COURSE DESCRIPTION CARD - SYLLABUS

Course name
Welding process engineering [S1MiTPM1>PPS]

Course

Field of study
Materials and technologies for automotive industry

Year/Semester
4/7

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

2,00

Coordinators

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Lecturers

Prerequisites

The student has basic knowledge of physics, material science, chemistry, environmental protection, mechanics. Has the ability to think logically, use information obtained from the library and the Internet. Understand the need to learn and acquire new knowledge.

Course objective

To know the operating conditions of automotive parts, which consists of temperature and mechanical load that are the initial conditions for the design of the welding treatment process in terms of the selection of coating material and its form, and the manufacturing method with process parameters.

Course-related learning outcomes

Knowledge:
1. The graduate knows and understands the operating environment of automotive parts.
2. The graduate knows and understands the metallurgy of the welding surfacing and thermal spraying processes using various methods to provide the expected properties of automotive parts.
3. The graduate knows and understands the ways and necessity of preparing the surface of the native material before the bonding process.

4. The graduate knows and understands the need for continuous modernization of welding processes in relation to the scale of production demand in the automotive aspect.

Skills:
1. The graduate is prepared to independently recognize the problem of selection of materials of additional process parameters and welding workmanship ensuring the effect in accordance with the expectations arising from the operating environment of automotive parts.
2. The graduate is prepared to analyze the course of welding processes and make adjustments to the process on the basis of observation of current work effects.
3. The graduate is able to design bonding processes with regard to obtaining a favorable economic factor and with concern for the environment and ecology.

Social competences:
1. The student is able to cooperate in a group.
2. The student is aware of the role of automotive welded joint testing and inspection processes in the modern economy and for society.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: credit on the basis of a colloquium consisting of 5 general questions (credit in case of correct answers to min. 3 questions: <3 = ndst, 3 = dst, 3.5 = dst+, 4 = db, 4.5 = db+, 5 = bdb) conducted at the end of the semester.
Laboratory: Credit on the basis of an oral or written answer on the content of each laboratory exercise performed, a report on each laboratory exercise as indicated by the instructor of laboratory exercises. In order to receive credit for the laboratory exercises, all exercises must be passed (a passing grade on the answer and a passing grade on the report).

Programme content

Presentation the possibilities of using modern welding systems to change the properties of welded nodes and to change the properties of the surface layer in terms of operational load. Presentation methods of selecting the welding process and additional material for the prevailing environment and operational expectations. Discussion of the use an additional materials protecting against electrolytic corrosion, high-temperature gas corrosion, erosion, abrasion and impact loading. Presentation the possibilities of computer-aided design of welding processes, the use of robotic systems and an explanation of the importance of the human factor in welding processes.

Course topics

Lectures:
1. Characterization of the type and size of automotive components to be welded as a basic criterion for the selection of the method and apparatus in terms of low/high energy welding.
2. Preparation of the parent material for welding, surfacing and thermal spraying as a key technological procedure determining the correct welding metallurgy, adhesion and cohesion of coatings.
3. Define the apparatus facilities due to weight, dimensions and production scale in the high-volume aspect of automotive production.
4. Define the human factor in modern welding production and justify the use of robotic welding systems in high-volume automotive production.
5. Select the welding method with regard to energy density, heating and cooling dynamics, and obtaining the best possible welding results for components protected against corrosion with zinc coating.
Laboratories:
1. Performance of welded joints using modern welding materials in the form of solid and powder wires - analysis of SWC in terms of strength of welded and welded joints.
2. Characterization of the number of cycles describing the service life of electrodes used in spot welding in the automotive industry.
3. Qualitative analysis of joints made by low-energy arc, laser micro-plasma and electron beam methods.
4. Analysis of the extent of the heat-affected zone in the aspect of welding with low-energy and high-

energy methods due to the amount of heat introduced.

Teaching methods

1. Lecture: multimedia presentation, presentation illustrated with examples provided on the board, discussion of the physically presented exhibits.
2. Laboratory: discussion of the issue by the instructor in order to substantively prepare students for the course of the classes. Preparation of equipment, materials and details for analysis / technological process / laboratory operational tests. Registration of analysis and measurement results constituting the basis for preparing a report on the classes.

Bibliography

Basic:
1. Pilarczyk J., Poradnik Inżyniera Spawalnictwo cz.1 i 2 WNT, Warszawa, 2001,
2. Klimpel A.,: Napawanie i natryskiwanie cieplne, WNT Warszawa 2000.

Additional:
1. global scientific literature resources like SCOPUS, Elsevier, etc. for keywords or phrases - “welding process design, automotive”.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00