POLITEHNICA University of Bucharest (**UPB**)
Faculty of Engineering and Management of Technological Systems (**IMST**)
Study Program: Industrial Engineering (**IE**)
Form of study: Master

# COURSE SPECIFICATION

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|---|---|---|---|
| ***Course title:*** | MECHANICAL BEHAVIOUR OF ENGINEERING MATERIALS | ***Semester:*** | 1 |
| ***Course code:*** | UPB.06.M1.O.02 | ***Credits (ECTS):*** | 6 |

| ***Course structure*** | Lecture | Seminar | Laboratory | Project | Total hours |
|---|---|---|---|---|---|
| *Number of hours per week* | 2 | | | 2 | 4 |
| *Number of hours per semester* | 28 | | | 28 | 56 |

| ***Lecturer*** | Lecture | Seminar / Laboratory / Project |
|---|---|---|
| *Name, academic degree* | GABRIEL JIGA | GABRIEL JIGA |
| *Contact (email, location)* | gabriel.jiga@upb.ro | gabriel.jiga@upb.ro |

***Course description:***

Phenomenology of mechanical behavior of materials at the macroscopic level. Relationship of mechanical behavior to material structure and mechanisms of deformation and failure. Topics include: elasticity, viscoelasticity, plasticity, creep, fracture, and fatigue. Case studies and examples drawn from a variety of classes of materials including: metals, ceramics, polymers, thin films, composites, and cellular materials. The course will focus on the design and processing of materials from the atomic to the macroscale to achieve desired mechanical behavior. The course is also focused on mechanical behavior of soft matter including cells, using state of the art atomic force microscopy and nano-indentation tools. Another area of investigation is in the field of combinatorial materials testing that encompasses simultaneous materials characterization along with testing to provide in-situ knowledge of the underlying micro-mechanisms of deformation.

***Seminar / Laboratory / Project description:***

1. General review of the material/application/mechanical behavior phenomenon you have chosen
2. Original research article highlighting mechanical behavior relevant to this material/application expressed as elasticity, plasticity, creep, fracture, and/or fatigue. This could be experimental, analytical, computational, or combination of three. This paper can be published from any period, but the more recent, the better.
3. Original research article explaining in detail the mechanisms of mechanical behavior discussed in article 2. This need not be in the same material class or application (e.g., analytical analysis of brittle fracture in ceramic oxides that are not, themselves, used as battery materials), but needs to include experimental, modeling, and/or computational

analyses of mechanical behavior that you feel *at this point* are over your head and difficult to understand based on your current knowledge.

***Intended learning outcomes:***

Gain practical experience in measurement and quantification of mechanical properties.

– Understand the physical and microstructure basis of mechanical properties.
– Become familiar with failure mechanisms of structural materials.
– Ability to predict the useful lifetime of a material under specific load conditions.
– Knowledge of how to incorporate material strength limitations into engineering design.
– Ability to determine states of stress in three dimensions.
– Ability to apply constitutive laws to solve deformable body problems
– Ability to formulate problems involving multi-dimensions and apply failure theories.
– Recognition of failure mechanisms and identify key mechanical properties and analyses and/or experiments needed to determine cause of failure and evaluate solutions to prevent failure

| ***Assessment method:*** | % of the final grade | Minimal requirements for award of credits |
|---|---|---|
| Written exam | 40 | 20 |
| Report / project | 20 | 10 |
| Homework | 20 | 10 |
| Laboratory | 20 | 10 |
| Other | | |

***References:***


1. Thomas H. Courtney, Mechanical Behavior of Materials, 2nd Edition (Waveland Press, 2000). ISBN: 978-1-57766-425-3
2. N.E. Dowling, Mechanical Behavior of Materials, 3rd Edition, Pearson Prentice Hall, 2007.


| ***Prerequisites:*** | ***Co-requisites*** ***(courses to be taken in parallel as a condition for enrolment):*** |
|---|---|
| Strength of materials Mechanics of Composite materials, Sandwich structures, Structure and Properties of Materials | Elasticity and Plasticity |

***Additional relevant information:***

Date: 13.06.2017

Professional degree, Surname, Name: **Prof.Dr.Ing. Gabriel JIGA**