



UNIVERSITY OF MISKOLC

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**FACULTY OF  
EARTH AND ENVIRONMENTAL  
SCIENCE AND ENGINEERING**

**Subject name:  
MECHANICAL AND BIOLOGICAL TREATMENT OF MUNICIPAL SOLID WASTE**

**FACULTY OF EARTH AND ENVIRONMENTAL SCIENCES & ENGINEERING  
MSc education**

**Course communication dossier**

**UNIVERSITY OF MISKOLC  
FACULTY OF EARTH AND ENVIRONMENTAL SCIENCES & ENGINEERING  
Institute of Raw Materials Preparation and Environmental Technology**

**Recommended semester: 2.**

## **Contents**

1. Course description (Content, Lecturer, Number of classes, Credits)
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3. Example for written examination/individual planning task
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# 1. COURSE DESCRIPTION

|  |                          |
|--|--------------------------|
| <b>Course Title: Mechanical and Biological Treatment of Municipal Solid Waste</b>  |                          |
| Type of course: compulsory   | Neptun code: MFEET720015 |
| Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: <b>1 lec. + 2 sem.</b>  |                          |
| <b>Type of Assessment</b> (exam. / pr. mark. / other): <b>exam.</b><br>During the semester the following tasks should be completed: laboratory work and report.  |                          |
| <b>Grading Limits:</b><br>> 80%: excellent,<br>70-79%: good,<br>60-69%: medium,<br>50-59%: satisfactory,<br>< 50%: unsatisfactory.   |                          |
| Position in Curriculum (which semester): <b>2<sup>nd</sup></b>   |                          |
| Pre-requisites ( <i>if any</i> ): -  |                          |
| <b>Course Description:</b>   |                          |
| <u>Study goals:</u> To introduce the concept of waste sorting facilities and the necessity of treatment of the residual fraction of municipal solid waste (MSW) to recover valuable materials (metals) and energy (refuse derived fuel (RDF) and biogas) for the creating of circular economy.   |                          |
| <u>Course content:</u> Circular economy and separative waste collection. Sorting plants: technology and machinery. Quality and quantity of MSW and its residual fraction. Biostabilisation of degradables. Recovery of metals. Recovery and separation of plastics. RDF separation and further operations. Evaluation of technologies meeting different processing goals. Machinery and economics, their design. Environmental impacts. Advanced technologies to achieve the highest energy recovera rate. |                          |
| <u>Education method:</u> Lectures and seminars   |                          |
| The 3-5 most important compulsory, or recommended <b>literature</b> (textbook, book) <b>resources:</b>   |                          |
| <ul style="list-style-type: none"><li>• Lecture notes</li><li>• Paul T. Williams.Waste Treatment and Disposal John Wiley &amp; Sons, 2013</li><li>• Thomas H. Solid Waste Technology &amp; Management, 1 &amp; 2. 2010. Online ISBN:9780470666883</li><li>• McKinnon D, Fazakerley J, Hultermans R (2017). Waste sorting plants. Extracting value from waste. ISWA</li></ul>   |                          |
| <b>Competencies to evolve:</b>   |                          |
| <b>Knowledge</b><br>Knows and applies scientific and technical theory and practice related to the profession of environmental engineering.<br>Knows the promotion and opinion-forming methods related to environmental engineering   |                          |
| <b>Skills</b><br>Can apply the acquired general and specific mathematical, natural and social science principles, rules, connections and procedures in solving problems arising in the field of environmental protection.<br>Able to conduct publications and negotiations in his/her field in his/her mother tongue and at least  |                          |

one foreign language.

Able to design, implement and operate environment-focused management systems

***Competence in terms of attitude***

Assumes the professional and moral values related to the field of environmental protection

Shares experiences with co-workers, thus helping their development.

***Competence in terms of autonomy and responsibility***

Shares the acquired knowledge and experience with formal, non-formal and informal information transfer with practitioners in their field.

**Responsible Instructor** (*name, position, scientific degree*):

**Ljudmilla Bokányi Dr., Associate Professor, PhD, CSc**

**Other Faculty Member(s) Involved in Teaching**, if any (*name, position, scientific degree*):

## 2. COURSE TOPICS

**Course topics (WEEKLY SCHEDULE)**  
**Actual semester: 2<sup>nd</sup>. semester**  
**Environmental Engineer Msc, Waste management**

|     |  |
|-----|--|
| 1.  | Municipal Solid Waste collection approaches.<br>Importance of education of population.                               |
| 2.  | Sorting plants 1: processing aims. Technology  |
| 3.  | Sorting plants 2: Machinery.   |
| 4.  | Sorting of special plastics.   |
| 5.  | Characterisation of the residual fraction of MSW.  |
| 6.  | Concept of MBT (mechanical-biological treatment). Operations and machinery.  |
| 7.  | MBT to bio-stabilise the greatest possible proportion of the residual solid waste to meet landfilling requirements 1 |
| 8.  | MBT to bio-stabilise the greatest possible proportion of the residual solid waste to meet landfilling requirements 2 |
| 9.  | MBT to recover high calorific value components at high yield 1   |
| 10. | MBT to recover high calorific value components at high yield 1   |
| 11. | Dry stabilisation and 3A technology  |
| 12. | Case studies   |
| 13. | Field trip to Györszol   |
| 14. | Advanced techniques to recover maximum energy  |
|     |  |

## Seminar work schedule

| <b>Date</b>     | <b>Description of tasks</b>  |
|-----------------|--|
| <b>Week 1.</b>  | Schedule of practice lessons, subject requirements                             |
| <b>Week 2.</b>  | Introduction (Selective waste sorting plant)                                   |
| <b>Week 3.</b>  | Calculations for Selective waste sorting plant                                 |
| <b>Week 4.</b>  | Calculations for Selective waste sorting plant                                 |
| <b>Week 5.</b>  | Deadline of Complex planning task I. (Selective waste sorting plant)           |
| <b>Week 6.</b>  | National Holiday   |
| <b>Week 7.</b>  | Introduction (Mechanical-biological waste treatment technologies)              |
| <b>Week 8.</b>  | Calculations for Mechanical-biological waste treatment technologies            |
| <b>Week 9.</b>  | Calculations for Mechanical-biological waste treatment technologies            |
| <b>Week 10.</b> | Calculations for Mechanical-biological wastetreatment technologies             |
| <b>Week 11.</b> | Consulting   |
| <b>Week 12.</b> | Consulting   |
| <b>Week 13.</b> | Deadline of complex planning II. (Mechanical-biological waste treatment plant) |
| <b>Week 14.</b> | Test   |

### 3. EXAMPLE FOR WRITTEN EXAMINATION/INDIVIDUAL PLANNING TASK

#### Task1

Design a complex technology based on *selective (separative) collected waste sorting!*

The following parameters are known:

- The number of inhabitants (N): 220 000.
- The specific quantity of the generated waste (q): 0.31 tonnes/capita/year.

Choose the appropriate technology and prepare the technological flowchart.

Prepare a literature overview, detailing:

- Selective waste collection types, trends.
- Applied equipment (working principle, etc.)

#### Task 2

Design a complex technology based on mechanical-biological waste treatment!

The following parameters and information are known:

- Quantity of feed material :195000 tonnes/year
- The fine fraction of municipal solid waste (<30...50) contains a relatively high quantity of biodegradable materials (65%)
- The coarse fraction of MSW (>80...100) contains relatively high quantity of combustible materials
- The intermediate fraction has a low combustible material content;the quantity of biodegradable materials within the fraction is 20%

Choose the appropriate technology and prepare the technological flowsheet!

#### **4. EXAM QUESTIONS**

Municipal Solid Waste collection approaches.

Importance of education of population.

Sorting plants: processing aims. Technology

Sorting plants, machinery.

Sorting of special plastics.

Characterisation of the residual fraction of MSW.

Concept of MBT (mechanical-biological treatment). Operations and machinery.

MBT to bio-stabilise the greatest possible proportion of the residual solid waste to meet landfilling requirements

MBT to recover high calorific value components at high yield

Dry stabilisation and 3A technology

Case studies

Advanced techniques to recover maximum energy

#### **5. OTHER REQUIREMENTS**

Planning tasks, report of the field trip

Using mobile phones during the test is forbidden.

Miskolc, 2023.

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| <p>Dr. Sándor Nagy<br/>Head of Institute, Associate Professor</p> | <p>Dr. Ljudmilla Bokányi<br/>Lecturer</p> |
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