

# Course description

## 1 General information

Course name	<b>Advanced, micro and nano technologies</b>
Course code	
Level of study (B.Sc, M.Sc., Ph.D.)	B.Sc
ECTS	4
Course manager	Adam Ruszaj, Prof., PhD, DSc, Eng.
Course length	One (1) semester
Coordinator for international programs	<a href="mailto:erasmus@mech.pk.edu.pl">erasmus@mech.pk.edu.pl</a>

## 2 Prerequisites

- Basic knowledge of physics, chemistry, machine building, computer aided design and manufacturing

## 2 Program

Type	Lectures	Classes	Labs	Computer labs	Project	Seminar
Hours	30		30			

## 3 Contents

Lectures		
No.		Hours
1	Introduction to micro and nanotechnologies	2
2	Historical background of micro and nanotechnologies development	2
3	Micro and nanotechnologies in technical development (MEMS, NEMS)	2
4	Basic removal processes of micro and nano parts or structures manufacturing (Cutting, Grinding, EDM, ECM, LBM, EBM, WJM)	8
5	Basic hybrid removal processes of micro and nano parts or structures manufacturing (Combination of: Cutting, Grinding, USM, EDM, ECM, LBM, EBM processes)	6
6	Basic additive manufacturing processes of micro parts and nanostructures manufacturing (SL, SLS, FDM, Focused ion beam chemical – vapor deposition).	6
7	Micro and nano technologies practical application in MEMS and NEMS manufacturing (including micro-assembly problems)	2
8	Directions of micro and nanotechnologies development	2
Σ		30

Labs		
No.		Hours
1	Microcutting	4
2	Electrochemical micromachining	4
3	Electrodischarge micromachining	4
4	Laser beam micromachining	4
5	Hybridization in micromachining	4
7	Additive micromanufacturing	4
8	Nanoscopy, tip based nanofabrication	4
9	Final classes	2
Σ		30

**3 Learning Outcomes (skills and knowledge):**

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- Student understand physical principles of selected micro and nano manufacturing processes
- Student can explain the role of micro and nano manufacturing processes in modern manufacturing.
- Student knows application of micro and nano manufacturing processes

**4 Assessment policy (examination):**

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- Understanding the merits of conventional micro manufacturing.
- Understanding the merits of non-conventional micro manufacturing.
- Understanding the merits of hybridization in micro manufacturing.
- Understanding the merits of additive micro manufacturing.
- Understanding the merits of nano manufacturing.

**5 Literature**

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1. Golam Kibria (ed), B. Bhattacharyya (ed) J. Paulo Davim (ed), Non-traditional Micromachining Processes. Fundamentals and Applications. Springer International Publishing AG 2017
2. Irene Fassi (ed), David Shipley (ed), Micro-Manufacturing Technologies and Their Applications – A theoretical and Practical Guide; Springer - MIMAN-T, Springer 2017, Switzerland
3. J. Paulo Davim (ed) Mark J. Jackson (ed), Nano and Micromachining, ISTE Ltd, 2009.
4. William A. Goddard III, Donald Brenner, Sergey Edward Lyshevski, Gerald J Iafrate, Handbook of Nanoscience, Engineering, and Technology, 3rd Edition, CRC Press, 2012.
5. Bert Huis in 't Veld, Micro additive manufacturing using ultra short laser pulses, CIRP Annals - Manufacturing Technology 64 (2015) 701–724.