

Discipline	PROGRAMING OF CNC MACHINES USING CAM , code: 44, winter semester		
Specialties:	1. "Computerized manufacturing technologies", 2. "Manufacturing engineering and technologies", 3. "Production engineering"		
ECTS credits: 6	Form of assessment: Exam - test		
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Department	MANUFACTURING TECHNOLOGIES AND MACHINE TOOLS		
Faculty	FACULTY OF MANUFACTURING ENGINEERING AND TECHNOLOGIES		
Learning objectives: <p>The course goals are to provide students with knowledge and practical skills in the field of computer aided preparation of production processes and in particular for programming of CNC machine tools using CAM software. As a result of the course students will be able to design parts with CAD and processing them with CAM software.. They will be able to create real machining processes using integrated algorithms and strategies for machining in CAM. Students will also be able to choose appropriate cutting tools and adjust correctly the regime parameters of CNC machines. Laboratory exercises are conducts in the department laboratory "CAD / CAM / CNC systems" using post-processors for the systems Fanuc, Haas, etc., hardware and software simulators, and CNC machines, such as 2-axis turning machine CT 161, 5-axis machining center MC 032 and 3-axis milling machine HAAS TM-1. As CAD-CAM software Dassault SolidWorks Educational, and Feature CAM are used in this course. Students will be provided with educational versions of the software installed on their own laptop during to the course, if they use MS Windows 10 (64 bit) as OS.</p>			
CONTENTS:			
Training Area		Hours lectures	Hours laboratory exercises
1. Programing CNC with CAM software. Introduction and overview; 1.1. Application of modern engineering software tools. 1.2. Data exchange between CAM and CAD systems. Basic requirements to the digital models. 1.3. A general algorithm for automated preparation of NC programs for CNC machines using CAM software systems;		4	4
2. FeatureCAM (Delcam Plc) interface overview; 2.1. Basic strategies for machining in modern CAM systems.		2	2

<p>2.2. FeatureCAM interface – basic elements.</p> <p>2.3. Principles of KBM (Knowledge-Based Machining).</p>		
<p>3. Geometric modeling in modern CAD/CAM systems. FeatureCAM: drawing capabilities, dimensioning, editing and spatial transformations of geometric elements – primitives and curves;</p> <p>3.1. Geometric modeling approaches in modern CAD/CAM systems.</p> <p>3.2. Tools for drawing, dimensioning and editing geometric primitives.</p> <p>3.3. Tools for creating two-dimensional sketches.</p> <p>3.4. Tools for creating planar and spatial curves. Methods in the Curve Wizard.</p> <p>3.5. The possibilities for spatial transformations of geometric objects.</p>	4	4
<p>4. Working with solid 3D models in FeatureCAM. Defining and aligning the workpiece and the stock. Using Local Coordinate Systems.</p> <p>4.1. Work with solid state 3D models.</p> <p>4.2. Approaches and instruments for 3D modeling in FeatureCAM.</p> <p>4.3. Defining the parameters of the stock.</p> <p>4.4. Importing and aligning 3D models, created by external CAD applications.</p>	2	2
<p>5. Create and setup clamps and machine design files in FeatureCAM. Appropriate post processor selection, according to the type of the CNC machine.</p> <p>5.1. Defining and setting-up clamps;</p> <p>5.2. Working with machine design files.</p> <p>5.3. Appropriate post processor selection.</p>	2	2
<p>6. Cutting tools defining and selection in FeatureCAM. Cutting tools properties and materials. Adjusting manufacturing operations characteristics by using machining attributes.</p> <p>6.1. Working with Tool database of FeatureCAM.</p> <p>6.2. Use the Tool Manager to view, edit, or add tools to a tool crib.</p> <p>6.3. Toolpaths type overview.</p> <p>6.4. Setting up a global machining attributes.</p>	2	2
<p>7. Create features defined by curves in FeatureCAM.</p> <p>7.1. Classification and characteristics of the CNC turning operations.</p> <p>7.2. Overview of FeatureTURN and Feature TURN/MILL modules.</p> <p>7.3. Machining attributes dialog for Turn parts.</p> <p>7.4. Turning and boring operations when using an existing 3D part model;</p>	2	2
<p>8. Create standard, nonstandard and tapered thread features on inner or outer surfaces. Set up the threading attributes in machining attributes panel.</p> <p>8.1. Features of the process threading on CNC lathes.</p> <p>8.2. Setup the threading attributes in FeatureCAM.</p> <p>8.3. Creating threading features and operations in FeatureCAM.</p>	2	2

<p>9. Turning features based on known dimensions and position in FeatureCAM: Holes, Grooves, Face turning, Cut-off and Bar-feed features.</p> <p>9.1. Necessity of setting up the attributes of the turning features.</p> <p>9.2. Machining attributes dialog for Holes, Grooves, Face turning, Cut-off and Bar-feed operations.</p>	4	4
<p>10. 2.5D milling features in FeatureCAM. Setup the parameters of 2.5D milling features and operations in machining attributes panel.</p> <p>10.1.2.5D milling features and operations in FeatureCAM overview.</p> <p>10.2.2.5D milling features defined form dimensions and from curve.</p> <p>10.3. Specifying groups of different features and feature patterns.</p>	4	4
<p>11. 3D-milling strategies in rough and finish milling operations. High Speed Machining (HSM).</p> <p>11.1. High Speed Machining overview.</p> <p>11.2. Requirements for CAM to programming HSM.</p> <p>11.3. Introduction to 3D milling strategies in FeatureCAM.</p> <p>11.4. 3D milling feature attributes.</p>	4	4
<p>TOTAL: 60 h</p>	30	30