Interactive lectures and case discussion</i> <i>Labwork</i>	2 x 45 menit kuliah sinkron 10 menit diskusi kasus 2 x 50 menit praktikum <i>2 x 45 minutes of synchronous lectures</i> <i>10 minutes of case discussion</i> <i>2 x 50 minutes labwork</i>
	CPMK1 CLO1	5. Nutrisi uptake, metabolisme substrat, berbagai jalur fermentasi dan metabolisme nitrogen 5. <i>Nutrient uptake, substrate metabolism, various</i>	Kuliah Interaktif Praktikum <i>Interactive lectures</i>	2 x 50 menit kuliah sinkron 2 x 50 menit praktikum

		<i>fermentation pathways and nitrogen metabolism</i>		<i>2 x 50 minutes of synchronous lectures</i> <i>2 x 50 minutes labwork</i>
	CPMK1 CLO1	6. Peran prekursor dan senyawa kaya energi terhadap metabolisme 6. <i>The role of precursors and energy-rich compounds in metabolism</i>	Kuliah Interaktif dan diskusi kasus Praktikum <i>Interactive lectures and case discussion</i> <i>Labwork</i>	2 x 45 menit kuliah sinkron 10 menit diskusi kasus 2 x 50 menit praktikum <i>2 x 45 minutes of synchronous lectures</i> <i>10 minutes of case discussion</i> <i>2 x 50 minutes labwork</i>
	CPMK3 CLO3	7. Fisiologi produksi hasil metabolisme primer dan sekunder 7. <i>Physiology of production of primary and secondary metabolism</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>
	UTS/Hasil Tugas Project/Hasil Analisis Kasus Mid Exam/Project Assignment Results/Case Analysis Results			
	CPMK1 CLO1	8. Enzim, regulasi dan ekspresi gen pada mikroba prokariot	Kuliah Interaktif <i>Interactive lectures</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes of</i>

		8. <i>Enzymes, regulation and gene expression in prokaryotic microbes</i>		<i>synchronous lectures</i>
	CPMK3 CLO3	9. Sintesis makromolekul I <i>9. Macromolecule Synthesis I</i>	Kuliah Interaktif dan diskusi kasus <i>Interactive lectures and case discussion</i>	2 x 45 menit kuliah sinkron 10 menit diskusi kasus <i>2 x 45 minutes of synchronous lectures</i> <i>10 minutes of case discussion</i>
	CPMK3 CLO3	10. Sintesis makromolekul II <i>10. Macromolecule Synthesis II</i>	Kuliah Interaktif dan tugas individu <i>Interactive lectures and individual assignment</i>	2 x 50 menit kuliah sinkron Pengumpulan tugas individu mengenai sintesis makromolekul <i>2 x 50 minutes of synchronous lectures</i> <i>Submittal of individual assignmen</i>
	CPMK3 CLO3	11. Informasi genetik dan genetika dalam fisiologi mikrobia <i>11. Genetic and genetic information in microbial physiology</i>	Kuliah Interaktif dan diskusi kasus <i>Interactive lectures and case discussion</i>	2 x 45 menit kuliah sinkron 10 menit diskusi kasus <i>2 x 45 minutes of synchronous lectures</i> <i>10 minutes of case discussion</i>

	CPMK3 CLO3	12. Pertumbuhan dan survival mikrobia dalam perubahan lingkungan <i>12. Microbial growth and survival in a changing environment</i>	Kuliah Interaktif dan diskusi kasus <i>Interactive lectures and case discussion</i>	2 x 45 menit kuliah sinkron 10 menit diskusi kasus <i>2 x 45 minutes of synchronous lectures</i> <i>10 minutes of case discussion</i>
	CPMK2 CLO2	13. Seminar Mahasiswa <i>13. Students Seminar</i>	Tugas Kelompok <i>Group assignment</i>	2 x 50 menit presentasi kelompok mengenai aplikasi mikrobia dalam daur unsur dan degradasi polutan <i>2 x 50 minutes of group presentation</i>
	UAS/ Hasil Tugas Project/Hasil Analisis Kasus Final Exam/Project Assignment Results/Case Analysis Results			
Metode Pembelajaran <i>Learning methods</i>	SCL: Case based and Project Based Learning			
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 penerapan fisiologi mikrobia pada bidang pertanian dan industri 2. Memperoleh pengalaman dalam kerja sama tim melalui tugas kelompok 3. Mendapatkan teknik mengenai cara mempresentasikan data melalui tugas presentasi <i>Synchronous: Conducting discussions related to lecture topics and their relation and potential application in the field of agricultural microbiology or agriculture in general</i> <i>Asynchronous:</i> 1. Obtain information on the application of microbial physiology in agriculture and industry			

Daftar Referensi <i>References</i>	Utama (<i>Main References</i>): 1. Moat, A.J., J.W. Foaster, & M.P. Spector. 2002. Microbial Physiology. 4 ed. John Wiley & Sons. New York 2. Stephen R. Bolsover, Jeremy S. Hya, Elizabeth A. Shephard, Hugh A. White, Claudia G. Wiedemann. 2004. Cell Biology. Scd Ed. Willey Liss. John Wiley & Son. 3. A. Bruce., J.A. Lewis, R. Martin, R. Keith and W. Peter. 2002. Molecular Biology of the Cell. Garland Publishing. New York 4. Inouye, M. 1979. Bacterial Outer Membranes : Biogenesis and Function. Wiley-Interscience. NY. 5. Hermann. K.M. and R.L. Somerville. 1983. Amino Acids: Biosynthesis and Genetic Regulation. Addison Reading. M.A. 6. Atlas, R.M. 1997. Principles of Microbiology. Wm. C. Brown Publishers. London Sydney Toronto. 7. Barbara Wexler. 2008. Genetic and Genetic Engineering. Information Plus. References Serie. Wiley . Texas. 8. Buku-buku Fisiologi dan Mikrobiologi terkait. Tambahan (<i>Additional References</i>): 1. Sari, E., A. P. Nugroho, E. Retnaningrum, and I. D. Prijambada. 2023. Literature review and experiment: diversity of bacteria in forest, revegetated post-mining land, and active tin mining with a metagenomic approach. Indonesian Journal of Science & Technology 8:19-48. 2. Sari, E., A. P. Nugroho, E. Retnaningrum, and I. D. Prijambada. 2022. Plant dispersal at Bangka post-tin mining revegetated land correlated with soil chemical physical properties and heavy metal distribution. Proceedings of the International Conference on Sustainable Environment, Agriculture and Tourism (ICOSEAT 2022). 3. Sari, S. L. A., T. Triyanto, Z. Zuprizal, and I. D. Prijambada. 2021. Lipolytic and proteolytic activities of fibrolytic bacteria from buffalo (bubalus bubalis) rumen. Proceedings of the 7th International Conference on Biological Science (ICBS2021). 4. Sari, S. L. A., T. Triyanto, Z. Zuprizal, and I. D. Prijambada. 2021. Cellulolytic and mannolytic aerobic bacteria isolated from buffalo rumen (Bubalus babalis) and its potency to degrade fiber in palm kernel meal. Biodiversitas Journal of Biological Diversity. Buku fisiologi mikrobial dan mikrobiologi terkait <i>Books related to microbial physiology and microbiology</i>
Nama Dosen Pengampu <i>(Team Teaching)</i>	1. Prof. Ir. Irfan D. Prijambada, M.Eng., Ph.D. 2. M. Saifur Rohman, S.P., M.Si., M.Eng., Ph.D. 3. Agung Dian Kharisma, Ph.D.

Otorisasi <i>Authorization</i>	Tanggal Penyusunan <i>Date of Authorizatio n</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>
	August 26 th , 2023	Prof. Irfan Prijambada, M.Eng.	Signature and Name	Ir. Ngadiman, M.Si., Ph.D.