SYLLABUS

1. Course title:

Hybrid vehicle drives

2. Code:

3. Cycle of study:

I

4. ECTS credits:

3

5. Type of course:

Elective

6. Prerequisites:

None

7. Class restrictions:

None

8. Duration / semester(s):

I 5

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	1		Individual work:	54,75	
9.3. Laboratory / Practice classes	0		In total:	88,50	

10. Faculty:

Faculty of Mechanical Engineering

11. Department/study program:

Mechatronics

12. Lecturer:

PhD Izudin Delić, associate professor

13. Course aims:

The goal of this course is to acquire basic knowledge about hybrid vehicle drives, their construction, characteristics, and their use and maintenance. During the class, participants will learn about the types, characteristics, importance, application, advantages and disadvantages of hybrid vehicle drives.

14. Learning outcomes:

At the end of the course, the student is expected to acquire knowledge about the architecture, use and improvement of hybrid vehicle drives that can be encountered today in practice and elements of the synthesis of hybrid vehicle drives with given characteristics. The student is trained for the technical observation of the hybrid vehicle drive, the possibility of choosing the structure and components of the hybrid drive according to the assigned task.

15. Course content:

01. Introduction to hybrid and electric vehicles (CO2 emissions, impact on the environment, economic aspects).
02. Types and architectures of hybrid vehicles.
03. Types of electric vehicles.
04. Overview of the development and available models of hybrid and electric vehicles.
05. Light electric vehicles.
06. Energy management strategy in the vehicle.
07. Plug-in electric vehicles.
08. The conception and idea of micro-grids.
09. Accumulators (types, characteristics, PHEV vehicle charging strategy, energy recovery systems, economic aspects, energy density, capacity and available power, behavior at low temperatures, development).
10. Alternative forms of obtaining and storing energy (fuel cells - types and characteristics, mechanical energy storage).
11. Electric motors in HEVs (principles of motor torque control, power control).
12. SUS engines and power transmissions.
13. Hybrid-electric power units.
14. Braking systems (regenerative braking, auxiliary hybrid braking systems, integration in hybrid vehicles.
15. Comfort and safety systems.

16. Learning methods:

- Lectures with the use of multimedia tools, active learning techniques and with active participation and discussions of students;
- Preparation and presentation of group and individual seminar papers.
- Exercises:- are carried out in the classroom, laboratories and in specialized vehicle service centers with the active participation of students.

17. Assessment methods:

After half of the semester (approximately 10 weeks), students take a written test covering the material from lectures and exercises up to that point. The test consists of simple theoretical questions without the derivation of equations. Students can earn a maximum of 50 points on this test. At the end of the semester, students who did not pass the test during the semester take a written exam. As part of their pre-exam obligations, students are required to prepare an individual programming assignment that will cover a specific topic from the course content. The programming assignment is submitted in written form to the course instructor for review and grading, and then defended orally. For a completed and defended programming assignment, students can earn from 0 to 15 points. Additionally, for continuous activity in lectures and exercises throughout the semester, students can earn from 0 to 10 points (each unjustified absence reduces the score by 1 point).
The final exam is oral. In the oral exam, students answer three randomly selected questions from the course syllabus covered in lectures and exercises that were not part of the test during the semester. The maximum number of points a student can earn on the oral exam is 35.
Assessments in all forms of knowledge are recognized as a cumulative exam if the achieved result is positive after each individual assessment and amounts to at least 50% of the total foreseen and/or required knowledge and skills.
To pass the course, a student must achieve a minimum of 54 cumulative points. Those who do not collect 50% of the points required for passing through assessments will take the scheduled final and retake exams.

Grade (Number)	Description	Letter Grade	Points
5 (five)	Does not meet the minimum criteria	F, FX	< 54
6 (six)	Meets the 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 some errors	B	85-94
10 (ten)	Exceptional success without errors or with minor errors	A	95-100

18. Assessment components:

- **Class Attendance: 10 points**
- **Programming Assignment during the semester: 15 points**
- **Test: 40 points**
- **Final Exam or Retake Exam: 35 points**
- **Total: 100 points**

19. Mandatory reading list:

1. Iqubal H. Electric and Hybrid Vehicles, Design Fundamentals, CRC Press 2011.
2. Ronald K.Jurgen: Electric and Hybrid-Electric Vehicles, V. 3. SAE, 2011.

20. Additional reading list:

1. Automotive Mechatronics: Operational and Practical Issues, volume I, B.T. Fijalkowski, Springer, 2010.

21. Web sources:

22. Applicable from the academic year:

2025./2026

23. Adopted in the Faculty/Academy session: