

General information		
Course leader	PhD Goran Đambić, Assistant Professor	
Course title	Sensors and Actuators	
Study programme		
Course status	Mandatory	
Year	Year 1, semester 2	
Number of credits and mode of teaching delivery	ECTS student workload coefficient	5
	Number of hours (L+E+S)	60 (30 P + 30 V + 0 S)

COURSE DESCRIPTION
<i>1.1. Course objectives</i>
Learn the basics of operation and application of sensors and actuators. Use embedded platform communication protocols, sensors, and actuators. Learn to use sensory fusion.
<i>1.2. Conditions for enrolment in the course</i>
No formal conditions. Student should be able to write programs comfortably in any object-oriented programming language.
<i>1.3. Expected learning outcomes of the course</i>
<ul style="list-style-type: none"> • L01 - Use the optimal serial protocol to communicate the embedded computer with sensors and actuators. • L02 - Apply methods for error detection in data transmission. • L03 - Create your own embedded computer software solution using synchronous and / or asynchronous serial protocol. • L04 - Select sensors and actuators that are compatible with the embedded computer for the intended purpose. • L05 - Create your own embedded computer software that will process sensor signals and generate actuator control signals. • L06 - Apply sensory data fusion in your own software and / or hardware solution of the embedded computer.
<i>1.4. Course content</i>
<p>Circuits and components: power supply, resistor, coil, capacitor, transistor and more.</p> <p>Methods for error detection in signal transmission.</p> <p>Synchronous and asynchronous communication protocols.</p> <p>Communication protocols: UART, USART, I2C, SPI, RS-232 and others.</p> <p>Sensors:</p> <ul style="list-style-type: none"> • Position • Presence • Proximity • Distances • Movement detection

- Accelerations
- Shift
- Temperature
- Moisture
- Particles in the air
- Sound
- Vibration
- Flow
- Others.

Electric motors: PMDC, BLDC, steppers, servo and others.

Displays.

Other actuators.

Sensory fusion.

Kalman filters.

<p>1.5. Teaching delivery modes:</p>	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> remote learning <input type="checkbox"/> field work	<input checked="" type="checkbox"/> independent work <input type="checkbox"/> multimedia and network <input checked="" type="checkbox"/> laboratory <input checked="" type="checkbox"/> mentoring <input type="checkbox"/> other					
1.6. Comments							
1.7. Student obligations							
<p>STUDENT ATTENDANCE</p> <p>Class attendance is mandatory in the percentage prescribed by the Studies and examination regulations.</p> <p>PASSING THE EXAM</p> <p>The course has defined learning outcomes. In order for a student to pass the course, he/she must achieve a minimum of 50% of the points available for each learning outcome and collect a minimum of 50.01 points out of a possible 100 points per course.</p>							
1.8. Monitoring ¹ student work							
Class attendance		Activity during class		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project	100%	Continuous assessment of knowledge		Student report		Practical work	
Portfolio		Homework					

¹ IMPORTANT NOTES: Next to each method of monitoring student work it is necessary to insert an adequate share of each activity in ECTS credits, so the total number of ECTS credits corresponds to the credit value of the course. You can use empty fields for additional activities.

1.9. Assessment and evaluation of student work during classes and the final exam

A grading system based is on a credit accumulation model combined with a defined sub-model, providing a model of the grading method and checking the satisfaction of learning outcomes used in this course.

CONCRETE REVIEW OF EVALUATION METHODS

The maximum number of points that a student can earn in a course is 100. Grades are calculated according to the following criteria table within which the distribution of passing grades in terms of the number of points is applied.

Points	Grade
0,00 - 50,00	(1) unsatisfactory
50,01 - 58,00	(2) sufficient
58,01 - 75,00	(3) good
75,01 - 92,00	(4) very good
92,01 - 100,00	(5) excellent

The method of accumulating points is determined in this course in accordance with the elements of scoring as follows:

Criterion	Maximum points
Project	100
TOTAL	100

The way of taking the colloquiums, the learning outcomes it covers, as well as the implementation of exams and remedial exams are defined by the "Instructions for attending and taking the course".

1.10. Required reading (at the moment of submitting the joint study programme report)

- **Daniele Lacamera: Embedded Systems Architecture: Explore architectural concepts, pragmatic design patterns, and best practices to produce robust systems, Packt Publishing (May 30, 2018)**

1.11. Additional reading (at the moment of submitting the joint study programme report)

1.12. Number of copies of required reading in relation to the number of students who currently attend a course

Title	Number of copies	Number of students

<i>1.13. Methods of quality monitoring that ensure the acquisition of knowledge, skills and competencies.</i>		
Monitoring the fulfilment of the desired learning outcomes is an important element of assessment because learning outcomes are the "guarantees" that the school gives to students, but also to employers and the wider community. Learning outcomes represent the minimum threshold that each student must achieve in order to pass the course. For a passing grade, the student must satisfy all the learning outcomes with the demonstrated knowledge, which corresponds to 50% of the points achieved for each learning outcome. The method of scoring based on learning outcomes is presented in the document "Instructions for attending and taking the course".		