7. Robotics in manufacturing

GENERAL INFORMATION ABOUT THE COURSE		
Course coordinator	Matija Bušić, PhD, assistant professor	
Course name	**Robotics in manufacturing**	
Study program	**Mechanical Engineering**	
Course status	Compulsory/elective	
Year	1	
Semester	2	
Number of credits and teaching methods	ECTS student load coefficient	5
	Number of hours (lectures + seminars + exercises)	30+15+0

1. DESCRIPTION OF THE COURSE
1.1. Course objectives
Familiarise students with the fundamentals of operating and using robots in processes for mechanical production. Training students to program and plan robotic applications for various activities.
1.2. Course enrolment prerequisites *(if applicable)*
No prerequisites.
1.3. Expected course learning outcomes
After having listened to the lectures and passed the exam in this course, students will be able to: 1. Identify and analyse production processes in terms of economic efficiency, productivity and profitability in robotic applications 2. Present their views with reasoning in regards to the issue of the performance of robotic applications in handing materials, manipulation and quality control 3. Organise and redesign production processes in which robots are used and other classical means of processing, as well as maintain them at the required level and reliability and undertake measures for continual improvement. 4. Plan preventive measures for maintenance and integrate procedures for the maintenance of robots in the maintenance system at the company level. 5. Manage and model robot work and transfer such knowledge to operators.

1.4. Course content

1. Introduction to production, automation and application of robots.
2. Development of robotics through history. Features of robots and their subsystems. Areas of application and classification of robots.
3. Robotic mechanical systems. Types of drives.
4. Robotic power systems.
5. Robotic measuring systems.
6. Robotic control systems.
7. Examples of robotic operation in handling material and working with tools.
8. Robot kinematics model. Solution for direct and inverse kinematic problems.
9. Robot kinematics model. Jacobian matrix. Planning kinematic motion for robots.
10. Robot dynamic model.
11. Controlling robots – concepts and analysis of feedback.
12. Program languages in robotics.
13. Features and operation of robots in combination with process machinery.
14. Mobile robots, structure, kinematics, dynamics and controlling robots.

1.5. Types of teaching	☒predavanja ☒seminari i radionice ☒vježbe ☐ obrazovanje na daljinu ☐ terenska nastava	☒samostalni zadaci ☐ multimedija i mreža ☐ laboratorij ☐ mentorski rad ☐ ostalo
1.6. Comments		

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

- Attending lectures and exercises
- Sitting for the interim exams
- Drafting and presenting the seminar paper
- Sitting for the final exam

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

Class attendance	1,5	Class participation		Seminar paper	1	Experimental work	
Written exam	0,5	Oral exam	1	Essay		Research	
Project		Continual assessment of knowledge	1	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)*
Interim exam, oral and written exam

1.10. **Mandatory literature** (relevant at the time of submitting the proposed study program)
- T. Šurina, M. Crneković: Industrijski roboti, Školska knjiga, Zagreb, 1990. - B. Siciliano, O. Khatib: Springer Handbook of Robotics, Springer 2008
1.11. Supplementary literature (relevant at the time of submitting the proposed study program
- Stadler, W.: Analytical Robotics and Mechatronics, McGraw-Hill, 1995.
1.12. Manner of tracking quality to ensure the acquisition of exit knowledge, skills and competences
The organised system ensures 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	Attending classes (lectures)	1-5	Record of attendance for students at lectures
Exercises	Participation in class and attending exercises		Assessing the concept and approach to tasks, grading procedures and accuracy of results, suitability and complexity of approach
Seminar paper	Studying the literature, conducting research, drafting the seminar paper	5	Assessing the quality of the seminar paper and grading accuracy and precision of the program
Continual evaluation of knowledge (interim exam)	Evaluation of acquired knowledge throughout the course	1-5	Grading solved questions and tasks
Oral exam	Actively adopting the course content and analysis	1-5	Grading given responses