5. Modern production technologies

GENERAL INFORMATION ABOUT THE COURSE		
Course coordinator	Matija Bušić, PhD, assistant professor	
Course name	**Modern production technologies**	
Study program	**Mechanical engineering**	
Course status	Compulsory/elective	
Year	1	
Semester	1	
Number of credits and teaching methods	ECTS student load coefficient	5
	Number of hours (lectures + seminars + exercises)	30 + 0 + 30

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Familiarising students with modern production technologies in the area of machining by chip removal, additive technologies, technologies for joining materials using welding and metal forming. Familiarising them with the advantages offered by modern technologies in terms of optimal use of materials and energy as well as highly efficient machining processes.

1.2. Course enrolment prerequisites *(if applicable)*

There are no prerequisites for enrolling into the course.

1.3. Expected course learning outcomes

1. Understanding the advantages and weaknesses in using particular types of machining.
2. Understanding new possibilities of applying particular machining processes.
3. Selecting the optimal manner of machining in regard to workpiece characteristics.
4. Compare the procedure for producing the piece with the assistance of a number of technologies.
5. Understanding the division of production technologies for adding and removal of material.
6. Understanding the sequence of production technologies in machining a certain product.

1.4. Course content

1. Introduction to modern manufacturing processes
2. Modern CNC machining systems
3. Tools for modern CNC machining systems

4. Flexible machining systems and flexible machining cells
5. Plasma cutting and welding – equipment and manner of work
6. Plasma cutting and welding – examples of application
7. Friction welding processes (FRW)
8. Friction stir welding (FSW)
9. Laser welding and cutting
10. Using robots in modern production
11. Modern metal inert gas (MIG)/metal active gas (MAG) welding processes
12. Additive manufacturing of metal parts
13. Processes for modifying and coating tools
14. Modern metal forming processes
15. Electrical-discharge machining (EDM) and Electro-chemical machining (ECM)

1.5. Types of teaching	☒ Lectures ☒ Seminars and workshops ☒ Exercises ☐ Distance learning ☒ Field work	☒ Autonomous exercises ☐ Multimedia and network ☐ Laboratory ☒ Mentor assistance ☐ Other types
1.6. Comments	Classes are held in classrooms in the form of lectures, seminars and auditory exercises. The student is to present the seminar paper as an example of using new technologies in practice. Some of the exercises in the area of optimisation are performed on a computer. Field classes provide a practical understanding of some of the new technologies for machining materials.	

1.7. Student obligations *(attendance at classes, lectures, tutorials, seminars)*

- Attending lectures and exercises
- Actively participating in classes
- Solving problems in the area of machining optimisation

1.8. Tracking student work (proportion of individual activities in terms of ECTS credits based on the total number of ECTS credits)

Class attendance	2	Class attendance	0.2	Seminar paper	1	Experimental work	
Written exam	1	Written exam	0.8	Essay		Research	
Project		Continual assessment of knowledge		Written seminar paper		Practical work	
Online activity							

1.9. Grading and assessment of student work during the semester and for the final exam *(interim exam, written exam, oral exam)*
All activities done by the student are graded using a particular number of points: 1. Attending lectures and exercises: 10% 2. Participation at lectures and exercises: 10% 3. Written part of the exam: 40% 4. Oral part of the exam: 20% 5. Drafting and presentation of the seminar paper: 20%

1.10. **Mandatory literature** (relevant at the time of submitting the proposed study program)
- H. El -Hofy: Advanced Manufacturing Processes, McGraw-Hill, New York, 2005 - D. Krumes, P. Raos, A. Stoić, M. Stubičar: Nove tehnologije, Slavonski brod: Strojarski fakultet u Slavonskom Brodu, 1998 - M.Math: Uvod u tehnologiju oblikovanja deformiranjem, Sveučilište u Zagrebu, FSB, Zagreb 2003. - M. Gojić: Tehnike spajanja i razdvajanja materijala, Metalurški fakultet, Sisak, 2008. - S. Kralj, Z. Kožuh, Š. Andrić: Zavarivački i srodni postupci, HDTZ I FSB, Zagreb, 2015. - R. Cebalo: Alatni strojevi i obradni sustavi, Vedograf, Zagreb, 1999
1.11. Supplementary literature (relevant at the time of submitting the proposed study program
1.12. Manner of tracking quality to ensure the acquisition of exit knowledge, skills and competences

2. COMBINING THE LEARNING OUTCOMES, TEACHING METHODS AND ASSESSMENT OF THE LEARNING OUTCOMES

2.1. Class participation	*2.2. Student participation*	*2.3. Learning outcome*	*2.4. Assessment method*
Lectures	Actively following lectures, participating in discussions, presenting one’s own opinion	1-6	Written exam Oral exam
Seminar paper Written exam	Drafting and presenting the seminar paper	1-4	Evaluating quality of the seminar paper presentation
	Solving machining optimisation issues	1-4	Obtain points
Exercises	Actively following lectures, participating in discussions, presenting one’s own opinion	1-6	Written exam Oral exam