SYLLABUS

1. Course title:

Operation and Control of Machining Centers

2. Code:

3. Cycle of study:

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4. ECTS credits:

3

5. Type of course:

Elective

6. Prerequisites:

No prerequisites

7. Class restrictions:

No restrictions

8. Duration / semester(s):

1 8

9. Weekly contact hours and student workload:

	Semester (1)	Semester (2)	(for two-semester courses)	Workload: (hours)	
9.1. Lectures	2			Classes:	33,75
9.2. Seminars	0			Individual work:	55,08
9.3. Laboratory / Practice classes	1			In total:	88,83

10. Faculty:

Faculty of Mechanical Engineering

11. Department/study program:

Mechatronics

12. Lecturer:

Adnan Mustafić, PhD

13. Course aims:

The main objectives are to familiarize students with the basic components of machining centers, motion control systems (open-loop and closed-loop), drive systems for primary and auxiliary motions, configurations of computer/numerically controlled machining systems, concepts of adaptive control, automatic control and programming, measurement systems

(closed, semi-closed, and quasi-closed), laser measurement systems for control and positioning, and to provide a clear understanding of the need to apply acquired knowledge in industrial practice.

14. Learning outcomes:

Based on the studied material, the student will acquire basic professional-theoretical knowledge related to the operation of machining centers, enabling them to successfully solve practical tasks in real-world applications and to further advance and develop in their profession and field of expertise.

15. Course content:

1. Introductory lectures, familiarization of students with the course, syllabus, teaching methods, grading system, etc.
2. Components of machining centers (main spindles, drive motors, supporting and guiding elements);
3. Structure and control systems for main rotary and main linear motion;
4. Dimensioning of drive units in machining centers;
5. Control systems for auxiliary movements;
6. Control systems for direction change, types of linear motors;
7. Tool change systems in machining centers;
8. Partial knowledge assessment;
9. Measuring systems (analog and digital);
10. Systems for automatic process and workspace monitoring;
11. Integrated safety systems in machining centers;
12. Machining systems with direct and adaptive control – DNC (Direct Numerical Control), AC (Adaptive Control);
13. Adaptive systems with limit control – ACC (Adaptive Control with Constraints) and adaptive systems with geometric control;
14. Application of CAM systems in machining processes;
15. Partial knowledge assessment.

16. Learning methods:

In order of successful learning within the subject the following activities are planned:
- Lectures - theoretical lectures, active two-way communication student - teacher, the obligatory presence of students; segment of active participation in the teaching of students will include and deal with a given topic by the student and public defense of the same.
- Exercises;
- Tests of the theory and problems - solving tests and problems;
- Seminar work - independent work of students in solving the above problem,
- Consultations.

17. Assessment methods:

After the mid-semester, students take the first written colloquium exam, which covers the material studied up to that point. The exam consists of theoretical questions and practical tasks. The maximum score on the first colloquium is 20 points.
At the end of the semester, students take the second written colloquium exam, also covering the studied material, with theoretical questions and tasks, where they can earn a maximum of 20 points.
The colloquium exams are prepared by the course instructor to ensure that students can answer the assigned questions within the designated time. All students take both tests simultaneously, ensuring uniformity in the knowledge being tested and the examination conditions.
As part of the pre-exam requirements, students must complete an individual seminar paper on a selected topic related to the course content. The seminar is submitted in written form for review and evaluation by the instructor, followed by an oral presentation and discussion of the selected topic.
During auditory exercises, students solve tasks and numerical examples related to lecture topics. In laboratory exercises, students complete a semester project related to machining center control.
For a completed and presented seminar paper, students can earn up to 10 points, and for mandatory class and exercise attendance, up to 5 points.
The final and makeup exam is oral, and the maximum number of points that can be earned is 45.
Student knowledge checks are recognized as cumulative assessments, provided that the student scores 50% or more on each individual test in terms of the required knowledge and skills.
To pass the course, a student must earn a minimum of 54 cumulative points.

Grading System: (5) + (10) + (40) + (45) = 100 points

Grade	Description	Letter Grade	Points Achieved
5 (five)	"unsatisfactory	"F,FX"	< 54 points
6 (six)	"sufficient"	"E"	54–64 points
7 (seven)	"good"	"D"	65–74 points
8 (eight)	"very good"	"C"	75–84 points
9 (nine)	"excellent"	"B"	85–94 points
10 (ten)	"outstanding"	"A"	95–100 points

18. Assessment components:

Grading will be based on the following activities:
• Attendance in lectures = 5 points
• Seminar paper + classroom participation = 10 points
• Tests = 40 points
• Pre-exam obligations = 55 points
• Final exam = 45 points
Total = 100 points

19. Mandatory reading list:

1. Ekinović S.: Alatne mašine, Univerzitet u Zenici, Mašinski fakultet, 2004. godine
2. Ekinović S.: Alatne mašine sa numerčkim i kompjuterskim upravljanjem, Univerzitet u Zenici, Mašinski fakultet, Zenica

20. Additional reading list:

1. Hans B. Kief; Helmut A. Roschiwal; Karsten Schwarz: „CNC Handbuch“, Carl Hanser Verlag, München 2017.
2. Manfred Weck; Christian Brecher: „Werkzeugmaschinen Kompendium (Band 1- Band 5)“, Springer-Verlag Berlin, Heidelberg, 2012.

21. Web sources:

22. Applicable from the academic year:

23. Adopted in the Faculty/Academy session: