

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



Agricultural Microbiology Major
Department of Agricultural Microbiology
Enzyme Technology and Engineering
PNM20193115

Team teaching:

Prof. Ir. Irfan D. Prijambada, M.Eng., Ph.D.
M. Saifur Rohman, S.P., M.Si., M.Eng., Ph.D.
Ahmad Suparmin, S.P., M.AgrSc., Ph.D.

**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) SEMESTER COURSE OUTLINE & LESSON PLANS						
Kode Mata Kuliah Course code	Nama Mata Kuliah Course name	Bobot (sks) Credits		Semester Semester	Status Mata Kuliah Course status	Mata Kuliah Prasyarat Prerequisite courses
PNM20193115	Teknologi dan Rekayasa Enzim Enzyme Technology and Engineering	T: 2	P: 0	First semester	Pilihan	Enzimologi
Deskripsi Singkat Mata Kuliah Course overview	Mata Kuliah ini merupakan mata kuliah yang ditujukan bagi mahasiswa dari program studi Mikrobiologi Pertanian, Fakultas Pertanian. Mata kuliah ini membahas mengenai konsep dasar enzim, fungsi, mekanisme kerja enzim, faktor-faktor lingkungan yang mempengaruhi kinerja enzim. Selain itu, pada mata kuliah ini juga membahas mengenai produksi, purifikasi, imobilisasi, rekayasa enzim serta pemanfaatan enzim untuk bidang industri kimia, industri pangan, energi, dan biosensor. This course is intended for students from the Agricultural Microbiology study program, Faculty of Agriculture. This course covers the basic concepts of enzymes, functions, mechanisms of enzyme work, environmental factors affecting enzyme performance. In addition, the course also discusses production, purification, immobilization, enzyme engineering and enzyme utilization in the fields of chemical, food, energy, and biosensor industries.					
Capaian Pembelajaran Lulusan Program Studi (CPL) Program Learning Outcome (PLO)	CPL1 PLO 1	Mampu menerapkan pemikiran logis, kritis, sistematis, dan inovatif dengan memanfaatkan teknologi informasi untuk menghasilkan solusi sesuai bidang keahlian secara berintegritas dan diwujudkan dalam dokumen saintifik. (KU1) Able to apply logical, critical, systematic, and innovative thinking by utilizing the technology of information to produce solutions according to the field of expertise with integrity and embodied in scientific documents. (G1)				
	CPL2 PLO 2	Mampu menjelaskan konsep teoritis biologi mikroorganisme serta mengembangkan teknologi berbasis mikroba untuk meningkatkan produksi tanaman dan layanan lingkungan.(P3) Able to explain theoretical concepts of biology microorganism and develop microbial-based technology to increase plant production and environmental services. (K3)				

	CPL3	Mampu membuat, mengambil, dan menyajikan data yang diperoleh dalam penelitian, serta mampu memanfaatkan bank data biologi. (KK4)		
	PLO 3	<i>Able to create, retrieve and present data obtained in research, and able to utilize biological data banks. (S4)</i>		
Capaian Pembelajaran Mata Kuliah (CPMK) Course learning Outcomes (CLO)	Setelah menyelesaikan pembelajaran mata kuliah ini, mahasiswa diharapkan mampu: <i>After completing this course, students are expected to able:</i>			
	CPMK1	Mahasiswa mampu menjelaskan konsep dasar enzim, fungsi, mekanisme kerja enzim, serta menyebutkan faktor-faktor lingkungan yang mempengaruhi kinerja enzim. [CPL 1]		
	CLO 1	<i>Students are able to explain the basic concept of enzymes, their functions, the mechanism of enzyme action, and mention environmental factors that influence enzyme performance. [PLO 1] □ G1</i>		
	CPMK2	Mahasiswa mampu menjelaskan teknik isolasi, produksi, purifikasi, imobilisasi, dan rekayasa enzim [CPL2]		
	CLO 2	<i>Students are able to explain the techniques of isolation, production, purification, immobilization, and engineering of enzymes. [PLO 2] □ K3</i>		
	CPMK 3	Mahasiswa dapat mengidentifikasi potensi penggunaan enzim dalam industri pada berbagai bidang seperti kimia, industri pangan, energi, lingkungan dan biosensor. [CPL 3]		
	CLO 3	<i>Students are able to explain the techniques of isolation, production, purification, immobilization, and engineering of enzymes [PLO 3] □ S4</i>		
Kaitan CPMK dengan Materi dan Bentuk Pembelajaran, serta Alokasi Waktu		Materi Pembelajaran Course material	Bentuk Pembelajaran (Luring/Daring) Course method (Offline/Online)	Alokasi Waktu Estimated time
	CPMK1 CLO 1	1. Pengantar Teknologi dan Rekayasa Enzim: Garis besar perkuliahan, fungsi dan mekanisme kerja enzim <i>Introduction to Enzyme Technology and Engineering: Outline of courses, functions and mechanisms of enzyme work</i>	Kuliah Interaktif <i>Interactive course</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes synchronized course</i>
	CPMK3 CLO 3	2. Pengaruh Faktor-Faktor Lingkungan Terhadap Kinerja Enzim <i>Effects of Environmental Factors on Enzyme Performance</i>	Kuliah Interaktif dan kuis <i>Interactive course and quiz</i>	40 menit kuliah sinkron 10 menit kuis

				<i>40 minutes synchronized course</i> <i>10 minutes quiz</i>
	CPMK1 CLO 1	3. Produksi Enzim Heterolog <i>Heterological Enzyme Production</i>	Kuliah Interaktif <i>Interactive course</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes synchronized course</i>
	CPMK1 CLO 1	4. Pemurnian Enzim <i>Enzyme Purification</i>	Kuliah Interaktif <i>Interactive course</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes synchronized course</i>
	CPMK3 CLO 3	5. Enzim Terimobilisasi <i>Immobilized Enzymes</i>	Kuliah Interaktif <i>Interactive course</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes synchronized course</i>
	CPMK2 CLO 2	6. <i>Enzyme Coupling</i> untuk Regenerasi Koenzim <i>Enzyme Coupling for Coenzyme Regeneration</i>	Kuliah Interaktif <i>Interactive course</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes synchronized course</i>
	CPMK2 CLO 2	7. <i>Fusi coupling enzyme</i> Fusion coupling enzyme	Kuliah Interaktif <i>Interactive course</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes synchronized course</i>

	UTS/Hasil Tugas Project/Hasil Analisis Kasus Mid exam/project assignment/ case analysis result			
	CPMK2 CLO 2	8. Rekayasa Enzim Secara Rasional <i>Rational Engineering of Enzymes</i>	Kuliah Interaktif <i>Interactive course</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes synchronized course</i>
	CPMK1 CLO 1	9. Rekayasa Enzim dengan Evolusi Terarah <i>Enzyme Engineering with Directed Evolution</i>	Kuliah Interaktif <i>Interactive course</i>	2 x 50 menit kuliah sinkron <i>2 x 50 minutes synchronized course</i>
	CPMK1 CLO 1	10. Man-made enzyme	Kuliah Interaktif dan tugas individu <i>Ingetactive course and individual assignment</i>	2 x 50 menit kuliah sinkron Pengumpulan jurnal review tentang man-made enzyme <i>2 x 50 minutes synchronized course</i> <i>Journal review submission</i>
	CPMK3 CLO 3	11. Pemanfaatan Enzim untuk Industri Kimia dan Polimer <i>Enzyme Utilization for Chemical and Polymer Industries</i>	Kuliah Interaktif dan Tugas Kelompok <i>Interactive course and group assignment</i>	40 menit kuliah sinkron 60 menit presentasi mahasiswa <i>40 minutes synchronized course</i>

				<i>60 minutes student presentation</i>
	CPMK3 CLO 3	12. Pemanfaatan Enzim untuk Industri Pangan dan Energi <i>Enzyme Utilization for Chemical and Polymer Industries</i>	Kuliah Interaktif dan Tugas Kelompok <i>Interactive course and group assignment</i>	40 menit kuliah sinkron 60 menit presentasi mahasiswa <i>40 minutes synchronized course</i> <i>60 minutes student presentation</i>
	CPMK3 CLO 3	13. Pemanfaatan Enzim untuk Biosensor <i>Enzyme Utilization for Biosensors</i>	Kuliah Interaktif dan Tugas Kelompok <i>Interactive course and group assignment</i>	40 menit kuliah sinkron 60 menit presentasi mahasiswa <i>40 minutes synchronized course</i> <i>60 minutes student presentation</i>
	UAS/ Hasil Tugas Project/Hasil Analisis Kasus Final exam/project assignment/case analysis			
Metode Pembelajaran Learning method	SCL: Case based and Project Based Learning			
Pengalaman Belajar Mahasiswa Students learning experience	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 teknologi dan rekayasa enzim dari berbagai sumber 2. Memperoleh pengalaman dalam kerja sama tim melalui tugas kelompok 3. Mendapatkan teknik mengenai cara mempresentasikan data melalui tugas presentasi			

	Synchronization: Conduct discussions on the subject of lectures and their relationships and potential applications in the field of agricultural or agricultural microbiology in general <i>Asynchronous:</i> 1. Obtaining information on enzyme technology and engineering from various sources 2. Gain experience in teamwork through group tasks 3. Acquiring techniques on how to present data through presentation tasks					
Akses Media Pembelajaran / LMS dan Persentase Luring & Daring Learning media and course method percentage	https://elok.ugm.ac.id Luring 100%					
Metode Penilaian dan Keselarasan dengan CPMK Assessment plan and relations with the CLOs	Basis Evaluasi Evaluation basis	Komponen Evaluasi Evaluation components	Bobot	CPMK 1 <i>CLO 1</i>	CPMK 2 <i>CLO 2</i>	CPMK 3 <i>CLO 3</i>
	A. Aktivitas Partisipatif^{*)} <i>Participatory activity</i>	Kuis (Quiz)	20%	v		
	B. Hasil Project/Hasil Studi Kasus/ Hasil PBL^{*)} Project result/case study result	Tugas Kelompok (Group assignment)	30%			v
	C. Kognitif Cognitive	UTS Mid exam	25%		v	
		UAS Final exam	25%			v
		Total	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	Utama (Main references):					

References	Nelson, D. L. and M. M. Cox. 2005. Lehninger Principles of Biochemistry 4th Edition. W. H. Freeman, United Kingdom. Tambahan (<i>additional references</i>): Buku-buku enzimologi terkait. Salsabila, A. F., Tauchid, A., Rohman, M. S., Widiyanto, D., & Margino, S. Biophysical characterization of folded state type II luciferase-like monooxygenase. <i>Indonesian Journal of Biotechnology</i>, 28(1), 37-45. <i>Related enzyomology books</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. Ahmad Suparmin, S.P., M.AgrSc., Ph.D.			
Otorisasi Authorization	Tanggal Penyusunan <i>Date of auctorization</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 Study Program</i>
	August 26 th 2023	Prof. Ir. Irfan D. Prijambada, M.Eng., Ph.D..	Signature and name	Dr. Ir. Ngadiman, M.Si