

**RENCANA PROGRAM DAN KEGIATAN
PEMBELAJARAN SEMESTER (RPKPS)
COURSE SYLLABUS
SEMESTER GANJIL (*ODD*)
2024/2025**



Master in Food Science and Technology
Department of Food and Agricultural Products Technology
Pengolahan Limbah
Waste Management
TPTP215124 (2 SKS)

Dosen Pengampu/*Lecturers*:
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**UNIVERSITAS GADJAH MADA
FACULTY OF AGRICULTURAL TECHNOLOGY
2024**

	Universitas Gadjah Mada Faculty of Agricultural Technology Department of Food and Agricultural Products Technology Master in Food Science and Technology Odd Semester 2024/2025					Kode Dokumen (Document code):
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RENCANA PROGRAM DAN KEGIATAN PEMBELAJARAN SEMESTER (RPKPS) (COURSE SYLLABUS)						
Kode Mata Kuliah (Course Number)	Nama Mata Kuliah (Course Title)	Bobot (Credits)		Semester (Semester)	Status Mata Kuliah (Course Status)	Mata Kuliah Prasyarat (Prerequisite Courses)
TPTP215124	Pengolahan Limbah (Waste Management)	T: 2	P: -	Gasal (Odd)	Pilihan (Elective)	-
Deskripsi Singkat Mata Kuliah (Short Course Description)	Mata kuliah ini membahas potensi limbah sebagai pencemar lingkungan serta pendekatan ilmiah dalam pencegahan dan pengelolaan pencemaran yang berkaitan dengan limbah. Topik yang dikaji meliputi konsep dasar pengelolaan limbah, pengolahan limbah secara aerob dan anaerob, pemanfaatan limbah melalui proses pengomposan, produksi biogas dan pendekatan biorefinery, serta pengolahan air limbah secara fisik, kimia, dan biologis, termasuk perkembangan terkini dalam ilmu pengetahuan dan teknologi pengelolaan limbah. Perkuliahan dilaksanakan melalui pembelajaran berbasis proyek dan berorientasi pada pemecahan masalah, dengan penekanan pada telaah kritis publikasi ilmiah terbaru (≥2020) di bidang pengelolaan limbah. Mahasiswa menganalisis permasalahan lingkungan yang berkaitan dengan timbunan dan pengolahan limbah, mengevaluasi kinerja teknologi berdasarkan data yang dilaporkan dalam literatur ilmiah, serta merumuskan solusi yang berbasis kajian ilmiah. Pemanfaatan Artificial Intelligence (AI) digunakan untuk mendukung analisis literatur dan identifikasi tren penelitian, sementara pendekatan statistik dasar diterapkan untuk menginterpretasikan dan membandingkan data kuantitatif dari studi yang ditelaah. Mata kuliah ini berkontribusi terhadap pencapaian Tujuan Pembangunan Berkelanjutan (SDGs), khususnya SDG 6 (Air Bersih dan Sanitasi Layak), SDG 12 (Konsumsi dan Produksi yang Bertanggung Jawab), serta SDG 13 (Penanganan Perubahan Iklim). Total workload mahasiswa dalam mata kuliah ini setara dengan 3,7 ECTS. <i>(This course discusses the potential of waste as an environmental pollutant and scientific approaches to prevent and manage waste-related pollution. Topics include fundamental concepts of waste management, aerobic and anaerobic waste treatment, waste utilization through composting, biogas and biorefinery approaches, and physical, chemical, and biological treatment of wastewater, as well as recent developments in science and technology in waste management.</i> <i>The course is delivered through project-based and problem-oriented learning, emphasizing critical reviews of recent scientific publications (≥2020) in the field of waste management. Students analyze environmental problems related to waste generation and treatment, evaluate technological performance based on published data, and propose scientifically based solutions. Artificial intelligence (AI)-assisted tools are used to support literature analysis and trend identification, while basic statistical approaches are applied to interpret and compare</i>					

	quantitative data reported in the reviewed studies. This course contributes to SDG 6 (Clean Water and Sanitation), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). The total student workload for this course is 3.7 ECTS.)			
Capaian Pembelajaran Lulusan yang Dibebankan pada MK (Program Learning Outcomes (PLO) Assigned to the Course)	CPL 3 (PLO 3)	Menguasai konsep teoritis dalam bidang spesifik ilmu dan teknologi pangan serta memahami perkembangan mutakhir di bidang tersebut (Mastering theoretical concepts in specific areas of food science and technology and understand its recent advances)		
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 to:)			
	CPMK 3.2 (CLO 3.2)	Memahami perkembangan terkini dalam ilmu dan teknologi pangan dari publikasi ilmiah terbaru [CPL 3] (Understand the current development in food science and technology from recent scientific publications [PLO 3])		
Kaitan CPMK dengan Materi dan Bentuk Pembelajaran, serta Alokasi Waktu (CLO Relation to Learning Material, Learning Forms, and Time Allocation)		Materi Pembelajaran (Learning Materials)	Bentuk Pembelajaran (Forms of Learning)	Alokasi Waktu (Time Allocation)
	CPMK 3.2 (CLO 3.2)	1. Pendahuluan; konsep pengelolaan limbah (Introduction; Concepts of Waste Management)	- Kuliah (Lecture) - Diskusi Interaktif (Interactive Discussion)	1 pertemuan 1 meeting Masing-masing terdiri dari: Each meeting consists of: 2x50 menit sinkronus (2x50 minutes synchronous) 2x60 menit penugasan terstruktur (2x60 minutes of structured assignments) 2x60 kegiatan mandiri (2x60 minutes of independent study)

		2. Pengolahan limbah secara aerob (<i>Aerobic Waste Treatment</i>)	- Kuliah (<i>Lecture</i>) - Diskusi Interaktif (<i>Interactive Discussion</i>)	1 pertemuan <i>1 meeting</i> Masing-masing terdiri dari: <i>Each meeting consists of:</i> 2x50 menit sinkronus (<i>2x50 minutes synchronous</i>) 2x60 menit penugasan terstruktur (<i>2x60 minutes of structured assignments</i>) 2x60 kegiatan mandiri (<i>2x60 minutes of independent study</i>)
		3. Pengolahan limbah secara anaerob (<i>Anaerobic Waste Treatment</i>)	- Kuliah (<i>Lecture</i>) - Diskusi Interaktif (<i>Interactive Discussion</i>)	1 pertemuan <i>1 meeting</i> Masing-masing terdiri dari: <i>Each meeting consists of:</i> 2x50 menit sinkronus (<i>2x50 minutes synchronous</i>) 2x60 menit penugasan terstruktur (<i>2x60 minutes of structured assignments</i>) 2x60 kegiatan mandiri

				(2x60 minutes of independent study)
		4. Pemanfaatan limbah (pengomposan, SCP/Single Cell Protein) (Waste Utilization (Composting, SCP))	- Kuliah (Lecture) - Diskusi Interaktif (Interactive Discussion)	1 pertemuan 1 meeting Masing-masing terdiri dari: Each meeting consists of: 2x50 menit sinkronus (2x50 minutes synchronous) 2x60 menit penugasan terstruktur (2x60 minutes of structured assignments) 2x60 kegiatan mandiri (2x60 minutes of independent study)
		5. Pemanfaatan limbah (biogas) (Waste Utilization (Biogas))	- Kuliah (Lecture) - Diskusi Interaktif (Interactive Discussion)	1 pertemuan 1 meeting Masing-masing terdiri dari: Each meeting consists of: 2x50 menit sinkronus (2x50 minutes synchronous) 2x60 menit penugasan terstruktur (2x60 minutes of structured assignments)

				2x60 kegiatan mandiri (2x60 minutes of independent study)
		6. Biorefinery dan pemanfaatan limbah secara fisikokimia (<i>Biorefinery and Physicochemical Waste Utilization</i>)	- Kuliah (<i>Lecture</i>) - Diskusi Interaktif (<i>Interactive Discussion</i>)	1 pertemuan 1 meeting Masing-masing terdiri dari: <i>Each meeting consists of:</i> 2x50 menit sinkronus (2x50 minutes synchronous) 2x60 menit penugasan terstruktur (2x60 minutes of structured assignments) 2x60 kegiatan mandiri (2x60 minutes of independent study)
		7. Pengolahan air limbah secara fisik (<i>Physical Treatment of Wastewater</i>)	- Kuliah (<i>Lecture</i>) - Diskusi Interaktif (<i>Interactive Discussion</i>)	1 pertemuan 1 meeting Masing-masing terdiri dari: <i>Each meeting consists of:</i> 2x50 menit sinkronus (2x50 minutes synchronous) 2x60 menit penugasan terstruktur

				(2x60 minutes of structured assignments) 2x60 kegiatan mandiri (2x60 minutes of independent study)
		Ujian Tengah Semester / Hasil Tugas Proyek / Studi Kasus <i>Midterm Exam/Project Results/Case Study Results</i>		
		8. Pengolahan air limbah secara kimia <i>(Chemical Treatment of Wastewater)</i>	- Presentasi <i>(Presentation)</i> - Diskusi Interaktif <i>(Interactive Discussion)</i>	7 pertemuan 7 meetings Masing-masing terdiri dari: Each meeting consists of: 2x50 menit sinkronus (2x50 minutes synchronous) 2x60 menit penugasan terstruktur (2x60 minutes of structured assignments) 2x60 kegiatan mandiri (2x60 minutes of independent study)
		9. Perkembangan ilmu pengetahuan dan teknologi dalam pengelolaan limbah <i>(Development in science and technology in waste management)</i>	- Presentasi <i>(Presentation)</i> - Diskusi Interaktif <i>(Interactive Discussion)</i>	6 pertemuan 6 meetings Masing-masing terdiri dari: Each meeting consists of: 2x50 menit sinkronus (2x50 minutes synchronous)

				2x60 menit penugasan terstruktur (2x60 minutes of structured assignments) 2x60 kegiatan mandiri (2x60 minutes of independent study)
		Ujian Akhir Semester / Hasil Tugas Proyek / Studi Kasus Final Exam/Project Results/Case Study Results		
Metode Pembelajaran (Learning Methods)	Presentasi, Tanya jawab, Diskusi, Pembelajaran berbasis proyek (Presentation, Q&A, Discussion, Project-based Learning)			
Beban kerja (Workload)	Total workload per semester adalah 96 jam, yang terdiri atas 120 menit per minggu untuk kegiatan perkuliahan, 120 menit per minggu untuk tugas terstruktur, dan 120 menit per minggu untuk belajar mandiri, dengan total 16 minggu termasuk UTS dan UAS. (The total workload is approximately 96 hours per semester, consisting of 120 minutes of lectures per week, 120 minutes of structured assignments per week, and 120 minutes of self-study per week, for a total of 16 weeks, including mid-term and final examinations.) Perhitungan Workload per Semester (Workload calculation for one semester) = 6 jam/minggu × 16 minggu/semester = 96 jam/semester = 96 jam/semester ÷ 26 jam/ECTS = 3,7 ECTS/semester = 6 hours/week × 16 weeks/semester = 96 hours/semester = 96 hours/semester ÷ 26 hours/ECTS = 3.7 ECTS/semester Total Workload = 3,7 ECTS/semester Catatan (Notes): 1 ECTS setara dengan 25–30 jam workload mahasiswa, dengan 26 jam ditetapkan sebagai standar minimum. (1 ECTS is equivalent to 25-30 hours of work, with 26 hours set as the minimum standard.)			

Pengalaman Belajar Mahasiswa <i>(Students Activities)</i>	Sesi Sinkron <i>(During Synchronous Sessions):</i> - Berpartisipasi aktif dalam diskusi terkait materi pembelajaran <i>Actively engage in discussions on material</i> Sesi Asinkron/Mandiri/Penugasan Terstruktur <i>(During Asynchronous/Self-Study/Structured Assignments):</i> - Belajar kelompok <i>Group study</i> - Meninjau literatur dan isu-isu lingkungan <i>Reviewing literature and environmental issues</i>							
Akses Media Pembelajaran/ LMS dan Persentase Luring & Daring <i>(Learning Media Access/LMS and Offline & Online Percentage)</i>	https://elok.ugm.ac.id https://simaster.ugm.ac.id/ Luring <i>(Offline)</i> : 100% Daring <i>(Online)</i> : 0%							
Metode Penilaian dan Keselarasan dengan CPMK <i>(Assessment Method for Each Course Learning Outcomes)</i>	Basis Evaluasi <i>(Evaluation Basis)</i>	Komponen Evaluasi <i>(Evaluation Component)</i>	Bobot <i>(Percent age)</i>	CLO 3.2				
	A. Aktivitas Partisipatif^{*)} <i>Participatory Activities</i>							
	B. Hasil Project/Hasil Studi Kasus/ Hasil PBL^{*)} <i>Project Results/Case Study Results/PBL Results</i>	Presentasi <i>Presentation</i>	40%	V				
	C. Kognitif <i>Cognitive</i>	UTS <i>Midterm Exam</i>	30%	V				
		UAS <i>Final Exam</i>	30%	V				
		Total	100%					

Daftar Referensi <i>(Reference)</i>	Jurnal ilmiah <i>(Scientific journals):</i> 1. Waste Management, Q1 2. Waste and Biomass Valorization, Q2 3. Waste Management and Research, Q2 Buku <i>(Books):</i> 1. Advanced Composite Materials for Wastewater Treatment. (2025). Norzita Ngadi, R.a. Ilyas, ... S.m. Sapuan. Elsevier. 2. Antibiofouling Membranes for Water and Wastewater Treatment: Principles and Applications. (2024). Zhiwei Wang, Ruobin Dai and Xuesong Li. Elsevier 3. Bio Refinery of Wastewater Treatment: Way to Generate Waste to Value. (2024). Maulin P. Shah and Angana Sarkar. Elsevier. 4. Biotechnologies for Wastewater Treatment and Resource Recovery: Current Trends and Future Scope. (2024). Arun Lal Srivastav, Inga Zinicovscaia and Liliana Cepoi. Elsevier. 5. Biomass, Biofuels, Biochemicals: Microbial Fermentation of Biowastes. (2022). shok Pandey, Yen Wah Tong, ... Jingxin Zhang. Elsevier.			
Nama Dosen Pengampu <i>(Teaching Team)</i>	1. Dr. Ir. Muhammad Nur Cahyanto, M.Sc. (MNC) 2. Dr. Ria Millati, S.T., M.T. (RM)			
Otorisasi <i>(Authorization)</i>	Tanggal Penyusunan <i>(Date)</i>	Koordinator Mata Kuliah <i>(Course Coordinator)</i>	Koordinator Bidang Keahlian (Jika Ada) <i>(Head of Curriculum (if available))</i>	Ketua Program Studi <i>(Head of the Study Program)</i>
	05 August 2024	 Dr. Ir. Muhammad Nur Cahyanto, M.Sc.	-	 Dr. Ir. Muhammad Nur Cahyanto, M.Sc