

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



Agricultural Microbiology Major
Department of Agricultural Microbiology
Introductory Synthetic Biology
PNM20193119

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				Kode Dokumen:	
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
PNM20193119	Pengantar Biologi Sintetik Introductory Synthetic Biology	T: 2	P: 0	First semester	Pilihan Elective	Biologi Mikroorganisme, Bioteknologi Pertanian, Genetika Mikrobia, Enzimologi, Fisiologi Mikrobia Biology of Microorganisms, Agricultural Biotechnology, Microbial Genetics, Enzymology, Microbial Physiology
Deskripsi Singkat Mata Kuliah Course Overview	Mata Kuliah ini merupakan mata kuliah pilihan yang ditujukan bagi mahasiswa program studi Mikrobiologi Pertanian, Fakultas Pertanian. Mata kuliah ini mengenalkan dasar <i>biobrick</i> , <i>boolean logic</i> , jalur metabolisme, merekayasa jalur metabolisme, dan aplikasinya dalam bidang bioteknologi. Topik yang dibahas meliputi jalur metabolisme, logika <i>boolean</i> , rekayasa jalur metabolisme untuk meningkatkan produk akhir yang diinginkan. This course is an elective course aimed for students of the Agricultural Microbiology study program, Faculty of Agriculture. This course introduces the basic <i>biobrick</i> , <i>boolean logic</i> , <i>metabolic pathways</i> , <i>engineering metabolic pathways</i> , and their applications in <i>biotechnology</i> . Topics covered include <i>metabolic pathways</i> , <i>logic boolean</i> , the <i>engineering of metabolic pathways</i> to increase the desired end product.					
Capaian Pembelajaran Lulusan (CPL) Program Learning Outcome	CPL1 PLO1	Mampu menjelaskan konsep teoritis biologi mikroorganisme serta mengembangkan teknologi berbasis mikroba untuk meningkatkan produksi tanaman dan layanan lingkungan. (P2) Able to explain theoretical concepts of biology microorganism and develop microbial-based technology to increase plant production and environmental services. (K2)				

(PLO)	CPL2	Mampu menguraikan metodologi mutakhir di bidang mikrobiologi untuk mewujudkan pembangunan pertanian yang ramah lingkungan dan berkelanjutan. (P3)		
	PLO2	Able to describe the latest methodology in the field of microbiology to create environmentally friendly and sustainable agricultural development. (K3)		
	CPL3	Mampu memilih, memanfaatkan, dan mengelola potensi mikroba dan mikrobioma untuk membangun sistem industri dan pertanian. (KK3)		
	PLO3	Able to select, utilize and manage the potential of microbes and microbiomes to build industrial and agricultural systems. (S3)		
Capaian Pembelajaran Mata Kuliah (CPMK) Course Learning Outcomes (CLO)	Setelah menyelesaikan pembelajaran mata kuliah ini, mahasiswa diharapkan mampu: After completing this course, students are expected to able:			
	CPMK1	Mahasiswa mampu menjelaskan prinsip dasar dalam biologi sintetik [CPL 1]		
	CLO1	Students are able to explain the fundamental principles in synthetic biology [PLO 1] & K2		
	CPMK2	Mahasiswa mampu menjelaskan dasar-dasar biobrick, Boolean logic, serta rekayasa jalur metabolisme pada makhluk hidup [CPL 2]		
	CLO2	Students are able to explain the basics of biobricks, Boolean logic, as well as metabolic pathway engineering in living organisms. [PLO 2] & K3		
	CPMK 3	Mahasiswa mampu mempraktikkan cara perancangan sirkuit, jalur metabolisme, serta melakukan rekayasa jalur metabolisme [CPL 3]		
	CLO3	Students are able to practice circuit design, metabolic pathways, and perform metabolic pathway engineering [PLO 3] & S3		
Kaitan CPMK dengan Materi dan Bentuk Pembelajaran, serta Alokasi Waktu Correlation among CLO, the material, learning method, and estimated time		Materi Pembelajaran Course Materials	Bentuk Pembelajaran (Luring/Daring) Course Method (Offline/Online)	Alokasi Waktu Estimated Time
	CPMK1 CLO 1	1. Pengantar: Kontrak perkuliahan , terminologi dan sejarah biologi sintetik 1. Introduction: contract lectures, terminology and history of synthetic biology	Kuliah Interaktif Interactive lectures	2 x 50 menit kuliah sinkron 2 x 50 minutes of synchronous lectures
	CPMK2 CLO 2	2. Biobrick 2. Biobrick	Kuliah Interaktif Interactive lectures	2 x 50 menit kuliah sinkron 2 x 50 minutes of synchronous lectures
	CPMK2	3. Boolean Logic	Kuliah Interaktif	2 x 50 menit kuliah sinkron

	CLO 2	3. <i>Boolean Logic</i>	<i>Interactive lectures</i>	<i>2 x 50 minutes of synchronous lectures</i>
	CPMK3 CLO 3	4. Perancangan Sirkuit <i>4. Circuit design</i>	Kuliah Interaktif dan PBL Tugas Individu <i>Interactive lectures and project-based learning in the form of individual assignment</i>	2 x 50 menit kuliah sinkron Pengumpulan tugas mengenai perancangan sirkuit <i>2 x 50 minutes of synchronous lectures</i> <i>Collection of assignments regarding circuit design</i>
	CPMK2 CLO 2	5. Jalur Biologi <i>5. Biological Pathways</i>	Kuliah Interaktif dan kuis <i>Interactive lectures and quizzes</i>	2 x 45 menit kuliah sinkron 10 menit kuis <i>2 x 45 minutes of synchronous lectures</i> <i>10 minutes quizzes</i>
	CPMK2 CLO 2	6. Rekayasa Jalur Biologi <i>6. Biological Pathway Engineering</i>	Kuliah Interaktif dan kuis <i>Interactive lectures and quizzes</i>	2 x 45 menit kuliah sinkron 10 menit kuis <i>2 x 45 minutes of synchronous lectures</i> <i>10 minutes quizzes</i>
	CPMK3 CLO 3	7. <i>Tools</i> Rekayasa Jalur Biologi	Kuliah Interaktif <i>Interactive lectures</i>	2 x 50 menit kuliah interaktif

		7. <i>Tools of biological pathway engineering</i>		2 x 50 minutes of interactive lectures
	UTS/Hasil Tugas Project/Hasil Analisis Kasus Mid Exam/Project Assignment Result/Case Analysis Result			
	CPMK2 CLO 2	8. <i>Bacterial Chassis</i> 8. <i>Bacterial Chassis</i>	Kuliah Interaktif <i>Interactive lectures</i>	2 x 50 menit kuliah sinkron 2 x 50 minutes of synchronous lectures
	CPMK1 CLO 1	9. <i>Genome Refactoring I</i> 9. <i>Genome Refactoring I</i>	Kuliah Interaktif <i>Interactive lectures</i>	2 x 50 menit kuliah sinkron 2 x 50 minutes of synchronous lectures
	CPMK1 CLO 1	10. <i>Genome Refactoring II</i> 10. <i>Genome Refactoring II</i>	Kuliah Interaktif <i>Interactive lectures</i>	2 x 50 menit kuliah sinkron 2 x 50 minutes of synchronous lectures
	CPMK3 CLO 3	11. Penerapan Biologi Sintetik I 11. <i>Application of Synthetic Biology I</i>	Kuliah Interaktif <i>Interactive lectures</i>	2 x 50 menit kuliah sinkron 2 x 50 minutes of synchronous lectures
	CPMK3 CLO 3	12. Penerapan Biologi Sintetik II 12. <i>Application of Synthetic Biology II</i>	Tugas Kelompok <i>Group assignments</i>	2 x 50 menit Presentasi mahasiswa mengenai penerapan biologi sintetik dalam berbagai bidang 2 x 50 minutes <i>Presentation of students on the application of synthetic biology in various fields</i>
	CPMK3	13. Penerapan Biologi Sintetik II	Tugas Kelompok	2 x 50 menit

	CLO 3	<i>13. Application of Synthetic Biology II</i>	<i>Group assignments</i>	Presentasi mahasiswa mengenai penerapan biologi sintetik dalam berbagai bidang <i>2 x 50 minutes Presentation of students on the application of synthetic biology in various fields</i>
	UAS/ Hasil Tugas Project/Hasil Analisis Kasus <i>Final Exam/Project Case Result/Special Case Analysis Result</i>			
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 teknik perakitan sirkuit biologi sintetik 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. <i>Getting information about synthetic biology circuit assembly techniques</i> 2. <i>Gain experience in teamwork through group assignments</i> 3. <i>Get 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>			

Learning Media and Course Method Percentage						
Metode Penilaian dan Keselarasan dengan CPMK Assessment Plan and Relations with the CLOs	Basis Evaluasi <i>Evaluation Basis</i>	Komponen Evaluasi <i>Evaluation Components</i>	Bobot <i>Percentage</i>	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^{*)} <i>Project Results/Case Study Results</i>	Tugas Kelompok <i>Group Assignment</i>	30%	v		
	C. Kognitif <i>Cognitive</i>	UTS <i>Mid Exam</i>	25%		v	
		UAS <i>Final Exam</i>	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 References	Utama (Main References): 1. Synthetic Biology: Parts, Devices and Application (Christine Smolke, Sang Yup Lee, Jens Nielsen, and Gregory Stephanopoulos); Year 2018 2. Synthetic Biology; Tools and Application (Huimin Zhao (Eds.)); Year 2013 3. BioBuilder: Synthetic Biology in the Lab (Natalie Kuldell, Rachel Bernstein, Karen Ingram, Kathryn M. Hart); Year 2015 4. System Biology: Constraint-based Reconstruction and Analysis (Bernhard palsson); Year 2015 5. Biochemistry Fourth Edision (Donald Voet/ Judith G. Voet); Year 2010 6. Bacterial Physiology and Metabolism (Byung Hong Kim and geoffrey Michael Gadd) Year 2012 Tambahan (Additional References): Video tutorial perakitan sirkuit dan <i>biobrick</i> di Youtube					

	Semiarti, E., Purwestri, Y. A., Rohman, M.S , & Putri, W. A. (2022). Genetic Transformation in Prokaryotic and Eukaryotic Cells. <i>IntechOpen</i> .			
	<i>Video tutoerial circuit assembly and biobrick on Youtube</i>			
Nama Dosen Pengampu <i>(Team Teaching)</i>	1. M. Saifur Rohman, S.P., M.Eng., M.Si., Ph. D. 2. Jaka Widada, S.P., M. Agr., Ph.D. 3. Ahmad Suparmin, S.P., M.AgrSc., 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>
	<i>August 21st 2023</i>	<i>M. Saifur Rohman, S.P., M.Eng., M.Si., Ph. D.</i>	<i>Signature and name</i>	<i>Ir. Ngadiman, M.Si., Ph.D.</i>