SEMESTER COURSE OUTLINE
& LESSON PLANS
SECOND SEMESTER
2022/2023

Agricultural Microbiology Major

Department of Agricultural Microbiology

Thermomicrobiology

PNU20193223

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 *Course Code*	Nama Mata Kuliah *Course Name*	Bobot (sks) *Credits*		Semester *Semester*	Status Mata Kuliah *Course Status*	Mata Kuliah Prasyarat *Prerequisite Courses*
PNM20193223	*Termomikrobiologi* *Thermomicrobiology*	*T: 2*	*P: 0*	*VI*	*Pilihan* *Elective*	*Biologi Mikroorganisme* *Biology of Microorganisms*

Deskripsi Singkat Mata Kuliah ***Course Overview***	Mata kuliah Termomikrobiologi merupakan mata kuliah pilihan yang diselenggarakan untuk mahasiswa program studi Mikrobiologi Pertanian. Matakuliah ini membahas tentang pengaruh suhu terhadap mikrobia, mekanisme ketahanan hidup nikrobia pada suhu ekstrem, dan pemanfaatan mikrobia suhu ekstrem. Mata kuliah ini juga memberikan pemahaman dan pengalaman praktis kepada mahasiswa tentang peranan suhu terhadap kehidupan mikrobia serta pemanfaatannya untuk menghambat dan membunuh mikrobia. *Thermomicrobiology is an elective course intended for students from Agricultural Microbiology study program. This course discusses the relationship between temperature on microbes, the survival mechanism of microbes at extreme temperatures, and the use of microbes at extreme temperatures. The course also provides students with practical understanding and experience about the effect of temperature on microbial life and its application to kill and inhibit bacterial growth.*	
Capaian Pembelajaran Lulusan Program Studi (CPL) ***Program Learning Outcome (PLO)***	***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).*
	CPL2 ***PLO2***	Mampu menguraikan metodologi mutakhir di bidang mikrobiologi untuk mewujudkan pembangunan pertanian yang ramah lingkungan dan berkelanjutan (P3) *Able to describe the latest methodology in the field of microbiology to create environmentally friendly and sustainable agricultural development (K3).*
	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	*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).*		
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 be able:***			
	CPMK1 ***CLO1***	Mahasiswa mampu menjelaskan mengenai peranan thermo mikrobiologi, peranan suhu dalam reaksi kima dan biokimia, pengaruh suhu terhadap mikroorganisme [CPL 3] *Students can explain the importance of thermomicrobiology, the role of temperature in chemical and biochemical processes and the effect of temperature on microorganisms [PLO 3] S2*		
	CPMK2 ***CLO2***	Mahasiswa mampu menjelaskan teori pemindahan panas, kinetika ketahanan panas, dan aplikasinya dalam bidang mikrobiologi [CPL 1] *Student can explain the theory of heat transfer, heat resistance kinetics, and its application in microbiology [PLO 1] K2*		
	CPMK 3 ***CLO3***	Mahasiswa mampu menjelaskan metode pengendalian mikroorganisme dengan memanfaatkan suhu tinggi maupun rendah [CPL 2] *Students can explain about the methods to suppress microorganism growth by high and low temperatures [PLO 2] K3*		
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 Methos (Offline/Online)***	**Alokasi Waktu** ***Estimated Time***
	CPMK1 ***CLO 1***	1. Pendahuluan: Peranan termomikrobiologi, peranan suhu dalam reaksi kima dan biokimia, pengaruh suhu terhadap mikroorganisme *1. Introduction: the importance of thermomicrobiology, the role of temperature in chemical and biochemical processes, the effect of temperature on microorganism*	Kuliah Interaktif *Interactive lectures*	2 x 50 menit kuliah sinkron *2 x 50 minutes of synchronous lectures*
	CPMK2 ***CLO 2***	2. Teori Pemindahan Panas I *2. Heat Transfer Theory I*	Kuliah Interaktif *Interactive lectures*	2 x 50 menit kuliah sinkron *2 x 50 minutes of synchronous lectures*

	CPMK2 ***CLO 2***	3. Teori Pemindahan Panas II *3. Heat Transfer Theory II*	Kuliah Interaktif *Interactive lectures*	2 x 50 menit kuliah sinkron *2 x 50 minutes of synchronous lectures*
	CPMK2 ***CLO 2***	4. Teori Pemindahan Panas III *4. Heat Transfer Theory III*	Kuliah Interaktif dan tugas kelompok *Interactive lectures and group assignment*	2 x 50 menit kuliah sinkron Pengumpulan penugasan mengenai teori pemindahan panas *2 x 50 minutes of synchronous lectures* *Submittal of group assignment*
	CPMK2 ***CLO 2***	5. Kinetika Ketahanan Panas I *5. Heat Resistance Kinetics I*	Kuliah Interaktif *Interactive lectures*	2 x 50 menit kuliah sinkron *2 x 50 minutes of synchronous lectures*
	CPMK2	6. Kinetika Ketahanan Panas II	Kuliah Interaktif dan tugas kelompok	2 x 50 menit kuliah sinkron Pengumpulan penugasan mengenai kinetika

				ketahanan panas
	CLO 2	*6. Heat Resistance Kinetics II*	*Interactive lectures and group assignment*	*2 x 50 minutes of synchronous lectures* *Submittal of group assignment*
	UTS/Hasil Tugas Project/Hasil Analisis Kasus ***Mid Exam/Project Results/Case Study Results***			
	CPMK2 ***CLO 2***	7. Biologi Mikroorganisme Terikut Hasil Panen 7. Biology of microorganisms followed by postharvest	Kuliah Interaktif *Interactive lectures*	2 x 50 menit kuliah sinkron *2 x 50 minutes of synchronous lectures*
	CPMK3 ***CLO 2***	8. Pengendalian Mikroorganisme *8. Control of microorganism*	Kuliah Interaktif *Interactive lectures*	2 x 50 menit kuliah sinkron *2 x 50 minutes of synchronous lectures*
	CPMK3 ***CLO 2***	9. Pengendalian Mikroorganisme Menggunakan Suhu Tinggi 9. *Control of microorganism*	Kuliah Interaktif *Interactive lectures*	2 x 50 menit kuliah sinkron *2 x 50 minutes of synchronous lectures*
	CPMK3	10. Pengendalian Mikroorganisme Menggunakan Suhu Rendah	Kuliah Interaktif	2 x 50 menit kuliah sinkron

	CLO 2	*10. Control of microorganisms using low temperature*	*Interactive lectures*	*2 x 50 minutes of synchronous lectures*
	CPMK3 ***CLO 3***	11. Biologi Mikroorganisme Psikrofil dan Pemanfaatannya *11. Biology of psychrophilic microorganisms and its application*	Kuliah Interaktif *Interactive lectures*	2 x 50 menit kuliah sinkron *2 x 50 minutes of synchronous lectures*
	CPMK3 ***CLO 3***	12. Biologi Mikroorganisme Termofil dan Pemanfaatannya *12. Biology of thermophilic microorganisms and its application*	Kuliah Interaktif *Interactive lectures*	2 x 50 menit kuliah sinkron *2 x 50 minutes of synchronous lectures*
	CPMK 1 ***CLO 1***	*13. Cryobiology* *13. Cryobiology*	Kuliah Interaktif dan diskusi *Interactive lectures and discussion*	2 x 50 menit kuliah sinkron *2 x 50 minutes of synchronous lectures*
	UAS/ Hasil Tugas Project/Hasil Analisis Kasus ***Final Exam/Project Results/Case Study Results***			
Metode Pembelajaran	**SCL: Pembelajaran berbasis *Case based and Project based***			

Learning Method	*SCL (Student Center Learning): Case based and project based learning*
Pengalaman Belajar Mahasiswa ***Student 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 termomikrobiologi serta pengaruh dan peranannya dalam bidang pertanian dan industri** **2. Memperoleh pengalaman dalam kerja sama tim melalui tugas kelompok** **3. Mendapatkan teknik mengenai cara mempresentasikan data melalui tugas presentasi** ***Synchronous lectures: conducting discussions related to lecture topics and their relationships and potential applications in the field of agricultural microbiology or agriculture in general*** ***Asynchronous lectures:*** ***1. Obtain information regarding themomicrobiology, effects and its role in agricultural and industrial sectors*** ***2. Gain teamwork experiences through group assignments*** ***3. Obtain techniques on how to present data through presentation assignments.***
Akses Media Pembelajaran / LMS dan Persentase Luring & Daring ***Learning Media and Course Method Percentage***	https://elok.ugm.ac.id Luring 100% *(Offline 100%) Project Results/Case Study Results*

Metode Penilaian dan Keselarasan dengan CPMK ***Methods of assessment in accordance with course***	**Basis Evaluasi** ***Evaluation Basis***	**Komponen Evaluasi** ***Evaluation Components***	**Bobot** ***Percentages***	**CPMK 1** **CLO 1**	**CPMK 2** **CLO 2**	**CPMK 3** **CLO 3**
	A. Aktivitas Partisipatif*) ***Participatory Activity***	**Diskusi** ***Discussion***	20%	v		
	B. Hasil *Project*/Hasil Studi Kasus/ Hasil PBL*) ***Project results/case study results***	**Tugas Kelompok** ***Group Assignments***	30%		v	

learning outcome	**C. Kognitif** ***Cognitive***	**UTS** ***Mid Exam***	25%		v	
		UAS ***Final Exam***	25%			v
		Total ***Total***	**100%**			
	*) Sesuai IKU 7, **jumlah persentase** aktivitas partisipatif (A) dan hasil project/studi kasus/hasil PBL (B) adalah minimal 50%. **) In accordance with IKU 7, the total percentage of participatory activities (A) and project results/case studies/PBL results (B) is at least 50%.*					

Daftar Referensi

References

Utama:

Main references:

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3. Lienhard, J.H. IV & V. 2003. A heat transfer textbook 3rd ed. Phlogiston Press. Cambridge
4. Bittar, E. E., and Willis, J. S. 1997. Advances in Molecular and Cells Biology: Thermobiology. Vol. 19: 293pp. Jai Press Inc. London.
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6. Stumbo, C. R. 1973. Thermobacteriology in Food Processing. 2nd ed. 329 pp.Academic Press. New York.
7. Kuddus, M. 2022. Microbial Extremozymes: Novel Sources and Industrial Appllication. Elsevier, United Kingdom.
8. Salwan, R. and V. Sharma. 2022. Physiological and Biotechnological Aspects of Extremophiles. Elsevier, United Kingdom.

Tambahan:

Jurnal-jurnal terkait Termomikrobiologi.

Additional references:

Scientific journals related to thermomicrobiology

Nama Dosen Pengampu

Team Teaching

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Otorisasi ***Authorization***	**Tanggal Penyusunan** ***Date of Authorization***	**Koordinator Mata Kuliah** ***Course Coordinator***	**Koordinator Bidang Keahlian (Jika Ada)** ***Expertise Coordinator (if any)***	**Ketua Program Studi** ***Head of the Study Program***

	January 20, 2023	*M. Saifur Rohman, S.P., M.Si., M.Eng., Ph.D.*		*Ir. Ngadiman, M.Si., Ph.D.*