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| Bachelor Degree in speciality: **Manufacturing engineering and technologies**Semester: 6 (summer)Course code: 37 „MANUALLY PROGRAMING OF CNC MACHINES” |
| ECTS credits: 5Grade form: Exam | Weekly classes: 2h lections + 2h exercisesEvaluation by: Exam based on test  |
| The course is held in: Department of MANUFACTURING TECHNOLOGIES AND MACHINE TOOLSFACULTY OF MANUFACTURING ENGINEERING AND TECHNOLOGIES |

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| Lecturer: assoc. prof. Stoyan Slavov, PHDDepartment of MANUFACTURING TECHNOLOGIES AND MACHINE TOOLS  |

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| **Course Description**: The primary focus of this course is on manual programming of computer numerical control (CNC) machine tools. Students learn what CNC-machines are, what they can do, and how they do it. Beginning with the basic concepts of program structure, students learn how to write, edit, and debug NC-programs and use the programs on a CNC- machine to produce a part. Programs become more complex as the semester progresses and require more sophisticated programming techniques. Laboratory exercises are conducts in the "CAD/CAM/CNC systems" laboratory of the department, using CNC lathe and CNC-mill machines. The toolpaths described by NC-programs are previously verified by hardware and software simulators, such as HAAS and CIMCO Edit. As an outcome of successful completion of the course, the student should: understand the nature, applications, advantages, and disadvantages of numerical control machine tools. Understand and follow safety-related procedures for part design and machine operation. Manually write, edit, debug, and use NC-programs to produce a piece part. Utilize canned cycles, loops, and subroutines. Set up, communicate with, and safely operate NC-machines. Select cutters, cutting and spindle speeds, and feedrates for both CNC-mill and CNC-lathe programs. Understand basic tooling and part holding requirements. |
| **Basic topics of the course:** * **Know your machine from a programmer's viewpoint**

 1: Lathe and mill machine configurations  2: Visualizing program execution  3: Program zero and the rectangular coordinate system  4: Introduction to programming words* **You must prepare to write programs**

 5: Preparation steps for programming* **Understand the motion types**

 6: Programming the three most basic motion types* **Know the compensation types**

 7: Introduction to compensation  8: Tool length compensation  9: Cutter radius compensation * **You must provide structure to your CNC programs**

 10: Introduction to program structure  11: Types of program format* **Special features that help with programming of the turning and mill CNC machines**

 12: Turning and boring canned cycles  13: Threading canned cycles 14: Hole-machining, grooving and cut-off canned cycles  15: Working with subprograms 16: Other special programming features in turn and mill CNC-machines |