COURSE SYLLABUS AND COURSE REQUIREMENTS
ACADEMIC YEAR 2025/2026 SEMESTER 2

Course title	*Autonomous systems*
Course Code	IVM100ANMI
Hours/Week: le/pr/lab	2/0/1
Credits	4
Degree Programme	Computer Science Msc English
Study Mode	*full-time*
Requirements	mid-term grade
Teaching Period	3
Prerequisites	-
Department(s)	Dept. of Information Technology
Course Director	*Dr. Tukora Balázs*
Teaching Staff	*Dr. Tukora Balázs*

COURSE DESCRIPTION

A short description of the course (max. 10 sentences).
Neptun: Instruction/Subjects/Subject Details/Basic data/Subject description

The course offers an introduction into the field of autonomous robotics. The students get acquainted with the hardware and software components of mobile robots, they get to know the various subtasks of robot navigation: localization, SLAM, path planning, vehicle control.

SYLLABUS

Neptun: Instruction/Subjects/Subject Details/Syllabus

1. GOALS AND OBJECTIVES

Goals, student learning outcome.
Neptun: Instruction/Subjects/Subject Details/Syllabus/Goal of Instruction

Familiarisation with the fundamentals of mobile robotics, getting hands-on experience in mobile robot control and programming.

2. COURSE CONTENT

Neptun: Instruction/Subjects/Subject Details/Syllabus/Subject content

	TOPICS
LECTURE	1. *Evolution of autonomous robots* 2. *Hardware and software components of mobile robots* 3. *Localization techniques* 4. *SLAM* 5. *Path planning* 6. *Obstacle avoidance* 7. *Vehicle control*
PRACTICE **LABORATORY PRACTICE**	1. *Programming of mobile robots on different levels*

DETAILED SYLLABUS AND COURSE SCHEDULE

ACADEMIC HOLIDAYS INCLUDED

LECTURE

week	**Topic**	**Compulsory reading; page number (from … to …)**	**Required tasks (assignments, tests, etc.)**	**Completion date, due date**
1.	Introduction, discussion of requirements			
2.	Evolution, hardware and software components of mobile robots (3 lessons)	[1] page 1-26		
3.	Localization: odometry, features, feature detecting algorithms, landmarks (3 lessons)	[1] page 27-46		
4.	Localization algorithms: Markov, particle filter, Kalman filter localization (3 lessons)	[2]		
5.	Introduction to SLAM: goals, techniques (3 lessons)	[1] page 47-		
6.	SLAM algorithms: EKF, particle filter, graph-based SLAM (3 lessons)	[5]		
7.	Path planning: Dijkstra, A* algorithms and their variations (3 lessons)	[3]		
8.	Obstacle avoidance using supervised and reinforcement learning (3 lessons)	[4] lessons S1-S6, R2		
9.	Spring holiday			
10.	Vehicle control: path following with steering and speed control (3 lessons)	[4] lessons G1-G2, P1-P2		
11.	-			
12.	-			
13.	-			
14.	-			

PRACTICE, LABORATORY PRACTICE

week	**Topic**	**Compulsory reading; page number (from … to …)**	**Required tasks (assignments, tests, etc.)**	**Completion date, due date**
1.	Introduction: tools and robots in the lab			
2.	-			
3.	-			
4.	-			
5.	-			
6.	-			
7.	-			
8.	-			
9.	-			
10.	-			
11.	Obstacle avoidance with supervised learning using AlphAI robots (3 lessons)			
12.	Obstacle avoidance with reinforcement learning using AlphAI robots (3 lessons)			
13.	SLAM, ROS with TurtleBot 3 robots (3 lessons)			
14.	Advanced navigation with Rosbot 2 Orin Nano robots (3 lessons)			

3. ASSESSMENT AND EVALUATION

(Neptun: Instruction/Subjects/Subject Details/Syllabus/Examination and Evaluation System)

ATTENDANCE

In accordance with the Code of Studies and Examinations of the University of Pécs, Article 45 (2) and Annex 9. (Article 3) a student may be refused a grade or qualification in the given full-time course if the number of class absences exceeds 30% of the contact hours stipulated in the course description.

Method for monitoring attendance *(e.g.: attendance sheet / online test/ register, etc.)*

attendance sheet

ASSESSMENT

Cells of the appropriate type of requirement is to be filled out (course-units resulting in mid-term grade or examination). Cells of the other type can be deleted.

Course-unit with final examination

Mid-term assessments, performance evaluation and their weighting as a pre-requisite for taking the final exam

(The samples in the table to be deleted.)

Type	Assessment	*Weighting as a proportion of the pre-requisite for taking the exam*
1. *Assignments to be solved individually*	*0-100%*	*100%*
2.		
3.		
4.		

Requirements for the end-of-semester signature

(Eg.: mid-term assessment of 40%)

On the practice the students get individual assignments to solve. The quality of their solutions determines the given grade.

Re-takes for the end-of-semester signature (PTE TVSz 50§(2))

The specific regulations for grade betterment and re-take must be read and applied according to the general Code of Studies and Examinations. E.g.: all the tests and the records to be submitted can be repeated/improved each at least once every semester, and the tests and home assignments can be repeated/improved at least once in the first two weeks of the examination period.

Repeated submission of the solutions is possible on the first week of the exam period.

Calculation of the grade *(TVSz 47§ (3))*

The grade calculated on the test/assignment results is offered for the students as the final grade of the subject. This grade can be accepted or improved at an oral exam in the exam period. Thus the mid-term performance accounts for ***100*** % OR the performance at the exam accounts for ***100*** % in the calculation of the final grade.

Calculation of the final grade based on aggregate performance in percentage.

Course grade	Performance in %
excellent (5)	85 % …
good (4)	70 % ... 85 %
satisfactory (3)	55 % ... 70 %
pass (2)	40 % ... 55 %
fail (1)	below 40 %

The lower limit given at each grade belongs to that grade.

4. SPECIFIED LITERATURE

In order of relevance. (In Neptun ES: Instruction/Subject/Subject details/Syllabus/Literature)

COMPULSORY READING AND AVAILABILITY

[1] Dr. Tukora Balázs: Mobile robotics, elektronikus kézirat, PTE, MIK, Műszaki Informatika Tanszék, online
[2] Dr. Tukora Balázs: Localization techniques, elektronikus kézirat, PTE, MIK, Műszaki Informatika Tanszék, online
[3] Dr. Tukora Balázs: Path planning, elektronikus kézirat, PTE, MIK, Műszaki Informatika Tanszék, online
[4] AlphAI Activities, material for AlphAI robots
[5] Søren Riisgaard and Morten Rufus Blas: SLAM for Dummies A Tutorial Approach to Simultaneous Localization and Mapping, available online

RECOMMENDED LITERATURE AND AVAILABILITY