



## Materials: Properties, Selection and Sustainability

### Educational subject description sheet

#### Basic information

|   |  |                                     |
|---|--|-------------------------------------|
| <p><b>Field of study</b><br/>Joint Bachelor in Sustainability</p> <p><b>Speciality</b><br/>Economics, Management &amp; Engineering</p> <p><b>Organizational unit</b><br/>Faculty of Law and Administration</p> <p><b>Study level</b><br/>first cycle (joint degree programme)</p> <p><b>Study form</b><br/>full-time degree programme</p> <p><b>Education profile</b><br/>General academic</p> <p><b>Mandatory</b><br/>obligatory</p> | <p><b>Education cycle</b><br/>2025/26</p> <p><b>Subject code</b><br/>UJ.WPAJBSEMES.880.16490.25</p> <p><b>Lecture languages</b><br/>english</p> <p><b>Subject related to scientific research</b><br/>Yes</p> <p><b>Disciplines</b><br/>Material Engineering, Economics and finance</p> <p><b>ISCED classification</b><br/>0311 Economics</p> <p><b>USOS code</b></p> |                                     |
| <b>Subject coordinator</b>  | Piotr Szwedo   |                                     |
| <b>Lecturer</b>   | Karel Van Acker  |                                     |
| <b>Period</b><br>Semester 4   | <p><b>Examination</b><br/>exam</p> <p><b>Activities and hours</b><br/>Lecture: 44</p>  | <b>Number of ECTS points</b><br>5.0 |

#### Goals

|    |  |
|----|--|
| C1 | This course deals with materials science and technology as an example of a technological discipline, integrating aspects such as resource scarcity, material properties and scientific foundations, technical processes, materials and process selection and economic and environmental aspects. |
|----|--|

## Subject's learning outcomes

| Code  | Outcomes in terms of   | Effects                | Examination methods               |
|---|--|------------------------|-----------------------------------|
| <b>Knowledge - Student knows and understands:</b> |  |                        |                                   |
| W1  | the key material properties from basic physical principles   | JBS_K1_W07             | written exam                      |
| W2  | the relationship between material properties, design and functionality   | JBS_K1_W07             | written exam, essay, presentation |
| W3  | how to place technological knowledge of materials and materials processing in a broader sustainability context   | JBS_K1_W03, JBS_K1_W06 | written exam, essay, presentation |
| <b>Skills - Student can:</b>                      |  |                        |                                   |
| U1  | make responsible choices of resources and materials and to evaluate their application in a balanced way with respect to performance and sustainability                                 | JBS_K1_U02, JBS_K1_U03 | essay, presentation               |
| <b>Social competences - Student is ready for:</b> |  |                        |                                   |
| K1  | to critically approach and verify statements around resource supply, sustainability and circularity of materials using recent information and insights, and to discuss this with peers | JBS_K1_K04             | written exam, essay, presentation |

## Calculation of ECTS points

| Activity form                            | Activity hours*     |
|--|---------------------|
| Lecture                                  | 44                  |
| preparation of a multimedia presentation | 30                  |
| preparation for classes                  | 24                  |
| preparation for the exam                 | 27                  |
| <b>Student workload</b>                  | <b>Hours</b><br>125 |
|  | <b>ECTS</b><br>5.0  |

\* hour means 45 minutes

## Study content

| No. | Course content   | Subject's learning outcomes |
|-----|--|-----------------------------|
| 1.  | Introduction and societal relevance<br>Material families, properties and materials selection | W1, W2, W3, U1, K1          |
| 2.  | Resources and materials consumption  | W1, W2, W3, U1, K1          |
| 3.  | Stiffness<br>The atomic structure of materials   | W1, W2, W3, U1, K1          |

| No. | Course content   | Subject's learning outcomes |
|-----|--|-----------------------------|
| 4.  | Strength<br>Defects in materials                                       | W1, W2, W3, U1, K1          |
| 5.  | Masterclass materials selection & eco-audit (software)                 | W1, W2, W3, U1, K1          |
| 6.  | Fracture and Fatigue<br>Thermal properties                             | W1, W2, W3, U1, K1          |
| 7.  | Electrical properties<br>Materials processing                          | W1, W2, W3, U1, K1          |
| 8.  | Environmental impact of materials                                      | W1, W2, W3, U1, K1          |
| 9.  | Life Cycle Analysis<br>Eco-audit                                       | W1, W2, W3, U1, K1          |
| 10. | Circular economy: recycling, substitution and circular business models | W1, W2, W3, U1, K1          |
| 11. | Group work presentations   | W1, W2, W3, U1, K1          |

## Course advanced

### Teaching methods :

project method, conversation lecture, practicals

| Activities | Examination methods               | Credit conditions   |
|------------|-----------------------------------|---|
| Lecture    | written exam, essay, presentation | Written closed-book exam with open and multiple choice questions (minimal passing score: 10/20). Active participation. The paper and presentation will count for 20% of the final scores. Students pass if they achieve minimally 10/20 in total. |

## Entry requirements

None

## Literature

### Obligatory

1. Slides and own course text (partially) published on Toledo.

## Effects

| Code       | Content   |
|------------|---|
| JBS_K1_K04 | The graduate can critically assess and verbalize own competencies and skills related to different aspects of sustainability as well as their need for development.  |
| JBS_K1_U02 | The graduate can present and report knowledge, methodologies, ideas, problems and solutions, clearly and comprehensively, in different forms destined for different audiences - including discussions and debates which require defending a substantiated opinion, as well as conversations in a foreign language at the CEFR B2 level.   |
| JBS_K1_U03 | The graduate can apply adequate methods and tools, including selected IT tools, to solve problems related to data collection, analysis, and management in the context of sustainability.  |
| JBS_K1_W03 | The graduate can give examples of sustainability-related dilemmas and hypothesize on the optimal course of action.  |
| JBS_K1_W06 | The graduate can describe interconnections between various aspects of sustainability and identify their significance in the context of natural and social sciences, with a special focus on disciplines included in the selected specialisation track (law and politics; chemistry and physics; chemistry and biology; economics and geography; economics, management and engineering; humanities). |
| JBS_K1_W07 | The graduate can apply the theory and methodology of disciplines included in the selected specialisation track to sustainability-related problems, taking into consideration practical limitations such as protection of intellectual property.   |