University: University of Žilina	
Faculty: Faculty of Mechanical Engineering	
Course ID: 2Y021	**Course name:** CNC Machine Tools Programming (CNC_E)
Povinnosť predmetu: Electorial; **Ukončenie:** Exam	
Profile course: - **Core course:** -	

Form, extent and method of teaching activities:

Number of classes per week in the form of lectures, laboratory exercises, seminars or clinical practice	Lectures: 2 classes Seminars: 0 classes Lab.exercises: 2 classes
Methods by which the educational activity is delivered	Present form of education
Applied educational activities and methods suitable for achieving learning outcomes	Lectures: problem-based lectures, interactive lectures with discussion, lectures supported by multimedia and audiovisual means Examination: presentation and defence of the project, oral examination

Number of credits: 6

Study workload: 156 hours in total; of which 52 hours are direct teaching, 34 hours are project development and consultation with the supervisor on project preparation, 70 hours are independent study of the student.

Recommended semester/term of study: winter

Study degree: 4

Required subsidiary courses:
Prerequisites:
-
Co-requisites:
-

Course requirements:
Continuous assessment / evaluation:
- active participation in exercises, project presentation
Final assessment /evaluation:
- written and oral exam
The resulting classification of the subject:
A: 93 – 100 points
B: 85 – 92 points
C: 77 – 84 points
D: 69 – 76 points
E: 61 – 68 points
FX: Less than 61 points

Minimálny počet bodov pre prihlásenie na skúšku nie je zadaný

Forms and methods of assessment	Predetermined weight %	Area of knowledge, skills and competence
Student portfolio (1 x semester project)	50%	practical skills, application of expertise, activities and correctness of solving tasks during the semester, working with various information sources, self-study
Exam (test / oral)	50%	Theoretical knowledge

Course outcomes:
After completing the course the student:
•   knows and can characterize automated workplaces equipped with CNC production machines,
•   knows and can characterize the basic technologies, methods and key technical elements in the field of automation of engineering production,

- knows basic information, classification and technical parameters of CNC machines, flexible production systems,
- knows how to apply appropriate optimization methods in programming the trajectory of CNC production machines and equipment,
- understand the structure, requirements and method of creating an NC program and apply it to real CNC production equipment,
- knows how to apply appropriate optimization methods in programming the trajectory of CNC production machines and equipment,
- can analyse and evaluate the outputs of optimisation approaches,
- can create own optimization approaches, based on conventional methods as well as artificial intelligence.

Course scheme:
Lectures:
- Numerical control of production technology (NC, CNC, DNC…). History and development of NC, CNC machines.
- Designing - Construction solutions of CNC machine tools - main parts.
- Concepts of CNC machines, types of control systems, control methods, interpolation.
- Fundamentals of machining technology on CNC machines, terminology, working modes.
- Preparation and methods of NC program creation - manual programming, workshop, CAM systems.
- Zero and reference points, machine coordinate system.
- CNC technological procedure, sequence of operation, sequence of creation of NC program.
- Construction of the NC program, NC program recording form, coding of information - EIA, ISO.
- Programming methods - the principle of absolute and incremental programming, subprograms, parametric and contour programming.
- Selected preparatory and auxiliary functions, fixed cycles, tool corrections.
- Cutting conditions, materials, tools, coding and tool clamping for CNC production machines.
- Clamping of workpieces, alignment and tool sheet for CNC production machines.
- Graphical simulation and debugging of the NC program.
- Methodology for the selection of milling strategies for free-form milling.
- Creation of databases of finished postprocessors, principle of postprocessing of data files .
- New model of data transfer between CAD/CAM systems and CNC machine - use of STEP and STEP NC formats.

Lab.exercises:
- Programming, simulation and verification of NC programm for the EMCO Concept TURN 55 CNC lathe.

Literature:
ČUBOŇOVÁ, N.: CNC machines programming, computer aided manufacturing: internal textbooks for Erasmus students. – 1st ed. – EDIS Žilina : University of Žilina, 2013. – p. 53, - ISBN 978-80-554-0650-3.
ČUBOŇOVÁ, N.: Computer aided CNC machine tools programming (in Slovak), 1st ed. – EDIS Žilina : University of Žilina, 2012, p. 115, ISBN 978-80-554-0514-8.
ČUBOŇOVÁ, N. – BULEJ, V. – NÁPRSTKOVÁ, N. – DODOK, T. - TLACH, V. Automation of Mechanical Production (in Slovak). 1st ed. – EDIS Žilina : University of Žilina, 2021. – p. 259, - ISBN 978-80-554-1836-0.
DODOK, T. - ČUBOŇOVÁ, N. - CÍSAR, M. Basics of CAD/CAM system Edgecam 2020.0. (in Slovak) - 1st ed. – EDIS Žilina : University of Žilina, 2020. – p. 129- ISBN 978-80-554-1672-4.
CÍSAR, M. – BULEJ, V. – ZAJAČKO, I. - ČUBOŇOVÁ, N. Basics of CNC machine programming with the Sinumerik 840D control system: support in the development of multi-criteria diagnostics (in Slovak). 1st ed. – EDIS Žilina : University of Žilina, 2018. – p. 164. - ISBN 978-80-554-1529-1.
SÁGA, M. – VAŠKO, M. - ČUBOŇOVÁ, N. – PIEKARSKA, W. Optimisation algorithms in mechanical engineering applications. Harlow, Essex : Pearson, 2016. – p. 291, - ISBN 978-1-78449-135-2.
ČUBOŇOVÁ,N. - SALAJ,J. - URÍČEK,J: Machining in system Pro/ENGINEER (in Slovak). University textbook. 1st ed. – EDIS Žilina : University of Žilina, 2012, 2000, ISBN 80-7100-620-3, 297 s.
GROOVER,M.P: Automation,Production Systems and Computer –Integrated Manufacturing. Učebnica, Second edition, Prentice Hall,USA, January 2000, ISBN 0-13-088978-4,832 p.

COTETIU, R. - KURIC, I. - NOVÁK-MARCINČIN, J. - UNGUREANU, N. New Trends in Mechanical Design and Technologies, Risoprint, Cluj Napoca 2005,ISBN 973-751-084-4,223p					
Instruction language: english					
Notes:					
Course evaluation:					
Total number of evaluated students: 0					
A	**B**	**C**	**D**	**E**	**FX**
00.00 %	00.00 %	0.00 %	0.00 %	0.00 %	0.00 %
Course teachers:					
Lecture: Prof. Ing. Nadežda Čuboňová					
Lab.exercises: Assoc.-prof. Ing. Miroslav Císar, PhD.					
Lab.exercises: Ing. Tomáš Dodok, PhD.					
Last updated:					
Approved by: prof. Ing. Ivan Kuric, Dr.					