



## SEMESTER STUDY PLAN

Study program: Master of Environmental Science

Faculty: School of Postgraduated Studies

| <b>Subject:</b>                      |                                      | <b>Solid and Hazardous Waste Management</b>   | <b>Code:</b><br>P-CIL-8-212                      | <b>Credit:2</b><br><b>(4 ECTS)</b>   | <b>Smt:2</b>  |  |            |
|--------------------------------------|--------------------------------------|---|--|--|---|--|------------|
| <b>Supporting lecturer:</b>          |                                      | <b>1. Prof. Dr. Ir. Syafrudin CES., MT</b><br><b>2. Dr. eng. Maryono, ST, MT</b>  |  |  |   |  |            |
| <b>Learning Outcomes Subject:</b>    |                                      | <ul style="list-style-type: none"> <li>· Students can understand and explain the need for solid waste management</li> <li>· Students can understand and explain the need for solid waste management</li> <li>· Students can understand and explain the need for B3 waste management</li> <li>· Students can understand and explain the need for B3 waste management</li> </ul>  |  |  |   |  |            |
| <b>Short Description of Courses:</b> |                                      | This Solid Waste Treatment Engineering course aims to equip students with knowledge, understanding and application of various solid and hazardous waste treatment methods. The lectures discussed various types of solid waste, B3 waste, solid waste management systems, and B3 waste management systems with various aspects. Learning activities include lectures with various approaches and methods that involve students a lot, such as discussions, observation activities in the field to learn to identify problems and solutions, learn to identify problems and their solutions. |  |  |   |  |            |
| 1                                    | 2                                    | 3   | 4  | 5  | 6   | 7  |            |
| Week                                 | Final Ability of each learning stage | Study Materials/ Subjects   | Learning methods                                 | Workload   | Student Learning Experience   | Evaluation   |            |
|                                      |                                      |   |  |  |   | Criteria & Indicators  | Weight (%) |
| 1.                                   | Introduction/ Lecture contract       | Understand the preparation before face-to-face lectures and the obligation to report face-to-face lectures  | Lectures, questions and answers, and discussions | 216minutes<br>(0.25 ECTS)<br>· Lecture = 1x 120 minutes<br>· Q&A = 1 x 20 minutes<br>· Discussion = 1 x 20 minutes<br>· Presentation = 1 x 20 minutes<br>· Individual Tasks (Self Work) = 1 x 36 minutes/day (16 | Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss | Accuracy and Completeness and the truth explanation as well accuracy understanding | 2.5        |

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|    |   |  |  | <i>weeks)</i>  |   |  |     |
| 2. | Students are able to explain the basics of engineering and waste management | <ul style="list-style-type: none"> <li>• Presentation on the basics of waste management and engineering</li> </ul>   | Lectures, questions and answers, and discussions | 216 minutes (0.25 ECTS) <ul style="list-style-type: none"> <li>• Lecture = 1x 120 minutes</li> <li>• Q&amp;A = 1 x 20 minutes</li> <li>• Discussion = 1 x 20 minutes</li> <li>• Presentation = 1 x 20 minutes</li> <li>• Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</li> </ul> | Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss | Accuracy and Completeness and the truth explanation as well accuracy understanding | 2.5 |
| 3. | Students are able to explain the design of waste management system planning | <ul style="list-style-type: none"> <li>• Presentation on the design criteria for planning infrastructure and facilities for the waste management system.</li> <li>• Assignment to make a resume regarding recycling of organic waste in development</li> </ul> | Lectures, questions and answers, and discussions | 216 minutes (0.25 ECTS) <ul style="list-style-type: none"> <li>• Lecture = 1x 120 minutes</li> <li>• Q&amp;A = 1 x 20 minutes</li> <li>• Discussion = 1 x 20 minutes</li> <li>• Presentation = 1 x 20 minutes</li> <li>• Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</li> </ul> | Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss | Accuracy and Completeness and the truth explanation as well accuracy understanding | 5   |
| 4. | Students are able to explain related to waste management at the source      | <ul style="list-style-type: none"> <li>• Presentation on the handling and segregation of waste at the source</li> </ul>  | Lectures, questions and answers, and discussions | 216 minutes (0.25 ECTS) <ul style="list-style-type: none"> <li>• Lecture = 1x 120 minutes</li> <li>• Q&amp;A = 1 x 20 minutes</li> <li>• Discussion = 1 x 20 minutes</li> <li>• Presentation = 1 x 20 minutes</li> </ul>   | Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss | Completeness and the truth explanation as well accuracy understanding              | 5   |

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|    |  |  |  | <ul style="list-style-type: none"> <li>· <i>Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</i></li> </ul>   |   |   |   |
| 5. | Students are able to explain the transportation and management of waste      | <ul style="list-style-type: none"> <li>• Presentation on transportation in waste management and transportation costs</li> </ul>  | Lectures, questions and answers, and discussions | 216 minutes (0.25 ECTS) <ul style="list-style-type: none"> <li>· <i>Lecture = 1x 120 minutes</i></li> <li>· <i>Q&amp;A = 1 x 20 minutes</i></li> <li>· <i>Discussion = 1 x 20 minutes</i></li> <li>· <i>Presentation = 1 x 20 minutes</i></li> <li>· <i>Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</i></li> </ul> | Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss | Completeness and the truth explanation as well accuracy understanding | 5 |
| 6. | Students are able to explain related to B3 waste management and its handling | <ul style="list-style-type: none"> <li>• Presentation on the management of hazardous and toxic waste materials</li> <li>• Assignments related to the classification of B3 waste &amp; its handling in the surrounding environment</li> </ul> | Lectures, questions and answers, and discussions | 216 minutes (0.25 ECTS) <ul style="list-style-type: none"> <li>· <i>Lecture = 1x 120 minutes</i></li> <li>· <i>Q&amp;A = 1 x 20 minutes</i></li> <li>· <i>Discussion = 1 x 20 minutes</i></li> <li>· <i>Presentation = 1 x 20 minutes</i></li> <li>· <i>Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</i></li> </ul> | Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss | Completeness and the truth explanation as well accuracy understanding | 5 |
| 7. | Students are able to explain strategies in managing B3 waste                 | <ul style="list-style-type: none"> <li>• Presentation on B3 waste management strategies</li> <li>• Assignments related to B3</li> </ul>  | Lectures, questions and answers, and discussions | 216 minutes (0.25 ECTS) <ul style="list-style-type: none"> <li>· <i>Lecture = 1x 120 minutes</i></li> <li>· <i>Q&amp;A = 1 x 20 minutes</i></li> <li>· <i>Discussion = 1 x 20 minutes</i></li> </ul>  | Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss | Completeness and the truth explanation as well accuracy understanding | 5 |

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|    |   | waste management   |  | <ul style="list-style-type: none"> <li>✓ <i>Presentation = 1 x 20 minutes</i></li> <li>✓ <i>Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</i></li> </ul>   |   |   |          |
| 8. | Students are able to explain related to B3 waste management in industry | <ul style="list-style-type: none"> <li>• Presentation on industrial waste management</li> <li>• Assignments related to industrial B3 waste management</li> </ul> | Lectures, questions and answers, and discussions | 216 minutes (0.25 ECTS) <ul style="list-style-type: none"> <li>✓ <i>Lecture = 1x 120 minutes</i></li> <li>✓ <i>Q&amp;A = 1 x 20 minutes</i></li> <li>✓ <i>Discussion = 1 x 20 minutes</i></li> <li>✓ <i>Presentation = 1 x 20 minutes</i></li> <li>✓ <i>Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</i></li> </ul> | Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss | Completeness and the truth explanation as well accuracy understanding | 5        |
| 9. | Students are able to explain related to the minimization of B3 waste    | <ul style="list-style-type: none"> <li>• Presentation on the minimization of B3 waste</li> <li>• Assignments related to B3 waste, MSDS</li> </ul>                | Lectures, questions and answers, and discussions | 216 minutes (0.25 ECTS) <ul style="list-style-type: none"> <li>✓ <i>Lecture = 1x 120 minutes</i></li> <li>✓ <i>Q&amp;A = 1 x 20 minutes</i></li> <li>✓ <i>Discussion = 1 x 20 minutes</i></li> <li>✓ <i>Presentation = 1 x 20 minutes</i></li> <li>✓ <i>Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</i></li> </ul> | Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss | Completeness and the truth explanation as well accuracy understanding | 5        |
| 10 | <b>Mid Term Examination (UTS)</b>                                       | <b>Meeting Material 1- 9</b>   | <b>Written test</b>                              | <b>216 minutes of processing time or the equivalent of 0.25 ECTS</b>  | <b>Students working on UTS questions</b>  | <b>Completeness and the truth explanation as well accuracy</b>        | <b>5</b> |

|    |  |   |  |  |   | <b>understanding</b>  |   |
|----|--|---|--|--|---|---|---|
| 11 | Students are able to explain related to infrastructure planning in managing solid waste and B3 | <ul style="list-style-type: none"> <li>• Presentation on infrastructure planning in solid waste and B3 . management</li> <li>• Assignments related to quantitative analysis of waste management infrastructure information</li> </ul> | Lectures, questions and answers, and discussions | 216 minutes (0.25 ECTS) <ul style="list-style-type: none"> <li>· Lecture = 1x 120 minutes</li> <li>· Q&amp;A = 1 x 20 minutes</li> <li>· Discussion = 1 x 20 minutes</li> <li>· Presentation = 1 x 20 minutes</li> <li>· Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</li> </ul> | Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss | Completeness and the truth explanation as well accuracy understanding | 5 |
| 12 | Students are able to explain about the B3 processing system                                    | <ul style="list-style-type: none"> <li>• Presentation on the B3 processing system</li> <li>• Assignment to make a resume related to waste management abroad and in the city of origin</li> </ul>                                      | Lectures, questions and answers, and discussions | 216 minutes (0.25 ECTS) <ul style="list-style-type: none"> <li>· Lecture = 1x 120 minutes</li> <li>· Q&amp;A = 1 x 20 minutes</li> <li>· Discussion = 1 x 20 minutes</li> <li>· Presentation = 1 x 20 minutes</li> <li>· Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</li> </ul> | Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss | Completeness and the truth explanation as well accuracy understanding | 5 |
| 13 | Students are able to explain related to calculating the pollutant load on water sources        | <ul style="list-style-type: none"> <li>• Presentation on calculating pollutant load and water pollutant load capacity in water sources</li> <li>• Assignment to write articles on B3 waste</li> </ul>                                 | Lectures, questions and answers, and discussions | 216 minutes (0.25 ECTS) <ul style="list-style-type: none"> <li>· Lecture = 1x 120 minutes</li> <li>· Q&amp;A = 1 x 20 minutes</li> <li>· Discussion = 1 x 20 minutes</li> <li>· Presentation = 1 x 20 minutes</li> <li>· Individual Tasks (Self</li> </ul>                                       | Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss | Completeness and the truth explanation as well accuracy understanding | 5 |

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|    |  | management (Fly ash & bottom ash, batteries waste, household hazardous waste, laboratory waste, etc.)  |  | <i>Work</i> = 1 x 36 minutes/day (16 weeks)  |   |   |   |
| 14 | Students are able to explain related to potential generation, hazards, regulations, and management in handling B3 waste    | <ul style="list-style-type: none"> <li>• Student presentations and presentations on B3 waste (potential generation, hazards &amp; risks, regulations, management in other countries, proposed alternative management)</li> </ul> | Lectures, questions and answers, and discussions | 216 minutes (0.25 ECTS) <ul style="list-style-type: none"> <li>• <i>Lecture</i> = 1x 120 minutes</li> <li>• <i>Q&amp;A</i> = 1 x 20 minutes</li> <li>• <i>Discussion</i> = 1 x 20 minutes</li> <li>• <i>Presentation</i> = 1 x 20 minutes</li> <li>• <i>Individual Tasks (Self Work)</i> = 1 x 36 minutes/day (16 weeks)</li> </ul>                    | Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss | Completeness and the truth explanation as well accuracy understanding | 5 |
| 15 | Students are able to explain the impact of potential generation, hazards, regulations, and management in handling B3 waste | <ul style="list-style-type: none"> <li>• Student presentations and presentations on B3 waste (potential generation, hazards &amp; risks, regulations, management in other countries, proposed alternative management)</li> </ul> | Lectures, questions and answers, and discussions | 216 minutes (0.25 ECTS) <p>Consist of:</p> <ul style="list-style-type: none"> <li>• <i>Lecture</i> = 1x 120 minutes</li> <li>• <i>Q&amp;A</i> = 1 x 20 minutes</li> <li>• <i>Discussion</i> = 1 x 20 minutes</li> <li>• <i>Presentation</i> = 1 x 20 minutes</li> <li>• <i>Individual Tasks (Self Work)</i> = 1 x 36 minutes/day (16 weeks)</li> </ul> | Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss | Completeness and the truth explanation as well accuracy understanding | 5 |

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|--------------------------|-------------------------|--|--------------|---|-----------------------------------|---|----|
| 16                       | Final Examination (UAS) | Meeting Materials 1-15 (resume material)   | Written test | 216 minutes of processing time or the equivalent of 0.25 ECTS | Students working on UAS questions | Completeness and the truth explanation as well accuracy understanding | 15 |
| <b>8.Reference List:</b> |                         | <ol style="list-style-type: none"> <li>1. Arif Zulkifli, 2014, Sustainable Waste Management, Graha Ilmu, Jogjakarta.</li> <li>2. Christensen, TH, R. Cossu, and R. Stegmann, 1998, Landfilling of Waste: Leachate, Barriers, Biogas (3 volume set), Chapman &amp; Hall.</li> <li>3. Tchobanoglous, G., 1993, Integrated Solid Waste Management: Engineering Principles, McGraw-Hill Book Company, New York.</li> <li>4. Wilson, DC, 1981, Waste Management: Planning, Evaluation, Technologies, Clarendon Press, Oxford.</li> <li>5. Weinstein, NJ, and RF Toro, 1976, Thermal Processes of Municipal Solid Waste for Resource and Energy Recovery, Ann Arbor Science, Michigan</li> <li>6. UU no. 18 of 2006 concerning Waste Management.</li> <li>7. Tammemagi, HY, 1999, The Waste Crisis: Landfills, Incinerators, and the Search for a Sustainable Future, ISBN 0-19-512898-2.</li> </ol> |              |   |                                   |   |    |

