Tempus Project *University of Kragujevac*

WBCVMnet

WBC Virtual Manufacturing Network
Fostering an Integration of the Knowledge Triangle

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European Commission
TEMPUS

Name	**NC programming and basics of CAM modeling**		
Code	CTC-BL-02		
ECTS	4		
Location	KTC Banja Luka, University in Banjaluka Faculty of Mechanical Engineering, Stepe Stepanovića 71, 78000 Banja Luka, B&H		
Trainer/s	PhD. Gordana Lakić-Globočki, Assistants: Stevo Borojević and Branislav Sredanović		
Purpose	Education of staff from economy for programming on NC and CNC machines through theoretical and practical training. Achieved knowledge will enable attendants to perform programming of manufacturing operations of turning, milling, drilling and machining of complex contours at work pieces.		
Recommended entry level	Minimal IV level of professional classification e.g. mechanical technicians, VI and VII level of professional classification of mechanical engineering		
Special requirements			
Duration	40 classes		
General objectives	Attendants which overcome this training, will be in possibility to: • Precisely define instruction of machine movement, • Perform of tool compensation, • Independently programming cycles of turning, milling and drilling, • Accept knowledge about possibilities of CAM modeling		
Topics	1. Introduction of NC programming; 2. Programming of NC machines; 3. Preparation for programming; 4. Instruction of movement 1; 5. Instruction of movement 2; 6. Instruction of movement 3; 7. Tool compensation; 8. Drilling cycles; 9. Milling cycles; 10. Turning cycles; 11. Possibilities of CAM modeling for turning/milling;		
Specific learning outcomes in topics	**Topic 1: Introduction of NC programming;**	**Nb. of classes**	**2**
	Trainees should be able to: • Accept basic knowledge about CNC controlling • Accept basics of manual programming of CNC machines		
	Topic 2: Programming of NC machines;	**Nb. of classes**	**2**
	Trainees should be able to: • Accept basic knowledge about programming with problem oriented (CNC) languages, • Accept basic knowledge about programming with CAD/CAM systems.		
	Topic 3: Preparation for programming, practical	**Nb. of classes**	**3**
	Trainees should be able to: • Select of coordinate system, • Define null - points, • Learn structure and syntax of program, • Accept form of frames (zero movements, rotating, mirror, scaling).		
	Topic 4: Instruction of movement 1, practical	**Nb. of classes**	**4**
	Trainees should be able to: • Learn structure of program (NC blocs, syntax, special signs, address, words), • Accept movement instructions, DIN 66025, G and M functions, • Programming in absolute and incremental (relative) dimensions, • Learn how to move null - points (frame), • Execute selections of machining plane		
	Topic 5: Instruction of movement 2, practical	**Nb. of classes**	**4**
	Trainees should be able to: • Learn commands of movement in polar coordinates,		

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- Accept movement instructions for rapid movement,
- Accept linear interpolation,
- Accept circular interpolation,
- Accept helicoids interpolation.

Topic 6: Instruction of movement 3,	**Nb. of classes**	**3**

Trainees should be able to:
- Define movement instructions for threat machining
- Define special turning functions (chamfer),
- Define frame (TRANS, ATRANS, ROT, AROT, SCALE, ASCALE, MIROR, A-MIROR).

Topic 7: Tool compensation, practical	**Nb. of classes**	**4**

Trainees should be able to:
- Perform tool length compensation,
- Perform tool radius compensation length,
- Learn tool coding for milling operations,
- Learn tool coding for drilling operations,
- Learn tool coding for turning operations,
- Learn tool coding for special operations,
- Execute collision monitoring,

Topic 8: Drilling cycles, practical	**Nb. of classes**	**4**

Trainees should be able to:
- Programming cycles of drilling and similar operations,
- Define program for drilling,
- Define program for drilling with special drilling heads,
- Define program for deep drilling,
- Define program for thread cutting at drilling machines,
- Examples of defining of drilling cycles for linear and circular pattern,

Topic 9: Milling cycles, practical	**Nb. of classes**	**5**

Trainees should be able to:
- Define program for slot milling (LONHOLE, SLOT),
- Define program for rectangular pocket milling (POCKET),
- Define program for circular pocket milling,
- Define program for face milling,
- Define program for path milling,

Topic 10: Turning cycles, practical	**Nb. of classes**	**4**

Trainees should be able to:
- Define program for flute machining,
- Define program for machining of canals,
- Define program for material removing,
- Define program for machining of canals for threads,
- Define program for thread machining,

Topic 11: Possibilities of CAM modeling for turning/milling	**Nb. of classes**	**5**

Trainees should be able to:
- Accept basics knowledge and possibilities of CAM turning,
- Accept basics knowledge and possibilities of CAM milling/drilling,

Portfolio assessment	The coach evaluates the level of success of each trainee through the assessment and testing at exercises. **Assessment Exercise:** Trainer defines exercises on the basis of which he can estimate degree of learning outcomes. Exercises can be performed individually or in team. **Testing:** Trainer define exam on the basis he can estimate knowledge of candidates.