

module title: <b>TECHNOLOGICAL PROCESS DESIGN FOR CNC MACHINES</b>		
field of study: <b>Mechanical Engineering</b>	type of study: <b>full-time</b>	course code: <b>S6_3-13</b>
course: <b>Modelling &amp; Simulation in Mechanics</b>	degree: <b>Master (MSc)</b>	year: <b>II</b> semester: <b>III</b>
type of classes: <b>lecture, laboratory, project, EXAM</b>	hours per week: <b>2L, 2Lab, 2P</b>	No of ECTS credits: <b>5</b>

## **MODULE DESCRIPTION**

### **TARGETS**

- T1.** Provide theory of metal machining.
- T2.** Provide the ability to operate CNC machine tools.
- T3.** Provide the ability of programming CNC machine tools with the help of CAD / CAM software.

### **PREREQUISITES & ADDITIONAL REQUIREMENTS**

- R1.** Fundamentals of mechanics and machining.
- R2.** Fundamentals of metrology.
- R3.** Safety rules during the use of laboratory equipment.
- R4.** Capability of using source literature.
- R5.** Capability of individual work and collaboration in a group.
- R6.** Data analysis and presentation of results.

### **LEARNING OUTCOMES**

- LO1.** Knowledge on fundamentals of metal cutting.
- LO2.** Knowledge on CNC machine tool construction.
- LO3.** Knowledge on CAD/CAM software for CNC machine tools programming.
- LO4.** Knowledge on CNC machine tool programming and operating.
- LO5.** Knowledge on advanced machining.
- LO6.** Knowledge on the production automation and robotics.
- LO7.** Knowledge on different ways of CNC machine tools programming.

## MODULE CONTENT

LECTURE	hours
L1-6 – Lathe and milling CNC machine tools, multi axes and multi task CNC machine tools, machine tools construction	6
L7-10 – Fundamentals of Metal Machining, High Speed Machining	4
L11-15 – Cutting tools geometry, rules for the selection of cutting tools	5
L16-17 – CNC machine tool control systems	2
L18-19 – WOP and CAD/CAM systems for CNC machine tool programming	2
L20-21 – Fundamentals of CNC machine tools programming, coordinate systems	2
L22 – Turning - basic functions	1
L23-24 – Turning – advanced functions	2
L25-27 – Milling – basic functions	3
L28-29 – Milling – advanced functions	2
L30 – Robotics and manufacturing automation	1

LABORATORY	hours
Lab 1-4 – Safety rules, machine tools construction, CNC control system, spindle, turret	4
Lab 5-8 - Preparing the machine tool for operation , working on the machine tool control panel	4
Lab 9-10 - Cutting tools measurement and exchange	2
Lab 11-14 – CNC machine tool programming	4
Lab 15-18 - Turning	4
Lab 19-22 - Milling	4
Lab 23-26 – Turning - advanced programming	4
Lab 27-30 – Milling – advanced programming	4

PROJECT	hours
P 1-2 – Introduction for technological processes design for CNC lathe machines.	2
P 3-6 – CAD systems - parts modelling.	4
P 7-14 – CAM systems – turning modelling	8
P 15-16 – Introduction for technological processes design for CNC milling machines.	2
P 17-24 – CAM systems – milling modelling	8
P 25-26 – Cutting tools - optimizing the parameters selection, milling, turning	2
P 27-30 – Elaboration of technological documentation, turning, milling	4

## TEACHING TOOLS

1 - lecture with the use of multimedia presentations
2 - experimental stands equipped with measuring instrumentation, cutting tools, CNC machine tools
3 - computer laboratory, software for CAD/CAM programming
4 - instructions to laboratory exercises and projects

## SOURCE LITERATURE

1. Winston A. Knight, Geoffrey Boothroyd: Fundamentals of Metal Machining and Machine Tools. McGraw-Hill Inc, US, 2006
2. Thomas Childs, Katsuhiko Maekawa, Tashiyuki Obikawa, Yasuo Yamane: Metal machining. Theory and Applications. Arnold, London, 2000
3. Peter Smid: CNC programming handbook. Industrial press Inc., New York, 2008
4. Peter Smid: CNC programming technics. Industrial press Inc., New York, 2006
5. Mike Mattson: CNC programming. Principles and Applications. Delmar, Albanz, 2001
6. Ken Evans: Programming of CNC machines. Student workbook. Industrial press Inc., New York, 2003
7. B. S. Pabla, M. Adithan: CNC machines. New AGE International Publishers, New Delhi, 2005

## TEACHERS

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