# 7th Semester

Materials selection in engineering design

| 1. GENERAL | | | |
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| **SCHOOL** | Faculty of Sciences in collaboration with Faculty of Engineering, Aristotle University of Thessaloniki | | |
| **DEPARTMENT** | Materials Science and Engineering | | |
| **LEVEL OF STUDIES** | ISCED level 7 (5-year Integrated Master's programme)<br>ISCED level 6 (4-year BSc programme) | | |
| **COURSE CODE** | MSEN 701 | **SEMESTER** | 7th Semester |
| **COURSE TITLE** | **Materials selection in engineering design** | | |
| **TEACHING ACTIVITIES**<br>Lectures, tutorials/problem sessions, laboratory/computer exercises (where applicable),<br>case studies and guided self-study. | | **TEACHING HOURS PER WEEK** | **ECTS CREDITS** |
| | | 4 (2L + 2Lab/Comp) | 6 |
| **COURSE TYPE** | Skill development / Scientific area | | |
| **PREREQUISITES** | Introduction to Materials Science and Engineering; basic Mechanics of Materials. | | |
| **TEACHING AND EXAMINATION METHODS** | Lectures plus computer-lab sessions using material property databases and charts; project-based assessment; final written exam. | | |
| **COURSE OFFERED TO ERASMUS STUDENTS** | Yes (taught in English, subject to minimum enrollment). | | |
| **COURSE URL** | https://elearning.auth.gr/course/view.php?id=xxxxx | | |

| 2. LEARNING OUTCOMES | |
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| **Learning Outcomes** | • Translate design requirements into performance indices and selection criteria.<br>• Use material property charts and databases to screen and rank candidate materials and processes.<br>• Incorporate manufacturing constraints, joining, tolerances, and surface treatments into selection decisions.<br>• Account for degradation mechanisms (corrosion, wear, fatigue) and apply basic failure analysis reasoning.<br>• Perform preliminary cost and environmental impact comparisons to support design decisions.<br>• Document and justify a defensible materials selection for a product component. |
| **General Skills** | • Systems thinking in design decisions<br>• Data-driven decision making with uncertainty<br>• Project planning and teamwork |

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| | • Professional reporting and presentations |

| 3. COURSE CONTENT |
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| • The role of materials selection in product development; requirements and constraints.<br>• Performance indices and Ashby-type methodology; screening and ranking.<br>• Materials property charts; multi-objective selection and trade-offs.<br>• Materials and process compatibility; joining and surface engineering options.<br>• Cost modeling concepts and sensitivity; availability and supply risk considerations (overview).<br>• Degradation and reliability: corrosion, wear, fatigue; failure analysis basics.<br>• Selection for functional requirements: thermal management, electrical, optical, magnetic (overview).<br>• Sustainability and circularity metrics in selection (overview / introduction).<br>• Case studies using databases and real components. |

| 4. LEARNING & TEACHING METHODS - EVALUATION | |
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| **Teaching method** | Face-to-face. Lectures plus hands-on computer labs and case-study workshops. |
| **Use of ICT** | Computer-lab sessions using materials/property databases and charting tools; e-learning for datasets, templates, and submission; spreadsheet/Python for ranking and sensitivity analyses. |
| **Teaching organization** | The supervised and unsupervised workload per activity is indicated below (total workload complies with ECTS standards). |

| Activity | Workload/semester (hours) |
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| Lectures | 26 |
| Computer laboratories / workshops | 26 |
| Project (team) and report | 24 |
| Independent study | 56 |
| Exam preparation | 16 |
| Final written exam | 2 |
| **Total** | **150** |

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| **Student evaluation** | Assessment language: English.<br>Methods: written final exam (40%), team project/report and presentation (40%), quizzes/short assignments (20%). Students are informed via the course guide and e-learning announcements. |

| 5. SUGGESTED BIBLIOGRAPHY |
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| **EUDOXUS** |
| To be specified in EUDOXUS. |
| **Additional bibliography for study** |
| • M.F. Ashby, Materials Selection in Mechanical Design.<br>• M.F. Ashby & K. Johnson, Materials and Design.<br>• ASM Handbooks (selected sections) and materials datasheets. |

- Selected open courseware notes (indicative): Northwestern Materials Selection course materials.