



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Advanced manufacturing techniques [S1ETI2>ZTW]

### Course

Field of study	Year/Semester
Education in Technology and Informatics	3/6
Area of study (specialization)	Profile of study
–	general academic
Level of study	Course offered in
first-cycle	Polish
Form of study	Requirements
full-time	compulsory

### Number of hours

Lecture	Laboratory classes	Other
15	0	0
Tutorials	Projects/seminars	
15	0	

### Number of credit points

2,00

### Coordinators

dr inż. Marek Rybicki  
marek.rybicki@put.poznan.pl

### Lecturers

### Prerequisites

The student has basic knowledge of physics, mathematics and mechanics. The student is able to use the acquired knowledge to analyze specific manufacturing techniques and is able to use information obtained from the indicated sources. The student shows independence in solving problems, gaining and improving the acquired knowledge and skills, understanding the need to learn.

### Course objective

1. Acquainting future engineers with kinematics, technological possibilities, machine tools and tools for various cutting and eroding methods. 2. Understanding the method of calculating theoretical roughness, parameters, moment forces and cutting power. Acquiring the ability to select the material and geometry of the blade, cutting and eroding parameters.

### Course-related learning outcomes

Knowledge:

1. has basic knowledge of technologies for producing and processing engineering materials.

Skills:

1. is able to obtain information from literature, databases and other sources, integrate it, interpret it and draw conclusions, formulate and justify opinions.
2. is able to select appropriate manufacturing technologies to design products, their structure and properties, recognizing social, economic, ecological and legal aspects.

Social competences:

1. understands the need for continuous education (e.g. by participating in courses and postgraduate studies) in order to improve professional and social competences and the need to think and act in an entrepreneurial and innovative way.
2. is aware of the importance of engineering activities and their non-technical aspects, including the impact on the environment.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Written exam (in case of answers to: from 50 to 60% of questions - dst, above 60 to 70% - dst +, above 70 to 80% - db, above 80 to 90% - db +, above 90 to 100% - very good)

Classes: Assessment based on tests from previous classes and tasks to be completed at home. In order to obtain credit for the exercises, the number of absences cannot exceed 1/3 of the classes. In case of solving from 50 to 60% of the tasks - dst, above 60 to 70% - dst +, above 70 to 80% - db, above 80 to 90% - db +, above 90 to 100% - very good)

### Programme content

The program content concerns the selection of appropriate manufacturing techniques of various engineering materials by removal (cutting and erosion) and addition. Computational exercises in the subject are related to the selection of tools from catalogs and manufacturing parameters in order to obtain a specific structure and properties of products.

### Course topics

Lecture

- 1) Classification of manufacturing techniques.
- 2) Kinematics and technological possibilities of various cutting methods:
  - a. performed with tools with defined geometry (turning, milling, drilling operations, broaching, chiselling),
  - b. performed with tools of undefined geometry (grinding, ultrasonic assisted grinding, honing, oscillating superfinishing, abrasive transfer machining, rotary / vibration abrasive machining, abrasive blasting).
- 3) The essence and technological possibilities of erosive machining.
  - a. EDM machining (drilling and cutting),
  - b. Electrochemical treatment
  - c. Erosion blasting (cutting: laser, water jet and abrasive water jet, plasma and electron beam, laser assisted machining)
- 4) The essence and application of additive processing (laser cladding, selective laser sintering)
- 5) Materials for machining and erosion tools.
- 6) Accuracy and roughness achieved with various machining methods.
- 7) Machinability of various materials
- 8) Trends in cutting technique (high speed machining HSM, high speed machining HPM, hard machining HM, complete machining, hybrid machining, micro machining, new lubrication / cooling techniques of cutting zone)

Exercise

- 1) Kinematics of the cutting process (cutting speed, feed rate, feed per revolution and per tooth)
- 2) Geometric and technological elements of the cutting layer with different processing methods:
  - a. Width and thickness of the cut layer, depth of cut,
  - b. Variation of the cross-section of the cutting layer for one blade and the total cross-section.
- 3) Forces, moment and power with different methods and types of cutting.
- 4) Tool life and periodic cutting speed.
- 5) Theoretical surface roughness after cutting.
- 6) Selection of conditions for EDM.
- 7) Catalog selection of tools and manufacturing parameters

## Teaching methods

1. Lecture: multimedia presentation, solving example tasks on the blackboard,
2. Exercises: problem solving, discussion.

## Bibliography

### Basic:

1. Erbel J. (red.): Encyklopedia technik wytwarzania w przemyśle maszynowym. Tom II. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2001.
2. Filipowski R., Marciniak.: Techniki obróbki mechanicznej i erozyjnej. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2000.
3. Kawalec M.: Ćwiczenia z podstaw skrawania. Skrypt 1138, Wydawnictwo Politechniki Poznańskiej 1983.
4. Olszak W.: Obróbka skrawaniem. WNT Warszawa 2008.
5. Żebrowski H. : Techniki wytwarzania. Obróbka wiórowa, ścierna i erozyjna. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2004.
6. Oczóś K., Kształtowanie materiałów skoncentrowanymi strumieniami energii. WUPR, Rzeszów 1988.
7. Harasymowicz J; red. Wantuch E., Obróbka gładkościowa: skrypt dla studentów wyższych szkół technicznych; Politechnika Krakowska im. Tadeusza Kościuszki. Kraków 1994
8. Przybylski L., Strategia doboru warunków obróbki współczesnymi narzędziami. Toczenie - wiercenie - frezowanie. Wyd. II, Z-d Graficzny Politechniki Krakowskiej, Kraków, 2000

### Additional:

- 1 Schneider G.: Cutting tool applications. ASM International 2002
- 2 Shaw M.C.: Metal Cutting Principles. Oxford University Press, Oxford 1996.
- 3 Oczóś K., Efektywność innowacyjnych technologii na przykładzie wybranych sposobów obróbki strumieniowo-erozyjnej, Mechanik, 2003 nr 8-9, s. 463-468
- 4 Gupta K., Jain, Neelesh K. J., Laubscher R. F., Hybrid Machining Processes: Perspectives on Machining and Finishing. Springer, 2016
- 5 Grzesik W., Advanced Machining Processes of Metallic Materials: Theory, Modelling and Applications. Elsevier, 2008
- 6 John F. R., Industrial applications of lasers. Elsevier Inc., 1997
- 7 Brandt M., Laser Additive Manufacturing: Materials, Design, Technologies, and Applications. Woodhead Publishing, 2016
- 8 Davim J.P., Jackson M.J. Nano and Micromachining. John Wiley & Sons, Inc., NJ USA 2009.
- 9 Ion J. C., Laser Processing of Engineering Materials: Principles, Procedure and Industrial Application. Elsevier Ltd., 2005
- 10 E. Paul Degarmo, J. T. Black, Ronald A. Kohser: Materials and Processes in Manufacturing. Wyd. 9. Wiley, 2003
- 11 Walker J. R., Machining Fundamentals. Goodheart-Wilcox Publisher, 2013
- 12 Brodowicz W.: Skrawanie i narzędzia. WSiP Warszawa 1998
- 13 Dul-Korzyńska B.: - Obróbka skrawaniem i narzędzia. Oficyna Wydawnicza Politechniki Rzeszowskiej 2009.
- 14 Kosmol J. (red.): Techniki wytwarzania - obróbka wiórowa i ścierna. Wydawnictwo Politechniki Śląskiej, Gliwice 2002

## Breakdown of average student's workload

	Hours	ECTS
Total workload	55	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)	25	1,00