



Univerza v Mariboru

Fakulteta za naravoslovje  
in matematiko

### UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION

<b>Predmet:</b>	Robotika
<b>Subject Title:</b>	Robotics

Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
Tehnika – področje izobraževanja, 3. stopnja		2	zimski/poletni ali
		3	poletni
Education in Engineering, 3 <sup>rd</sup> cycle		2	winter/summer or
		3	summer

Univerzitetna koda predmeta / University subject code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Labor work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
10	5				75	3

Nosilec predmeta / Lecturer:

Karl Gotlih

Jeziki /

Languages:

Predavanja / Lecture:

Vaje / Tutorial:

Slovenščina / Slovene

**Pogoji za opravljanje študijskih obveznosti:**

Ni posebnih pogojev

**Prerequisites:**

No prerequisites

**Vsebina:**

Predmet Robotika podaja znanja, ki so potrebna pri razumevanju, načrtovanju in konstrukciji elementov robotskih sistemov in robotiziranih tehnoloških sistemov v celoti. Obravnavane bodo osnovne teme, kot so geometrija, kinematika in dinamika sistemov, direktna in inverzna kinematika in dinamika, singularnost, robotski elementi, prijemala, orodja, periferija. V vseh navedenih primerih so ob teoretičnih osnovah podani tudi praktični primeri. Obravnavane so tudi osnove krmilij, načini programiranja, servisiranja ali vzdrževanja.

**Content (Syllabus outline):**

The subject Robotics gives the knowledge, which is important for understanding, planning and designing of elements of a robotic technological system. Given are basic chapters of geometry, kinematics and dynamics of systems, direct and inverse kinematics and dynamics, singularities; robot elements, grippers, tools, outer devices. Parallel to the theoretical background are presented practical exercises for illustration. Included in the subject are also basics in control theory, programming and maintenance.

**Temeljni literatura in viri / Textbooks:**

- BAJD, Tadej, MIHELJ, Matjaž, LENARČIČ, Jadran, STANOVNIK, Aleš, MUNIH, Marko. Robotika. 1. izd. Ljubljana: Fakulteta za elektrotehniko, 2008.
- LENARČIČ, Jadran, BAJD, Tadej. Robotski mehanizmi. 1. izd. Ljubljana: Fakulteta za elektrotehniko, 2003.
- ANGELES, Jorge: Fundamentals of robotic mechanical systems. Springer, 2003.
- VDI 2740 Blatt1: Greifer für Handhabungsgeräte und Industrieroboter, 1995.
- EU 2006/42, ISO 8373, ISO 10218-1, ISO 10218-2, ISO 15066, ISO 12100

#### **Cilji:**

- študent bo osvojil poglobljena znanja s področja teorije in funkcionalne uporabe robotov;
- osvojene metode in spretnosti omogočajo študentu vpeljavo robotov v industrijske in neindustrijske aplikacije.

#### **Objectives:**

- the student will master detailed knowledge in the theoretical field and the functional use of robots;
- Learned methods and skills allow the student the implementation of robots into industrial and non-industrial applications.

#### **Predvideni študijski rezultati:**

##### Znanje in razumevanje:

- uporabe robotov in njihove aplikacije v industrijski ali servisni sistem;
- integriranja osnovnih principov delovanja sistema kot več-masnega vodenega sistema;
- konstruiranja sistema z robotom;
- načrtovanja dela z industrijskim robotom;
- vrednotenje različnih konceptov in sistemov z roboti;

##### Prenesljive/ključne spretnosti in drugi atributi:

*Spretnosti komuniciranja:* ustni zagovor laboratorijskih vaj, pisno izražanje pri pisnem izpitu.  
*Uporaba informacijske tehnologije:* uporaba programskih orodij za programiranje robotov.  
*Reševanje problemov:* načrtovanje nalog za robota.  
*Delo v skupini:* skupinsko delo pri laboratorijskih vajah.

#### **Intended learning outcomes:**

##### Knowledge and understanding:

- use of robots and its applications in industrial or service systems;
- integration of basic principles of a multibody controlled system;
- designing a system with robots;
- planning of work with industrial robots;
- evaluation of different concepts and systems with robots

##### Transferable/Key Skills and other attributes:

*Communication skills:* oral lab work defence, manner of expression at written examination.  
*Use of information technology:* use of programming tools for robot programming.  
*Problem solving:* design of robot tasks.  
*Working in a group:* group work at the lab work.

#### **Metode poučevanja in učenja:**

- predavanja
- dialog
- praktično delo na vajah

#### **Teaching and learning methods:**

- lectures
- dialogue
- practical laboratory work

#### **Načini ocenjevanja:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt):

- pisni izpit iz teorije,
- izdelana seminarska naloga (pisno).

Delež (v %) /  
Weight (in %)

**50**  
**50**

#### **Assessment methods:**

Type (examination, oral, coursework, project):

- written examination of the theory,
- written semira work.

#### **Materialni pogoji za izvedbo predmeta:**

- Predavalnica,
- Laboratorij za robotizacijo

#### **Material conditions for subject realization:**

- Classroom
- Laboratory for robotisation

#### **Obveznosti študentov:**

Pisni izpit, ustni izpit, domače naloge, projekti:

#### **Student's commitments:**

Written examination, oral examination, coursework, proje

- *pisni izpit iz teorije,*
- *izdelana seminarska naloga (pisno).*

- *written examination of the theory,*
- *written seminar work.*

**Reference nosilca / Lecturer's references:**

- GOTLIH, Janez, KARNER, Timi, GOTLIH, Karl, BREZOČNIK, Miran. Accuracy improvement of robotic machining based on robot's structural properties. International journal of advanced manufacturing technology. May 2020, vol. 108, str. 1309-1329. ISSN 0268-3768. DOI: 10.1007/s00170-020-05438-z. [COBISS.SI-ID 17156611], [JCR, SNIP]
- GOTLIH, Janez, KARNER, Timi, GOTLIH, Karl, BREZOČNIK, Miran. Application of industrial robots for robotic machining. V: KARABEGOVIĆ, Isak (ur.), BANJANOVIĆ-MEHMEDOVIĆ, Lejla (ur.). Industrial robots : design, applications and technology. New York: Nova Science Publishers, Inc., cop. 2020. Str. 397-434, ilustr. Robotics research and technology. ISBN 978-1-53617-779-4. [COBISS.SI-ID 19277571]
- GOTLIH, Janez, KARNER, Timi, GOTLIH, Karl, BREZOČNIK, Miran. Experiment based structural stiffness calibration of a virtual robot model. V: KATALINIĆ, Branko (ur.). DAAAM International scientific book 2018. Vienna: DAAAM International Vienna, 2018. Str. 131-140, ilustr. DAAAM International scientific book. ISBN 978-3-902734-19-8. ISSN 1726-9687. [COBISS.SI-ID 21830934]