# DEPARTMENT OF MATERIALS SCIENCE AND TECHNOLOGY
# COURSE SYLLABUS

| Course Details | | | | |
|---|---|---|---|---|
| **Code** | **Academic Year** | | | **Semester** |
| MWT301 | 3 | | | 1 |
| **Title** | **T** | **A** | **L** | **ECTS** |
| Real Crystals and Their Properties | 3 | 2 | | 6 |

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|---|---|---|---|---|---|---|
| **Language** | German | | | | | |
| **Level** | **Undergraduate** | **X** | **Graduate** | | **Postgraduate** | |
| **Department / Program** | Department of Material Science and Technology | | | | | |
| **Forms of Teaching and Learning** | Face to Face | | | | | |
| **Course Type** | **Compulsory** | **X** | **Elective** | | | |
| **Objectives** | The main aim of this course is to understand the interaction between the processing, microstructure and properties of the material and to provide the theoretical basis for how and why different processes (such as heat treatment) affect the atomic structure/order and microstructure of the material. | | | | | |
| **Content** | Point defects: thermodynamics and structure of intrinsic and extrinsic point defects, crystal plasticity: stress-strain curves, tristate curves, line defects: dislocation theory, detection of dislocations, interaction of point defects and impurities with dislocations: climbing, dislocations, solid solution hardening, surface defects: grain boundaries and surfaces, domain walls, interaction of point defects with surface defects, interaction of dislocations with grain boundaries: fine grain hardening, volume defects: formation and properties of precipitates, interaction of point, line and surface defects with precipitates, related defects and mechanical / electrical etc. with material properties | | | | | |
| **Prerequisites** | - | | | | | |
| **Coordinator** | - | | | | | |
| **Lecturer(s)** | Asist Prof.Dr. Çağatay Elibol | | | | | |
| **Assistant(s)** | - | | | | | |
| **Work Placement** | - | | | | | |

| Recommended or Required Reading | |
|---|---|
| **Books / Lecture Notes** | John D. Verhoeven: Fundamentals of Physical Metallurgy, Wiley, 1975<br>G. Gottstein: Physikalische Grundlagen der Materialkunde, Springer 2007<br>P. Haasen: Physikalische Metallkunde, Springer 1994<br>R.W. Cahn, P. Haasen: Physical Metallurgy (Vol. I, II, III), Elsevier 1996 |
| **Other Sources** | |

| Additional Course Material | |
|---|---|
| **Documents** | |
| **Assignments** | |
| **Exams** | |

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| Course Composition | | |
|---|---|---|
| **Mathematics und Basic Sciences** | | % |
| **Engineering** | | 70% |
| **Engineering Design** | | % |
| **Social Sciences** | | % |
| **Educational Sciences** | | % |
| **Natural Sciences** | | % |
| **Health Sciences** | | % |
| **Expert Knowledge** | | 30% |

| Assessment | | |
|---|---|---|
| **Activity** | **Count** | **Percentage (%)** |
| **Midterm Exam** | 1 | 40 |
| **Quiz** | | |
| **Assignments** | | |
| **Attendance** | | |
| **Recitations** | | |
| **Projects** | | |
| **Final Exam** | 1 | 60 |
| | **Total** | **100** |

| ECTS Points and Work Load | | | |
|---|---|---|---|
| **Activity** | **Count** | **Duration** | **Work Load (Hours)** |
| **Lectures** | 14 | 3 | 42 |
| **Self-Study** | 14 | 5 | 70 |
| **Assignments** | 4 | 5 | 20 |
| **Presentation / Seminar Preparation** | | | |
| **Midterm Exam** | 1 | 3 | 3 |
| **Recitations** | 14 | 3 | 42 |
| **Laboratory** | | | |
| **Projects** | | | |
| **Final Exam** | 1 | 3 | 3 |
| | | **Total Work Load** | **180** |
| | | **ECTS Points** (Total Work Load / Hours) | **6** |

| Learning Outcomes | |
|---|---|
| **1** | Students should be able to control & manipulate the atomic arrangement and microstructure of the material through different processes such as casting, machining and heat treatment to achieve the desired physical properties. |
| **2** | |

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| | |
|---|---|
| **3** | |
| **4** | |
| **5** | |
| **6** | |
| **7** | |
| **8** | |
| **9** | |
| **10** | |
| **11** | |
| **12** | |
| **Weekly Content** | |
| **1** | Plastic deformation of metals (mechanisms, critical shear stress, deformation of fcc single crystals and polycrystals) |
| **2** | Plastic deformation of metals (mechanisms, critical shear stress, deformation of fcc single crystals and polycrystals) |
| **3** | Crystal / lattice defects (dislocations, vacancy, interfaces) |
| **4** | Crystal / lattice defects (dislocations, vacancy, interfaces) |
| **5** | Crystal / lattice defects (dislocations, vacancy, interfaces) |
| **6** | Diffusion (phenomenological and atomistic view) |
| **7** | Diffusion (phenomenological and atomistic view) |
| **8** | Solidification of melts (homogeneous vs. heterogeneous nucleation & growth) |
| **9** | Solidification of melts (homogeneous vs. heterogeneous nucleation & growth) |
| **10** | Recovery & Recrystallization |
| **11** | Precipitation processes |
| **12** | Martensitic phase transformation |
| **13** | Special topics in physical metallurgy (strengthening mechanisms, high strength steels) |
| **14** | Special topics in physical metallurgy (strengthening mechanisms, high strength steels) |
| **15** | |

**Contribution of Learning Outcomes to Program Objectives (1-5)**

| | **P1** | **P2** | **P3** | **P4** | **P5** | **P6** | **P7** | **P8** |
|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 3 | 5 | 2 | 3 | 5 | 1 | 2 |
| **2** | | | | | | | | |
| **3** | | | | | | | | |
| **4** | | | | | | | | |
| **5** | | | | | | | | |
| **6** | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|
| **7** | | | | | | | | |
| **8** | | | | | | | | |
| **9** | | | | | | | | |
| **10** | | | | | | | | |
| **11** | | | | | | | | |
| **12** | | | | | | | | |

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|---|---|
| **Contribution Level** | 1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High |
| **https://obs.tau.edu.tr/oibs/bologna/progLearnOutcomes.aspx?lang=en&curSunit=207** | |
| **Compiled by:** | Res. Asst. Burak Evren |
| **Date of Compilation:** | 25.04.2022 |