# SYLLABUS

**1. Course title:**

Flexible Material Handling Systems

**2. Code:**

**3. Cycle of study:**

I

**4. ECTS credits:**

5

**5. Type of course:**

Mandatory

**6. Prerequisites:**

No prerequisites

**7. Class restrictions:**

None

**8. Duration / semester(s):**

I VI

**9. Weekly contact hours and student workload:**

| | Semester (1) | Semester (2) | (for two-semester courses) | Workload: (hours) | |
|---|---|---|---|---|---|
| 9.1. Lectures | 3 | | | Classes: | 45,00 |
| 9.2. Seminars | 0 | | | Individual work: | 104,9 |
| 9.3. Laboratory / Practice classes | 1 | | | In total: | 149,9 |

**10. Faculty:**

Faculty of Mechanical Engineering Tuzla

**11. Department/study program:**

Production Engineering / Mechatronics

**12. Lecturer:**

Alan Topčić PhD, Full Professor

**13. Course aims:**

Understanding the function and role of material handling/transportation systems in the industry within the production system; Mastery of basic theoretical and practical knowledge and skills in the field of study, aimed at understanding the

**possibilities and methods of automation of material handling/transportation systems in industry, in accordance with the needs of the production process.**

## 14. Learning outcomes:

**Upon successful completion of the course, the student will be able to:**
**Identificate and classificate of transportation means and devices with in raliisation the material flow in a production system; Understand the operating principles and technical-technological characteristics of transportation means and devices, as well as the possibilities for their automation within an efficient and flexible material handling system, in accordance with the requirements of the production process; To understand the basic concepts of inventory management and storage processes; To understand and apply fundamental approaches to modeling and simulation of the operation of a flexible material handling/transportation system in industry.**

## 15. Course content:

**1. Concept, definition, and structure of flexible material handling/transport systems in industry;**
**2. Types of material handling and transport equipment and devices in industry;**
**3. Conventional and automated material handling/transport equipment and systems;**
**4 The concept of flexible transport in industrial environments;**
**5. Continuous and cyclic types of material handling/transport equipment;**
**6. Conventional material handling/transport systems in industry;**
**7. Automated Guided Vehicles (AGVs);**
**8. Management of flexible material handling and industrial transportion systems; Test 1;**
**9. Safety aspects in operating flexible material handling systems;**
**10. Loading/unloading and transfer segments of material handling systems;**
**11. Machinery and devices for packaging, palletizing, and depalletizing in industry;**
**12. Fundamentals of inventory management;**
**13. Basics of storage and storage processes;**
**14 Fundamentals of modeling flexible material handling/transport systems;**
**15. Basics of simulation of flexible material handling/transport systems; Test 2.**

## 16. Learning methods:

**LECTURES (PR) – Theoretical lectures using multimedia tools, along with active two-way communication between student and professor;**
**LABORATORY EXERCISES (LV) – Work in the laboratory and in the field aimed at acquiring practical skills related to the subject matter; Preparation and presentation of seminar and graphical assignments;**
**CONSULTATIONS – Additional sessions that allow students to clarify specific segments of the lectures/exercises with the professor or assistant after their completion.**

## 17. Assessment methods:

**PRE-EXAM OBLIGATIONS: Students are required to take two written tests from the theoretical part (PR) and one from the laboratory exercises (LV). Theoretical tests are scheduled as follows:**
- **After the first half of the semester – First midterm,**
- **At the end of the semester – Second midterm.**

**Laboratory exercise (LV) test is scheduled at the end of the semester.**
**The tests cover the material presented up to that point in lectures and exercises. Theoretical tests (PR) consist of multiple-choice questions, short answer questions, and essay-type questions. Students can earn a maximum of 10 points per midterm — totaling 20 points for all two theoretical tests. Auditorium exercise test (AV) consist of problems, and students can earn a maximum of 10 points. All students take the tests at the same time, ensuring uniform knowledge evaluation and consistent testing conditions.**
**As part of the pre-exam obligations, students are required to prepare an individual Seminar paper (PR) on a topic related to the course content. It must be submitted in written form to the course professor for review and evaluation, and then defended orally. Successfully completed and defended Seminar assignment is worth up to 9 points.**
**In addition, students must prepare, submit to the assistant for review and evaluation, and then defend a Laboratory Exercise Report, for which they may earn a maximum of 7 points.**
**For continuous participation during lectures (PR) and laboratory exercises (LV) throughout the semester, students may earn:**
- **Up to 18 points from lectures (PR),**
- **Up to 6 points from Laboratory exercises (LV).**

**The final exam is oral.**
**Only students who have successfully fulfilled more than 50% of the pre-exam obligations and attended more than 70% of lectures and exercises are eligible to take the final exam. In the final exam, students must answer five questions from the course material covered in lectures and exercises. The maximum score for the final exam is 30 points.**
**All forms of knowledge assessment are recognized as part of the cumulative grading system. To pass the course, a student must earn a minimum of 54 cumulative points.**
**If a student misses lectures/exercises, they are required to provide valid justification.**
**The condition for signing is the student's attendance at a minimum of 70% of lectures and exercises.**

**Grading Scale:**

| Grade | Descriptive | Letter | Points |
|---|---|---|---|
| 5 (five) | Does not meet minimum criteria | F, FX | <54 |
| 6 (six) | Meets minimum criteria | E | 54÷64 |
| 7 (seven) | Generally good, but with significant shortcomings | D | 65÷74 |
| 8 (eight) | Average, with noticeable errors | C | 75÷84 |
| 9 (nine) | Above average, with occasional errors | B | 85÷94 |
| 10 (ten) | Exceptional success with no errors or with minor errors | A | 95÷100 |

## 18. Assessment components:

**The exam grade is based on the total number of points that the student earned by fulfilling pre-exam obligations and taking the exam, and contains a maximum of 100 points. It is determined according to the following scale:**

- **Attendance at Lectures (PR): 18 points**
- **Theory tests (PR): 2 tests × 10 points = 20 points**
- **Seminar paper (PR): 9 points**
- **Attendence to Laboratory exercises (LV): 6 points**
- **Test with problem tasks (LV): 10 points**
- **Report form Laboratory exercise (LV): 7 points**

**Prerequisites total: 70 points**
**Final exam: 30 points**
**TOTAL: 100 points**

## 19. Mandatory reading list:

**Šelo R. (2002) „Fleksibilni transport“, Mašinski fakultet Tuzla, Tuzla**

## 20. Additional reading list:

**G.Ullrich , T.Albrecht (2023) „Automated Guided Vehicle Systems A Guide - With Practical Applications - About The Technology - For Planning“, Springer**
**T.Aized (2012) "Material Handling in Flexible Manufacturing System", IntechOpen**
**R.E. Compton (2005) "Robotic Material Handling Applications in a Flexible Manufacturing System", Society of Manufacturing Engineers**
**K.L. Kerstetter (2000) "Flexible Materials Handling for Industrial Robots", Society of Manufacturing Engineers**

## 21. Web sources:

**https://babel.hathitrust.org/cgi/pt?id=mdp.39015004484427&seq=17**

## 22. Applicable from the academic year:

**2025/2026.**

## 23. Adopted in the Faculty/Academy session:

**25.04.2025.**