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| To be completed by Course Team | Module name :  **Welding processes and technology** | | | | | | Module code: | | |
| Course name:  **Welding processes and technology** | | | | | | Course code: | | |
| Faculty:  **Institute of Technology** | | | | | | | | |
| Field of study:  **Mechanical engineering** | | | | | | | | |
| Mode of study :  **STATIONARY** | | | Learning profile:  **PRACTICAL** | | | Speciality: | | |
| Year/ semester: | | | Module/ course status: | | | Module/ course language:  **Consultation in English** | | |
| Type of classes | lecture | lessons | | lab | project | | tutorial | other (please specify) |
| Course load | **15** |  | | **7,5** |  | |  |  |

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| Module/ course coordinator | Prof. Jerzy Łabanowski |
| Lecturer | Prof. Jerzy Łabanowski PhD, DSc, Eng.  Dr inż. Anna Rehmus-Forc |
| Module/ course objectives | The aim of this course is to provide students with the general knowledge on welding processes and technology; especially, introduction to thermal joining and cutting of metals, welding metallurgy and steel weldability. |
| Entry requirements |  |

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| **LEARNING OUTCOME** | | |
| Nr | LEARNING OUTCOME DESCRIPTION | Learning outcome reference |
| 1 | Student knows the basic technologies of welding and cutting of metals and alloys | K1P\_W13 |
| 2 | Student knows rules for the selection of materials for welded structures and characterize their behaviour during welding | K1P\_W09 |
| 3 | Student recognizes and classifies methods of welding and cutting | K1P\_U18 |
| 4 | The student is able to select the appropriate parameters in various welding processes | K1P\_U17 |

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| **CURRICULUM CONTENTS** |
| **Lecture** |
| Welding methods an overview: History of welding, terminology, distortion, the welding arc shielding gases, power sources. Gas welding. Materials and device for gas welding. Oxy-acetylene flame. Welding technology and technique. Welding parameters. Gas welding of steel and non-ferrous metals. Metal arc welding with coated electrodes. Description of the method, equipment, electrodes, weld defects. Semi-automatic gas-shielded welding with a consumable electrode (MIG / MAG). Construction of power sources and wire feed systems. Shielding gas selection. Steel welding technology with the MIG / MAG method. Semi-automatic welding in argon shield with a non-consumable electrode (TIG). Construction of power sources and gas system. Welding technique. Welding parameters of stainless steel and Al alloys.  Submerged arc welding. Description, equipment, filler material, the effect of the welding parameters, productivity improvements.  High-energy welding methods. Plasma welding. Laser welding. Electron beam welding.  Pressure welding methods. Resistance welding. Friction welding. Ultrasonic welding. Explosion welding. Magnetic pulse welding. Cold pressure welding. Diffusion welding. Cutting methods. Thermal cutting. Water jet cutting. Soldering and brazing. Soft soldering. Brazing. The weldability of steel. Carbon steels. High-strength and extra high-strength steels. Austenitic steels. Control methods of welded joints. DT and NDT methods. |
| Laboratory |
| Gas welding. Electric welding with a coated electrode (MMA). Semi-automatic gas-shielded welding with a consumable electrode (MIG / MAG) and with a non-consumable electrode (TIG). |

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| Basic literature | 1. Weman K., Welding processes handbook. Woodhead Publishing Ltd., 2003. 2. Welding, brazing and soldering, Metals Handbook, vol. 6. American Society for Metals, Metals Park, Ohio 1993. 3. O’Brien R., (Ed) Jefferson’s Welding Encyclopedia, Eighteenth Edition, American Welding Society, 1993. |
| Additional literature |  |

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| Teaching methods | | Lecture with multimedia presentation, individual and teamwork at laboratory, individual consultations with the lecturer. | |
| Assessment method | | | Learning outcome number |
| Exam: written examination – theory | | | 1, 2, 3 |
| Project and laboratory work : assessment of laboratory work | | | 4 |
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| Form and terms of an exam | lecture: written examination  Laboratory work : assessment of laboratory work | | |

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| **STUDENT WORKLOAD** | | |
| Type of activities/activities | Number of hours | |
| Total | Including related activities with practical training |
| Participation in lectures | 15 |  |
| Independent study of lecture topics | 12,5 |  |
| Participation in tutorials, labs, projects and seminars | 7,5 | 7,5 |
| Independent preparation for tutorials\* |  |  |
| Preparation of projects/essays/etc. \* | 15 |  |
| Preparation/ independent study for exams | 15 |  |
| Participation during consultation hours | 5 |  |
| Other |  |  |
| **TOTAL student workload in hours** | 70 |  |
| **Number of ECTS credit per course unit** | **4** | |
| Number of ECTS credit associated with practical classes | **1,7** | |
| Number of ECTS for classes that require direct participation of professors | **1,4** | |