# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Manufacturing of surface layers by welding methods [S1IMat1>WWWMS]

## Course

Field of study
Materials Engineering

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

## Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

## Number of credit points

3,00

## Coordinators

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## Lecturers

## Prerequisites

Basic knowledge in the field of physics, materials science. Ability to think logically, use information from the library and the Internet. understanding of the need to learn and acquire new knowledge.

## Course objective

Learn about methods and ways of producing top layers by welding methods. Understanding the properties and applications of such layers.

## Course-related learning outcomes

Knowledge:
1. the student should characterize the types of top layers produced by different welding methods. [k_w02, k_w03, k_w07, k_w08]
2. the student should select the parameters of the process of making top layers by welding methods. - [k_w07, k_w10, k_w16]
3. the student should define the elements of the construction of the top layers produced by welding methods. - [k_w10, k_w12]

Skills:
1. the student can operate welding equipment. - [k_u01, k_u05, k_u12]
2. the student can choose the initial conditions of the processes of making top layers. - [k_u08, k_u21]
3. the student is able to plan the processes of making top layers. - [k_u07, k_u09, k_u21]

Social competences:
1. the student can cooperate in a group - [k_k01, k_k03, k_k04]
2. the student is aware of the role of top layer manufacturing processes by welding methods in the modern economy and society. - [k_k06, k_k07]

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture: pass on the basis of a colloquium consisting of 5 general questions (pass in case of correct answer to min. 3 questions: <3 = ndst, 3 = dst, 3,5 = dst+, 4 = db, 4,5 = db+, 5 = bdb) carried out at the end of the semester.
Laboratory: Based on an oral or written response to the content of each laboratory exercise performed, a report of each laboratory exercise according to the indications of the laboratory exercise operator. In order to be counted in laboratories, all exercises must be completed (positive assessment from the response and report).

## Programme content

Lectures:
1.Construction and operation of welding equipment.
2.Welding methods of surface layering by gas burner, MMA, TIG, MIG/MAG, microplasm and heat spraying by flame, arc, supersonic, plasma, cold gas spraying).
3.Properties of connections of different materials.
4.Characteristics and classification of additional materials for welding.
5.Properties of top layers produced by different welding methods.
6.The role of parameters for the manufacture of top layers by incinerator methods in shaping the properties of layers.
Laboratories:
1.Top layering by gas burner, MMA, GTA, GMA, SAW, plasma and microplasm layers and by flame spraying.
2.Study of the effect of the amount of heat introduced on the geometry of the welds and the contribution of the substrate material to the welds.
3.Testing of the properties of flame sprayed top layers without melting and melting.
4.Comparison of the performance of welded and thermally sprayed layers by different methods.

## Course topics

The subject of the course Manufacturing of Surface Layers by Welding Methods includes the possibility of using welding-related methods to change the properties of the surface layer. Topics describe additive methods that use diverse additive materials due to their form and chemical composition. The course topics explain the differentiation of metallurgical processes into invasive and non-invasive with relation to the reactions occurring between the additive material and the substrate. The metallurgy of producing surface layers by differentiated methods will also be explained in depth, because of the rate of heating, the amount of heat introduced and the extent the zone of microstructural transformation. Thermal spraying methods will be explained in detail in the chronology of spray gun power and spray jet energy, as well as the coating materials used in relation to their morphology and form. The course will conclude with a presentation the application of thermal spraying methods significantly expanding the possibility of using materials with limited resistance to the operating environment and protected by a coating and, ultimately, working in conditions where their application and long-term operation were previously impossible.

## Teaching methods

Microsoft® Translator
1. Lecture: multimedia presentation, presentation illustrated with examples given on the board,
2. Laboratory exercises: practical exercises, performing experiments, discussion, teamwork, case study.

## Bibliography

Basic
1. Napawanie i natryskiwanie cieplne, Klimpel A., WNT, Warszawa, 2000,
2. Maszyny i urządzenia spawalnicze, Dobaj E., WNT Warszawa, 1998.
Additional
1. Poradnik Inżyniera Spawalnictwo cz.1, Pilarczyk J., WNT, Warszawa, 2001,
2. Spawalnictwo, Ferenc K., WNT, Warszawa, 2007.

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 30 | 2,00 |
| Classes requiring direct contact with the teacher | 15 | 1,00 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 15 | 1,00 |