COURSE DESCRIPTION CARD - SYLLABUS

Course name

Subtractive technologies

Course

Field of study

Management and Production Engineering

Year/Semester

1/2

Area of study (specialization)

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

polish

Form of study

part-time

Requirements

compulsory

Number of hours

Lecture

10

Laboratory classes

10

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

PhD Tadeusz Chwalczuk

email: tadeusz.chwalczuk@put.poznan.pl

ph. +48 61 665 27 23

Faculty of Mechanical Engineering

Piotrowo 3, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Student has basic knowledge in: basics of machining, mathematics, physics, mechanics. Student is able to apply the acquired knowledge to the analysis of the modern subtractive manufacturing technologies and to use information acquired from the library and internet. Student has the independence in troubleshooting, acquiring and improving the knowledge, understands the need for learning.

Course objective

Introducing the characteristics of modern solutions in terms of subtractive machining, orientation of students to acquiring new knowledge related to the new solutions, as well as its evaluation.

Course-related learning outcomes

Knowledge

1. Student recognizes the modern tendencies and development directions in a range of subtractive technologies.

Skills

1. Acquiring the information regarding modern manufacturing processes in mechanical engineering, integration of acquired information and their interpretation, as well as formulation of conclusions and ability to justification of these statements.

2. Student is able to develop the opinion regarding part's manufacturing technology.

3. Student is able to select the modern subtractive technologies to conduct the manufacturing processes, and to improve the manufacturing system's effectiveness by the integrating activities.

Social competences

1.Student correctly identifies and solves the problems connected with technologist's profession in a range of subject's program.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Exam from the contents presented during the lectures

Lab: Qualification based on appropriate execution of activities and report from the each of the lab activities, according to lecturer's remarks. During the lab, the student's theoretical knowledge related to the activity is being evaluated orally by the lecturer. In order to credit the lab, all activities have to be passed. (positive grade from oral answer and reports).

Programme content

1) Introduction on the classification and essence of individual manufacturing techniques

2) High Efficiency Machining (High Cutting Speed HSM, High Efficiency HPM, High Feed HFM)

3) New cutting tools (multi-purpose, for high-performance 3D surface machining, for deburring, etc.)

4) New cutting zone cooling / lubrication techniques (minimum lubrication MQL, minimum cooling MQCL, air cooling SSP, high pressure liquid cooling HPC etc.)

5) Complete machining (examples of structures and new machining cycles of modern turning and milling centers enabling: milling, grinding, turn-miling, machining of gears and cams, and erosive machining).

6) Micro machining (etching, lithography + etching, LIGA technique, EFAB technique, microstereolithography, micro-cutting, processing with pico and femtosecond lasers)

7) The use of lasers in manufacturing techniques (cleaning, structuring, engraving, marking, padding, hollowing, cutting, selective sintering, etc.)

8) Combined and hybrid machining (machining and electro-erosion with ultrasonic assistance UAM and EDUM, laser assisted machining by LAM, electrochemical grinding ECG and others)

Teaching methods

1. Lecture: multimedia presentation, examples illustrated, discussion and problem analysis.

2. Laboratory: practical classes, problem solving, discussion, teamwork.

Bibliography

Basic

1. Cichosz P. (red.), Obróbka skrawaniem, Wysoka produktywność (Rozdz. 5. Oczoś K., Obróbka wysoko produktywna wiodącym trendem obróbki skrawaniem, s.31-50), Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2007.

2. Kawalec M., Efekty technologiczne obróbki na twardo materiałów metalowych, Mechanik, 2006 nr 1, s. 20-25.

3. Oczoś K., Hybrydowe procesy obróbki ubytkowej - istota, przykładowe procesy, wyzwania rozwojowe, Mechanik, 2000 nr 5-6, s. 315-324.

4. Oczoś K., Kształtowanie mikroczęści, charakterystyka sposobów mikroobróbki i ich zastosowanie, 1999 nr 5-6, s. 309-324.

5. Oczoś K., Obróbka kompletna, obrabiarki, metody, narzędzia, Mechanik, 1999 nr 3, s. 123-135.

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Additional

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

2. Grzesik W., Advanced Machining Processes of Metallic Materials, Elsevier B.V., 2008.

3. Grzesik W., Podstawy skrawania materiałów konstrukcyjnych, WNT 2010.

4. Jurgen L., Werkzeuge fur die Hochgeschwindigkeitsbearbeitung, C. Hanser Verlag Munchen, Wien, 1999.

5. Kusiński J.: Lasery i ich zastosowanie w inżynierii materiałowej. Wydawnictwo Naukowe ?Akapit?, Kraków 2000,

6. Oczoś K., Kształtowanie ceramicznych materiałów technicznych, Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów, 1996.

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

8. Praca pod redakcją Żebrowskiego H., Techniki wytwarzania. Obróbka wiórowa, ścierna i erozyjna, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2004.

9. Tonshoff H.K., Denkena B., Spanen. Grundlagen, Springer-Verlag Berlin Heidelberg , Berlin, 2004.

10. Czasopisma naukowo - techniczne, Mechanik, Werkstatt und Betrieb, Industr. Diam. Rund.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	30	1,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	45	1,5

[1] delete or add other activities as appropriate