
 Universitas Airlangga	<b>SEMESTER LEARNING PLAN</b>		<b>Prepared by</b>	<b>Examined by</b>	<b>Approved by</b>	<b>Document Registration Number</b>
	<b>SLP</b>		<b>(Person in Charge)</b>	<b>(Head of Bachelor Program / Head of Department)</b>	<b>Vice Dean I</b>	01/S1Kesmas/RPS/2019
	<b>Revision - Date</b>	<b>January 1<sup>st</sup>, 2019</b>	Dr. Lilis Sulistorini, Ir., M.Kes	Dr. Diah Indriani, S.Si., M.Si	Dr. Santi Martini, dr., M.Kes	
<b>Faculty of Public Health</b>	<b>Valid on Semester (odd/even) / Academic Year</b>	<b>Even Semester</b>	(sign)	(sign)	(sign)	

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## A. DETAILS OF COURSE


<b>1. Course Name</b>	Waste Management
<b>2. Course Code</b>	LKM312
<b>3. Credits (SKS)</b>	2 (two) SKS
<b>4. Semester / Term</b>	VI (sixth)
<b>5. Study Program</b>	Bachelor of Public Health
<b>6. Student Learning Achievement</b>	The students are able to carry out community empowerment program
<b>7. Course Learning Achievement</b>	At the end of the course, students will be able to explain how to manage liquid, solid and gas waste and how to control different types of waste (domestic, industrial and B3 waste) and explain the negative impact of waste on public health
<b>8. Course Outline</b>	This course is delivered through lectures, field visits and presentations; it discusses the sources and types of waste (liquid, solid and gas) and their effects on public health, liquid waste management systems (oxidation ponds, activated sludge, filtration, aeration, sludge management), waste water garden, industrial area liquid waste management systems, fecal waste management system, solid waste management (4R, landfill, incinerator, and composting), Biogas, microbial pathogen transmission (anal and oral), radioactive waste management, waste gas management, B3 waste management.
<b>9. Course Prerequisites (if any)</b>	None
<b>10. Instructor</b>	Dr. Lilis Sulistorini, Ir., M.Kes
<b>11. Teaching Assistants</b>	

## B. TEACHING PROGRAM

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<b>Week</b>	<b>Skills expected at the end of each learning phase (Sub-Course Achievement) (C, A, P)</b>	<b>Study Materials</b>	<b>Teaching Methods</b>	<b>Additional Materials for Learning</b>	<b>Meeting Time</b>	<b>Course Objectives</b>	<b>Criteria and Indicator of Evaluation / Measurable Learning Outcome (hard dan soft skills)</b>	<b>Mark / Grade / Percentage (%)</b>	<b>Reference Number Ref. (nomor)</b>
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
1	Students are able to explain the sources and types of waste (liquid, solid and gas) and their effects on public health	1. Definition of waste: <ol style="list-style-type: none"> <li>Characteristics of waste</li> <li>Quality standard of waste</li> <li>Classification of water quality</li> </ol> 2. Types of waste: <ol style="list-style-type: none"> <li>Liquid waste</li> <li>Solid waste</li> <li>Gas waste</li> </ol> 3. Sources of waste: <ol style="list-style-type: none"> <li>Domestic</li> <li>Industry</li> </ol> 4. Effects of waste on health:	Lectures Discussions	LCD and Laptop	2x50 minutes		Discipline Communication skill Complex thinking Teamwork		Required: 1, 2

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1	2	3	4	5	6	7	8	9	10
		a. Health problems caused by liquid waste b. Health problems caused by solid waste c. Health problems caused by gas waste 5. Disease transmission by pathogen microorganisms: a. Types of pathogen microorganisms							

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1	2	3	4	5	6	7	8	9	10
		b. Mechanism of disease transmission by pathogen microorganisms							
2	Students are able to explain the sources and types of waste (liquid, solid and gas) and their effects on public health	1. Definition of waste: <ol style="list-style-type: none"> <li>Characteristics of waste</li> <li>Quality standard of waste</li> <li>Classification of water quality</li> </ol> 2. Types of waste: <ol style="list-style-type: none"> <li>Liquid waste</li> <li>Solid waste</li> <li>Gas waste</li> </ol>	Lectures Discussions	LCD and Laptop	2x50 minutes		Discipline Communication skill Complex thinking Teamwork		Required: 1, 2

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<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
		3. Sources of waste: a. Domestic b. Industry 4. Effects of waste on health: a. Health problems caused by liquid waste b. Health problems caused by solid waste c. Health problems caused by gas waste 5. Disease transmission by							

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1	2	3	4	5	6	7	8	9	10
		pathogen microorganisms: a. Types of pathogen microorganisms b. Mechanism of disease transmission by pathogen microorganisms							
3	Students are able to explain the sources and types of waste (liquid, solid and gas) and their effects on public health	1. Definition of waste: a. Characteristics of waste b. Quality standard of waste	Lectures Discussions	LCD and Laptop	2x50 minutes		Discipline Communication skill Complex thinking Teamwork		Required: 1, 2

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<b>Week</b>	<b>Skills expected at the end of each learning phase (Sub-Course Achievement) (C, A, P)</b>	<b>Study Materials</b>	<b>Teaching Methods</b>	<b>Additional Materials for Learning</b>	<b>Meeting Time</b>	<b>Course Objectives</b>	<b>Criteria and Indicator of Evaluation / Measurable Learning Outcome (hard dan soft skills)</b>	<b>Mark / Grade / Percentage (%)</b>	<b>Reference Number Ref. (nomor)</b>
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
		c. Classification of water quality 2. Types of waste: a. Liquid waste b. Solid waste c. Gas waste 3. Sources of waste: a. Domestic b. Industry 4. Effects of waste on health: a. Health problems caused by liquid waste b. Health problems caused by solid waste							

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<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
		c. Health problems caused by gas waste 5. Disease transmission by pathogen microorganisms: a. Types of pathogen microorganisms b. Mechanism of disease transmission by pathogen microorganisms							
4	Students are able to explain the sources and types of waste (liquid,	1. Definition of waste:	Lectures Discussions	LCD and Laptop	2x50 minutes		Discipline Communication skill		Required: 1, 2



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1	2	3	4	5	6	7	8	9	10
	solid and gas) and their effects on public health	a. Characteristics of waste b. Quality standard of waste c. Classification of water quality 2. Types of waste: a. Liquid waste b. Solid waste c. Gas waste 3. Sources of waste: a. Domestic b. Industry 4. Effects of waste on health: d. Health problems					Complex thinking Teamwork		

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1	2	3	4	5	6	7	8	9	10
		caused by liquid waste e. Health problems caused by solid waste f. Health problems caused by gas waste 5. Disease transmission by pathogen microorganisms: a. Types of pathogen microorganisms b. Mechanism of disease transmission							

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<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
		by pathogen microorganisms							
5	Students are able to explain liquid waste management	1. Liquid waste disposal system: <ol style="list-style-type: none"> <li>Definition</li> <li>Types of liquid waste disposal</li> </ol> 2. Liquid waste management: <ol style="list-style-type: none"> <li>Definition</li> <li>On site and off site management (communal)</li> <li>Initial management, biological, sludge</li> </ol>	Lectures Discussions	LCD and Laptop	2x50 minutes		Discipline Communication skill Complex thinking Teamwork		Required:2,3,5,6 Additional: 1

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1	2	3	4	5	6	7	8	9	10
		d. Waste water garden 3. Liquid waste management in industry area: a. Infiltration well and pump house b. Sedimentation and flotation c. Oxidation ditch d. Final clarifier e. Biological Indicator f. Sludge management 4. Faecal waste management: a. Rotating Biological							

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1	2	3	4	5	6	7	8	9	10
		Contactor (RBC) b. Physical treatment c. Biological treatment							
6	Students are able to explain liquid waste management	1. Liquid waste disposal system: a. Definition b. Types of liquid waste disposal 2. Liquid waste management: a. Definition b. On site and off site management (communal) c. Initial management,	Lectures Discussions	LCD and Laptop	2x50 minutes		Discipline Communication skill Complex thinking Teamwork		Required:2,3,5,6 Additional: 1

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		biological, sludge d. Waste water garden 3. Liquid waste management in industry area: a. Infiltration well and pump house b. Sedimentation and flotation c. Oxidation ditch d. Final clarifier e. Biological Indicator f. Sludge management 4. Faecal waste managemen:							

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<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
		a. Rotating Biological Contactor (RBC) b. Physical treatment c. Biological treatment							
7	Students are able to explain liquid waste management	1. Liquid waste disposal system: a. Definition b. Types of liquid waste disposal 2. Liquid waste management: a. Definition b. On site and off site management (communal)	Lectures Discussions	LCD and Laptop	2x50 minutes		Discipline Communication skill Complex thinking Teamwork		Required:2 ,3,5,6 Additional: 1

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<b>Week</b>	<b>Skills expected at the end of each learning phase (Sub-Course Achievement) (C, A, P)</b>	<b>Study Materials</b>	<b>Teaching Methods</b>	<b>Additional Materials for Learning</b>	<b>Meeting Time</b>	<b>Course Objectives</b>	<b>Criteria and Indicator of Evaluation / Measurable Learning Outcome (hard dan soft skills)</b>	<b>Mark / Grade / Percentage (%)</b>	<b>Reference Number Ref. (nomor)</b>
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
		c. Initial management, biological, sludge d. Waste water garden 3. Liquid waste management in industry area: a. Infiltration well and pump house b. Sedimentation and flotation c. Oxidation ditch d. Final clarifier e. Biological Indicator f. Sludge management							



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1	2	3	4	5	6	7	8	9	10
		4. Faecal waste management: a. Rotating Biological Contactor (RBC) b. Physical treatment c. Biological treatment							
<b>MID TERM EXAMINATION</b>									
8	Students are able to explain liquid waste management	1. Liquid waste disposal system: a. Definition b. Types of liquid waste disposal 2. Liquid waste management: a. Definition	Lectures Discussions	LCD and Laptop	2x50 minutes		Discipline Communication skill Complex thinking Teamwork		Required:2 ,3,5,6 Additional: 1

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Week	Skills expected at the end of each learning phase (Sub-Course Achievement) (C, A, P)	Study Materials	Teaching Methods	Additional Materials for Learning	Meeting Time	Course Objectives	Criteria and Indicator of Evaluation / Measurable Learning Outcome (hard dan soft skills)	Mark / Grade / Percentage (%)	Reference Number Ref. (nomor)
1	2	3	4	5	6	7	8	9	10
		b. On site and off site management (communal) c. Initial management, biological, sludge d. Waste water garden 3. Liquid waste management in industry area: a. Infiltration well and pump house b. Sedimentation and flotation c. Oxidation ditch d. Final clarifier							

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Week	Skills expected at the end of each learning phase (Sub-Course Achievement) (C, A, P)	Study Materials	Teaching Methods	Additional Materials for Learning	Meeting Time	Course Objectives	Criteria and Indicator of Evaluation / Measurable Learning Outcome ( <i>hard dan soft skills</i> )	Mark / Grade / Percentage (%)	Reference Number Ref. (nomor)
1	2	3	4	5	6	7	8	9	10
		e. Biological Indicator f. Sludge management 4. Faecal waste management: a. Rotating Biological Contactor (RBC) b. Physical treatment c. Biological treatment							
9	Students are able to explain liquid waste management	1. Liquid waste disposal system: a. Definition b. Types of liquid waste disposal	Lectures Discussions	LCD and Laptop	2x50 minutes		Discipline Communication skill Complex thinking Teamwork		Required:2 ,3,5,6 Additional: 1

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1	2	3	4	5	6	7	8	9	10
		2. Liquid waste management: <ol style="list-style-type: none"> <li>Definition</li> <li>On site and off site management (communal)</li> <li>Initial management, biological, sludge</li> <li>Waste water garden</li> </ol> 3. Liquid waste management in industry area: <ol style="list-style-type: none"> <li>Infiltration well and pump house</li> <li>Sedimentation and flotation</li> </ol>							

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Week	Skills expected at the end of each learning phase (Sub-Course Achievement) (C, A, P)	Study Materials	Teaching Methods	Additional Materials for Learning	Meeting Time	Course Objectives	Criteria and Indicator of Evaluation / Measurable Learning Outcome (hard dan soft skills)	Mark / Grade / Percentage (%)	Reference Number Ref. (nomor)
1	2	3	4	5	6	7	8	9	10
		c. Oxidation ditch d. Final clarifier e. Biological Indicator f. Sludge management 4. Faecal waste management: a. Rotating Biological Contactor (RBC) b. Physical treatment c. Biological treatment							
10	Students are able to explain solid waste management	1. 4R(Reduce, Reuse, Recycle, Replace) 2. Landfill:	Lectures Discussions	LCD and Laptop	2x50 minutes		Discipline Communication skill Complex thinking		Required: 7

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Week	Skills expected at the end of each learning phase (Sub-Course Achievement) (C, A, P)	Study Materials	Teaching Methods	Additional Materials for Learning	Meeting Time	Course Objectives	Criteria and Indicator of Evaluation / Measurable Learning Outcome ( <i>hard dan soft skills</i> )	Mark / Grade / Percentage (%)	Reference Number Ref. (nomor)
1	2	3	4	5	6	7	8	9	10
		a. Controlled landfill b. Sanitary landfill 3. Incineration: a. Definition b. Incineration on household scale c. Communal incineration 4. Composting: a. Definition b. Types of composter 5. Biogas: a. Definition b. Types of biogas					Teamwork		

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<b>Week</b>	<b>Skills expected at the end of each learning phase (Sub-Course Achievement) (C, A, P)</b>	<b>Study Materials</b>	<b>Teaching Methods</b>	<b>Additional Materials for Learning</b>	<b>Meeting Time</b>	<b>Course Objectives</b>	<b>Criteria and Indicator of Evaluation / Measurable Learning Outcome (hard dan soft skills)</b>	<b>Mark / Grade / Percentage (%)</b>	<b>Reference Number Ref. (nomor)</b>
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
11	Students are able to explain solid waste management	1. 4R(Reduce, Reuse, Recycle, Replace) 2. Landfill: a. Controlled landfill b. Sanitary landfill 3. Incineration: a. Definition b. Incineration on household scale c. Communal incineration 4. Composting: a. Definition b. Types of composter 5. Biogas: a. Definition	Lectures Discussions	LCD and Laptop	2x50 minutes		Discipline Communication skill Complex thinking Teamwork		Required: 7

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Week	Skills expected at the end of each learning phase (Sub-Course Achievement) (C, A, P)	Study Materials	Teaching Methods	Additional Materials for Learning	Meeting Time	Course Objectives	Criteria and Indicator of Evaluation / Measurable Learning Outcome ( <i>hard dan soft skills</i> )	Mark / Grade / Percentage (%)	Reference Number Ref. (nomor)
1	2	3	4	5	6	7	8	9	10
		b. Types of biogas							
12	Students are able to explain gas waste management	Controlling air pollution: a. Control gas emissions b. Remove particulate from gas waste c. Open green space	Lectures Discussions	LCD and Laptop	2x50 minutes		Discipline Communication skill Complex thinking Teamwork		Required: 11
13	Students are able to explain B3 waste management	1. B3 waste management: a. Deviation of B3 waste b. Collection of B3 waste c. Documents of B3 waste	Lectures Discussions	LCD and Laptop	2x50 minutes		Discipline Communication skill Teamwork		Required: 4, 8, 9, 10



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<b>Week</b>	<b>Skills expected at the end of each learning phase (Sub-Course Achievement) (C, A, P)</b>	<b>Study Materials</b>	<b>Teaching Methods</b>	<b>Additional Materials for Learning</b>	<b>Meeting Time</b>	<b>Course Objectives</b>	<b>Criteria and Indicator of Evaluation / Measurable Learning Outcome (hard dan soft skills)</b>	<b>Mark / Grade / Percentage (%)</b>	<b>Reference Number Ref. (nomor)</b>
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
		d. Symbols and Labels of B3 waste 2. Radioactive waste management: a. Radioactive waste management at hospitals b. Radioactive waste management at Batan							
14	Students are able to explain B3 waste management	1. B3 waste management: a. Deviation of B3 waste b. Collection of B3 waste	Lectures Discussions	LCD and Laptop	2x50 minutes		Discipline Communication skill Teamwork		Required: 4, 8, 9, 10

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<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
		c. Documents of B3 waste d. Symbols and Labels of B3 waste 2. Radioactive waste management: a. Radioactive waste management at hospitals b. Radioactive waste management at Batan							
<b>FINAL TERM EXAMINATION</b>									

### C. REQUIRED TEXTS / REFERENCES / ESSENTIAL READINGS

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#### Required Readings:

1. Lippmann. M. 2000. Human Exposures and Their Health Effects. School of Medicine. New York University. USA.
2. Sewage Treatment in Hot Climate, Mara D, 1976
3. Teknik pengol air limbah sec. Biologis Marsono,BD,1997
4. Pedoman, pengelolaan limbah klinis, WHO & Depkes, 1991
5. Dasar-dasar Pengelolaan Air Limbah, Sugiarto, 1987
6. Wastewater Engineering Treatment Disposal and Refuse” Metcalf and Eddy, 1979
7. UU RI No. 18 tahun 2008 tentang Pengelolaan Sampah
8. Keputusan Kepala Bapedal no 2 tahun 1995 tentang Dokumen Limbah B3
9. Keputusan Kepala Bapedal no 5 tahun 1995 tentang Simbol dan Label Limbah B3
10. Keputusan Kepala Bapedal no 1 tahun 1995 tentang Tata Cara dan Persyaratan Teknis Penyimpanan dan Pengumpulan Limbah B3
11. Peraturan Pemerintah RI., No. 41 Tahun 1999 tentang Pengendalian Pencemaran Udara

#### Additional Readings :

1. Wiesmann U., Choi IS., Dombrowski EM., 2007, Fundamentals of Biological Waste Water Treatment, Wiley-VCH, Verlag GmbH&Co. KGaA WeinHeim, Berlin, Germany