COURSE DESCRIPTION CARD - SYLLABUS

Course name
Modern techniques for bonding vehicle constructions [S1MiTPM1>NTSKP]

Course

Field of study
Materials and technologies for automotive industry

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

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 learn about modern minimally invasive with high energy density welding methods used in automotive manufacturing. To learn and understand the essence of welding with modern techniques in view of the human, energy and economic factor. To realize the direction and need for development in the aspect of modern welding in view of the reduction of introduced heat, reduction of the degree of mixing of components and reduction of the thickness of coatings.

Course-related learning outcomes

Knowledge:
1. The graduate should characterize welding heat sources in terms of the amount of thermal energy generated and its density in relation to the metallurgy of the process.
2. The graduate should select the parameters of the welding process by selected methods.

3. The graduate should define the types of joints produced by welding methods and the surface condition of coatings.

Skills:
1. Graduates are able to operate modern welding equipment.
2. The graduate is able to select the initial conditions of welding processes using modern welding materials.
3. Graduates can plan tasks that enable the implementation of modern welding processes.

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

As part of the subject, issues related to the construction and operation of modern welding equipment will be explained. Various heat sources will be characterized due to their interaction with the base material in terms of energy density and the rate of heating and cooling of the joint and the range of the heat-affected zone during welding. Modern additional materials used in welding, surfacing and thermal spraying, such as solid wires, cored wires and powders of various morphologies, will be described. The metallurgy of high-performance and low-energy welding using heat sources in the form of an electric arc, electron beam, micro-plasma and plasma jet and laser beam using modulation and regulation of spot geometry will be explained.

Course topics

Lectures:
1. Construction and principle of operation of modern welding equipment used in vehicle manufacturing.
2. Characteristics of welding heat sources for selected modern power sources.
3. Modern welding consumables in the form of wires and powders for automotive applications.
4. Characteristics and classification of welding consumables.
5. Properties of joints and properties of surface layers produced by modern welding methods dedicated to matorization.
6. The course of welding processes and the benefits of using modern welding methods in view of the human, energy and economic factor in the global automotive market.
Laboratories:
1. Performance of welded joints using modern welding materials in the form of solid and powder wires - SWC analysis.
2. Making weld beads using modern welding materials in the form of solid and powder wires and powders.
3.Fabrication of surface layers by welding methods using additive materials in the form of powders.
4.Study of selected performance properties of the produced welds and surface layers.
5.Comparison of the obtained results with the properties of the joints obtained using commonly used additive materials in for a load typical of vehicle operation.

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, WNT, Warszawa, 2001,
2. Klimpel A.,: Napawanie i natryskiwanie cieplne, WNT Warszawa 2000.

Additional:
World scientific literature resources like SCOPUS, Elsevier, etc. for keywords or phrases - “modern bonding techniques, automotive”.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	32	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	18	0,50