# Subject programme

1. Subject name / subject module: **Strength of Materials**
2. Lecture language: **English**
3. The location of the subject in study plans:
   - Area or areas of the studies: **Computer Engineering and Mechatronics**
   - Degree of the studies: **1st degree studies**
   - Ftield or fields (implementation of effects standard): **Mechatronics**
4. Supervision of subject implementation:
   - The Institute / Another unit: **Institute of Informatics and Mechatronics**
   - The person responsible for the subject: **Gireń Bolesław, prof. dr hab. inż.**
   - People cooperating in the development of the programme of the subject:
5. The number of hours and forms of teaching for individual study system and the evaluation method:

| Teaching activities with the tutor | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mode of study | Form of classes | | | | | | | | | | | | | | | | | | | | | Total |
| | ... | SOW | ECTS | Laboratory work | SOW | ECTS | ... | SOW | ECTS | ... | SOW | ECTS | ... | SOW | ECTS | ... | SOW | ECTS | ... | SOW | ECTS | ECTS |
| Full-time studies | | | | 27 | 36 | 2,5 | | | | | | | | | | | | | | | | **2,5** |
| Part-time studies | | | | | | | | | | | | | | | | | | | | | | |
| Credit rigor | | | | Graded assignment | | | | | | | | | | | | | | | | | | |

6. Student workload – ECTS credits balance:
   *1 ECTS credit corresponds to 25-30 hours of student work needed to achieve the expected learning outcomes including the student's own work*

| **Activity** (please specify relevant work for the subject) | **Hourly student workload (full-time studies/part-time studies)** |
|---|---|
| Participation in lectures | - |
| Participation in laboratory classes | 27 |
| Preparation to laboratory classes | 12 |
| Preparation of homeworks | 10 |
| Independent study of the subject | 6 |
| Preparation of final project | 6 |
| Participation in an exam / graded assignment | 2 |
| Total student workload (TSW) | 63 |
| ECTS credits | 2,5 |
| * Student's workload related to trainings | 63 |
| Student's workload in classes requiring direct participation of academic teachers | 27 |

7. Implementation notes: recommended duration (semesters), recommended admission requirements, relations between the forms of classes:
   - Recommended admission requirements – none.
   - Recommended duration of the subject is taken from the course plan.
8. Specific learning outcomes – knowledge, skills and social competence:

| **Specific learning outcomes for the subject** | | **Form** | **Teaching method** | **Methods for testing of (checking, assessing) learning outcomes** |
|---|---|---|---|---|
| **Outcome symbol** | **Outcome description** | | | |
| **Knowledge** | | | | |
| **K_W02** | **A student has the knowledge on the characteristics and properties of the materials which is necessary to understand the complex relationships between mechanical systems and various external loadings. Student knows results of various loadings - tensil** | **Laboratory work** | **Inquiry methods** | **Student learning activities.** |
| **K_W09** | **A student knows and understands issues relating to materials used in mechatronics and the practical applications of this knowledge, i.e. knows the requirements materials should satisfy for various specific applications, characteristics of the materia** | | | |
| **Skills** | | | | |
| **K_U11** | **A student can predict material performance under given conditions and possible influence of stresses and deformations on mechatronics device operation. Student can assess the operating lifetime of the facility. Student can recognise and distinguish t** | **Laboratory work** | **Inquiry methods** | **Student learning activities.** |
| **K_U15** | **A student is able to assess the suitability and choice of methods and tools to solve mechanical tasks in the field of mechatronics, including computational determination of the simple systems performance and experimental determination of materials st** | | | |

**9.** Assessment rules / criteria for each form of education and individual grades

| | | | |
|---|---|---|---|
| **0% - 50%** | ndst | **80% - 86%** | db |
| **51% - 70%** | dst | **87% - 93%** | db+ |
| **71% - 79%** | dst+ | **94% - 100%** | bdb |

| Activity | Grades | Calculation | To Final |
|---|---|---|---|
| Homework - 10 jobs | 5 * (number of jobs X)/10 | 0.4 * 5 * (X/10) | 0.4 * 5 |
| 5 Lab tasks | Y = sum of the grades | 0.4*5*(y/5) | 0.4 * 4 |
| Project on material characterization | z=grade | 0.2 * z | 0.2 * 5 |
| Final result | | | 4,6 |
| Grade | | 4,6/5 = 92% | **Db+ (4,5)** |

**10.** The learning contents with the form of the class activities on which they are carried out:

(Laboratory work)

Durability, strength and resistance of materials. Constitution and structure of materials, elasto-plastic and brittle materials, physical and mechanical properties of solid states, properties dependence on the structure and the physical state of the materials, physical quantities and the units of measurements, materials characterization, standardized parameters, methods of materials investigation, rules and principles as referred to rigid body and continuum, types of loads. Passive and active forces, surface and body forces, internal forces, loads, stresses, strains, quasi-equillibrium static and dynamic processes, homogeneity and anisotropy. Stress and strain tensors, fundamentals of theory of elasticity, stress-strain diagram at uniaxial loading, hysteresis of deformation, strength parameters, temperature characteristics of the strength parameters variations, dependence of strain-stress relationship on the rate of deformation, yield point for plastic deformation, tensile strength, impact strength, toughness, hardness, fatigue strength, shear, bending-stress and strain state, deflection line, torsion, stresses within the bar during torsion, fracture, fatigue process, degradation and wear processes, fundamentals of fracture mechanics, the Griffith theory, environmental interactions and loadings, temperature and radiation influences, resistance of various materials to damage, materials performance under various loadings of various intensity.

**11.** Required teaching aids:

Lecture - multimedia projector

Laboratory classes - specialist laboratory

**12.** Literature:

a. Basic literature:

- K.Ramesh, Strength of Materials, Laboratory Manual, 2003, IIT Madras; avaiable at: https://home.iitm.ac.in/kramesh/Strength%20of%20Materials%20Laboratory%20Manual.pdf

b. Supplementary literature:

- Pytel A. and Singer F.L., Problems in Strength of Materials - Solution Manual B; 2016
- R.K. Bansal, Strength of materials, 2012
- R. W. Hertzberg, R. P. Vinci, J. L. Hertzberg, Deformation and Fracture Mechanics of Engineering Materials,

c. Internet sources:

- https://www.academia.edu/34277150/Mechanics_of_Materials_7th_edition_beer.pdf

**13.** Available educational materials divided into forms of class activities (Author's compilation of didactic materials, e-learning materials, etc.)

**14.** Teachers implementing particular forms of education:

| Form of education | Name and surname |
|---|---|
| 1. Lecture | |
| 2. Laboratory classes | Gireń Bolesław, prof. dr hab. inż. |
| 3. Training | |
| 4. Project classes | |
| 5. Workshop classes | |
| 6. Simulation game | |
| 7. Language classes | |