COURSE DESCRIPTION CARD - SYLLABUS

Course name

Advanced manufacturing processes in mechatronics

Course

Field of study

Mechatronics

Year/Semester

1/1

Area of study (specialization)

-

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

15

Laboratory classes

15

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

dr inż. Marek Rybicki

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Responsible for the course/lecturer:

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Prerequisites

1) The student has basic knowledge of physics, mathematics, mechanics, the basics of material removal manufacturing processes

2) The student is able to use the acquired knowledge to analyze new manufacturing techniques and knows how to use information obtained from the library and the Internet

3) The student is independent in solving problems, acquiring and improving the acquired knowledge and skills, understanding the need to learn

Course objective

Acquaintance with tendencies in manufacturing processes, mechatronic tools and tooling equipment, machine tools for complex, micro and erosion machining. Acquiring skills of modern manufacturing technology selection of parts with specified shape and surface layer properties.

Course-related learning outcomes

Knowledge

1) He has extensive knowledge of manufacturing techniques of mechanical parts, mechatronics devices including world trends, micromachining applications and microtools, high speed machining processes, processing of constructional materials by energy beam (laser, plasma, water jet, ultrasonic etc.), economic and quality aspects of product design mechatronic.

Skills

1) He is able to obtain information from the Internet, literature, databases and other properly selected sources (mostly in English) in the field of mechatronics; He can integrate obtained information, interpret it, draw conclusions as well as formulate and justify the opinions.

2) He is able to choose advanced machining methods to make mechanical parts. He is able to identify opportunities and need for micro-machining and machining with high speed mechanical parts of mechatronic devices.

Social competences

1) Correctly identifies and resolves dilemmas related to the profession.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Written examination (in case of answer on: from 50 to 60% questions – satisfactory, above 60 to 70% – satisfactory plus, above 70 to 80% – good, above 80 to 90% – good plus, above 90 to 100% – very good grade)

Laboratory: Reports from the classes. Absence from the classes must not cross 1/3 to pass it.

Programme content

1) Classification of manufacturing processes, conditions of material decohesion, kinematics of machining.

2) High speed machining (HSM) and high performance machining (HPM).

3) Hard machining (HM).

4) Complete machining.

5) Micromachining of microelectromechanical systems MEMS (etching, LIGA and others).

6) Finish machining (grinding with ultrasonic assistance, honing, superfinishing, lapping, vibratory and rotary finishing, abrasive flow machining, abrasive blasting, brush deburring).

7) Burnishing of important surfaces and threads.

8) New techniques of cooling/lubrication of cutting zone (MQL, MQCL, SSP, HPC etc.).

9) Mechatronic tools and tooling equipment.

10) Electro-erosion machining (electro discharge and wire electro discharge machining) as well as electro-chemical machining.

11) Stream-erosion machining: cutting by laser, waterjet and abrasive waterjet, plasma as well as electron beam.

12) Hybrid machining (machining and electro erosion with ultrasonic assistance, machining with heating of work material, electrochemical grinding and others).

13) Lasers in manufacturing (cleaning, texturing, engraving, marking, cladding, drilling, selective sintering etc.)

Teaching methods

Lecture: multimedia presentation, discussion

Laboratory: performing laboratory exercises and developing reports according to the instructions in the outline

Bibliography

Basic

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3. Erbel J. (red.): Encyklopedia technik wytwarzania w przemyśle maszynowym tom II. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2001

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8. Siwczyk M.: Obróbka elektroerozyjna. Technologia i zastosowanie. WNT, Warszawa 1981

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10. Oczoś K., Kształtowanie materiałów skoncentrowanymi strumieniami energii. WUPR, Rzeszów 1988

Additional

1. Oczoś K., Efektywność innowacyjnych technologii na przykładzie wybranych sposobów obróbki strumieniowo-erozyjnej, Mechanik, 2003 nr 8-9, s. 463-468

2. Gupta K., Jain, Neelesh K. J., Laubscher R. F., Hybrid Machining Processes: Perspectives on Machining and Finishing. Springer, 2016

3. Grzesik W., Advanced Machining Processes of Metallic Materials: Theory, Modelling and Applications. Elsevier, 2008

4. John F. R., Industrial applications of lasers. Elsevier Inc., 1997

5. Brandt M., Laser Additive Manufacturing:Materials, Design, Technologies, and Applications. Woodhead Publishing, 2016

6. Davim J.P., Jackson M.J. Nano and Micromachining. John Wiley & Sons, Inc., NJ USA 2009.

7. Ion J. C., Laser Processing of Engineering Materials: Principles, Procedure and Industrial Application. Elsevier Ltd., 2005

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	30	1,0

[1] delete or add other activities as appropriate