



### UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	Praktično izobraževanje
<b>Course title:</b>	Practical education

Izobraževalni program in stopnja Educational programme and level	Študijska smer Study field	Študijsko leto Academic year
NOO projekt piloti: Naprednejša računalniška znanja (nivo: visokošolski strokovni študijski program)	Digitalizacija, internet stvari ter industrijska avtomatizacija	2022/23
RRP pilot project: Advanced computer skills (level: first cycle professional study programme)	Digitalization, Internet of Things, and Industrial Automatization	2022/23

**Vrsta predmeta / Course type** Obvezni / Obligatory

**Univerzitetna koda predmeta / University course code:** NOO-DISIA-VS-PI-2022-23

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
-	-	-	-	30	60	3

**Nosilec predmeta / Lecturer:** izr. prof. dr. Katarina Rojko, mentorji iz prakse.

**Jeziki / Languages:**

<b>Predavanja / Lectures:</b>	Slovenski / Slovenian, Angleški / English
<b>Vaje / Tutorial:</b>	Slovenski / Slovenian, Angleški / English

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Pogoj za opravljanje praktičnega izobraževanja je vpis v izobraževalni program in osvojene učne vsebine predmetov Osnove programiranja, Informacijski sistemi, Industrijska avtomatizacija za informatiko, Internet stvari in Uvod v kibernetiko varnost.

**Prerequisites:**

The prerequisite for practical education is enrollment in the educational program and acquired learning content of the subjects Basics of programming, Information systems, Industrial automation for informatics, Internet of things and Introduction to cyber security.



## Vsebina:

### Računalniško geometrijsko modeliranje:

- moduli (kosi, sestavi, dokumentacija). Osnovni ukazi:
  - izbira ravnine za 2D risanje,
  - priprava skice,
  - kotiranje skice,
  - ekstrudiranje na podlagi skice,
  - volumski izrezi,
  - linearni vzorci,
  - sestavljanje kosov v sestav z ujemanji (mates),
  - priprava načrta z različnimi pogledi.
- Praktična naloga: priprava preprostega 3D modela.

### Navidezna resničnost:

- kratka zgodovina virtualne resničnosti, različni tipi (virtualna (VR), obogatena (AR), mešana (MR), razširjena (XR)). Trenutno stanje (praktični preizkus različne VR/AR/XR opreme (Hololens, Oculus, Treadmill, Senseglove, ...), pričakovani razvoj VR/XR oz. kako bo integriran v naš vsakdan.
- osnove razvoja VR aplikacij s programom Unity:
  - kreiranje novih objektov, materialov, dodajanje gravitacije itd., osnovne komponente za VR,
  - osnove premikanja in obračanja v VR prostoru (locomotion in teleportiranje), kako prijemat predmete,
  - vtičnice, preko katerih se predmete obesijo enega na drugega (npr. sliko na steno),
- praktična naloga 1: ustvariti sobo napolnjeno s predmeti, po kateri se bo potrebno premikati, premeščati predmete in jih obešati.

## Content (Syllabus outline):

### Computer geometric modelling:

- modules (pieces, assemblies, documentation). Basic commands:
  - choosing location for 2D drawing,
  - sketch preparation,
  - sketch dimensioning,
  - extruding based on a sketch,
  - volume cuts,
  - linear patterns,
  - assembling pieces into a composition with matches (mates),
  - preparing a plan with different views.
- Practical task: preparation of a simple 3D model.

### Virtual reality:

- a brief history of virtual reality, different types (virtual (VR), augmented (AR), mixed (MR), eXtended (XR)). Current situation (practical test of various VR/AR/XR equipment (Hololens, Oculus, Treadmill, Senseglove, ...), expected development of VR/XR or how it will be integrated into our everyday life.
- the basics of developing VR applications with Unity:
  - creating new objects, materials, adding gravity, etc., basic components for VR,
  - basics of moving and turning in VR space (locomotion and teleportation), how to grasp objects,
  - sockets, through which objects are hung one on top of the other (e.g., a picture on the wall),
- practical task 1: create a room filled with objects, in which it will be necessary to move, move objects and hang them.



- Naprednejša uporaba VR v programu Unity:
  - Uporaba artikla
  - Interakcije
  - Skripte
  - Uporabniški vmesnik
  - Haptične rokavice
- Praktična naloga 2: v kreirani sobi v sklopu praktične naloge 1 dodati dogodke (npr. prižig luči), ustvariti skripto za premikanje oz. rotiranje predmetov, dodati uporabniški vmesnik z informacijami/navodili, dodati komponento za delovanje haptičnih rokavic.

#### Programiranje programabilnih logičnih krmilnikov (PLK):

- spoznavanje več vrst PLK-jev, različne programske opreme ter različnih načinov programiranja:
- Osnove delovanja PLK-ja
- Začetna konfiguracija PLK-ja
- Vezava elementov prek digitalnih vhodov in izhodov (tipke/stikala, luči)
- Programiranje v LADDER DIAGRAMU, koračno programiranje v SCL/ST
- Praktična naloga 1: Vezava stikal in luči na krmilnik in izvedba kratkega programa za simulacijo semaforja.
- Spoznavanje industrijskih komunikacijskih protokolov in povezava ventilskih otokov:
  - Konfiguracija SMC ventilskega otoka preko ind. komunikacije s krmilnikom
  - Elektro-pnevmatska vezava elementov (ventilski otok)
  - zvedba programa za prikaz delovanja pnevmatskih cilindrov v sekvenci
- Praktična naloga 2: Izvedba krmiljenja pnevmatskega manipulatorja za premikanje majhnih predmetov.

- More advanced use of VR in Unity:
  - Using the item
  - Interactions
  - Scripts
  - User interface
  - Haptic gloves
- Practical task 2: in the created room as part of practical task 1, add events (e.g., turning on the light), create a script for movement or rotate objects, add info/instructions UI, add component for haptic gloves to work.

#### Programmable logic controllers (PLCs):

- getting to know several types of PLCs, different software and different programming methods:
  - Basics of PLK operation
  - Initial configuration of the PLC
  - Binding of elements via digital inputs and outputs (buttons/switches, lights)
  - Programming in LADDER DIAGRAM, step programming in SCL/ST
  - Practical task 1: Binding switches and lights to the controller and executing a short program to simulate a traffic light.
  - Getting to know industrial communication protocols and the connection of valve islands:
    - Configuration of SMC valve island via ind. communications with the controller
    - Electro-pneumatic connection of elements (valve island)
    - execution of a program to show the operation of pneumatic cylinders in sequence
  - Practical task 2: Implementation of the control of a pneumatic manipulator for moving small objects.
- #### Robotics:
- Basics of robotics:
    - What is a robot?



### Robotika:

- Osnove robotike:
  - Kaj je robot?
  - Kje robote lahko uporabimo?
  - Kakšne robote poznamo? (artikulirani, scara, delta...)
  - Kakšne so razlike med roboti? (Razvrstitev; industrijski, kolaborativni, 6 osni...)
  - Zakaj bi uvedel robota?
  - Kdaj se robot splača?
  - Katere dejavnike moram upoštevati?
  - Kako uvajanje robotov vpliva na ostale zaposlene?
- Delovanje robotov:
  - Osnovni elementi robota (robot, orodje-prijemalo, krmilna omara, konzola, itd.).
  - Koordinatni sistem robota, prijemala...
  - Način programiranja (konzola, offline v simulacijskih okoljih Roboguide, RoboDK...).
- Zagon robotskega programa (demo aplikacija)
  - Kje so shranjeni programi, kako se zažene program?
  - Varnostne zahteve za zagon programa.
  - Prekinitve med delovanjem in ponovni zagon.
- Premikanje robota in kreiranje enostavnega programa
  - Premikanje robota v različnih koordinatnih sistemih.
  - Kako se kreira program, kako deluje prijemalo?
  - Programiranje enostavnega programa pobiranja in odlaganja.

- Praktična naloga: Izvedba robotske aplikacije za premikanje palet z obdelovancem.

- Where can we use robots?
- What kind of robots do we know? (articulated, scara, delta...)
- What are the differences between robots? (Classification; industrial, collaborative, 6 axes...)
- Why introduce a robot?
- When is a robot worth it?
- What factors should be considered?
- How does the introduction of robots affect other employees?
- Operation of robots:
  - Basic elements of the robot (robot, tool-gripper, control cabinet, console, etc.).
  - Coordinate system of the robot, grippers...
  - Programming method (console, offline in simulation environments Roboguide, RoboDK...).
- Starting the robot program (demo application)
  - Where are the programs stored; how does the program start?
  - Security requirements for running the program.
  - Interruptions during operation and restarts.
- Moving the robot and creating a simple program
  - Moving the robot in different coordinate systems.
  - How is the program created, how does the gripper work?
  - Programming a simple program for pick-up and drop-off.

- Practical task: Implementation of a robotic application for moving pallets with a workpiece.



### Temeljni literatura in viri / Readings:

- Pravilnik o izvajanju delovne prakse študentov na Fakulteti za informacijske študije v Novem mestu.
- Regulations on performing student work practice at the Faculty of Information Studies in Novo mesto.

### Cilji in kompetence:

*Učna enota prispeva k razvoju naslednjih splošnih:*

- zmožnost vzpostavljanja in vzdrževanja odnosov za delo v skupini in z drugimi uporabniki ter skupinami (lokalna skupnost, organizacije javne uprave, gospodarstvo, nevladne organizacije)
- usposobljenost za načrtovanje organizacijskih in informacijskih sprememb v organizaciji, ki so potrebne pri uvajanju informacijsko komunikacijske tehnologije ter pri kakovostni uporabi le-te
- usposobljenost za samostojno in avtonomno uporabo, nadzor in vzdrževanje informacijsko komunikacijske tehnologije v organizaciji
- razvoj (samo)kritične presoje
- občutljivost za ljudi in socialno okolje ter razvoj komunikacijskih sposobnosti in spretnosti

*in predmetno- specifičnih kompetenc:*

- **Računalniško geometrijsko modeliranje:** moduli in osnovni ukazi: sposobnost priprave preprostega 3D modela.
- **Navidezna resničnost:** sposobnost osnovnega razvoja VR aplikacij s programom Unity: in naprednejša uporaba VR v programu Unity.
- **Programiranje programabilnih logičnih krmilnikov (PLK):** poznavanje vrst PLK-jev, različne programske opreme ter različnih

### Objectives and competences:

*The instructional unit contributes to the development of the following general:*

- ability to establish and maintain relationships for group-work as well as with other users and groups (local communities, public administration organizations, industry, non-governmental organizations)
- competence for planning of organisational and information changes in an institution, which are required in the introduction of information communication technology and a quality use thereof,
- competence for independent and autonomous use, monitoring and maintenance of information communication technology in an institution
- development of (self)critical judgement
- sensitivity for people and social environment and development of communication competences and skills, especially for communication in the international environment

*and subject-specific competences:*

- **Computer geometric modelling:** modules and basic commands: the ability to prepare a simple 3D model.
- **Virtual Reality:** Ability to develop basic VR applications with Unity: and more advanced use of VR in Unity.
- **Programmable logic controllers (PLCs):** knowledge of PLC types, different software and programming methods, industrial communication



načinov programiranja, industrijskih komunikacijskih protokolov in povezav ventilskih otokov.

- **Robotika:** razumevanje uporabe, robotov, njihovih osnovnih elementov in sposobnosti programiranja in upravljanja enostavnega robotskega programa (aplikacije).

protocols, and connections of valve islands.

- **Robotics:** understanding the use of robots, their basic elements, and the ability to program and manage a simple robot program (application).

### Predvideni študijski rezultati:

Znanje in razumevanje:

- usposobljenost za osnovno delo s računalniškim programom za **računalniško geometrijsko modeliranje** (Solid Works); sposobnost izdelave preprostega 3D modela.
- **Navidezna resničnost:** sposobnosti ustvariti sobo v programu Unity napolnjeno s predmeti, po kateri se bo potrebno premikati, premeščati predmete, jih obešati, dodati dogodke (npr. prižig luči), ustvariti skripto za premikanje oz. rotiranje predmetov, dodati uporabniški vmesnik z informacijami/navodili, dodati komponento za delovanje haptičnih rokavic.
- **Programiranje programabilnih logičnih krmilnikov (PLK):** usposobljenost za vezavo stikal in luči na krmilnik in izvedbo kratkega programa za simulacijo semaforja; sposobnost izdelave krmiljenja pnevmatskega manipulatorja za premikanje majhnih predmetov.
- **Robotika:** Sposobnost izvedbe osnovne robotske aplikacije.

### Intended learning outcomes:

Knowledge and understanding:

- qualification for basic work with a computer program for **computer geometric modelling** (Solid Works); the ability to create a simple 3D model.
- **Virtual reality:** the ability to create a room in Unity filled with objects, to be able to move around the room, move objects, hang them, add events (e.g., turning on a light), create a movement script or rotate objects, add info/instructions, add a component for haptic gloves to work.
- **Programmable logic controllers (PLCs):** competence in binding switches and lights to the controller and execution of a short program for traffic light simulation; the ability to make pneumatic manipulator controls to move small objects.
- **Robotics:** The ability to perform a basic robotic application.



**Metode poučevanja in učenja:**

- učenje in praktično delo v realnem in/ali simuliranem delovnem okolju
- priprava in praktična izvedba nalog posameznih šestih vsebinskih sklopov

**Learning and teaching methods:**

- learning and practical work in a real and/or simulated work environment
- preparation and practical implementation of the tasks of individual six content sections

**Načini ocenjevanja:**

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

- praktične naloge šestih vsebinskih sklopov praktičnega izobraževanja

Delež (v %) /  
Weight (in %)

100

**Assessment:**

Type (examination, oral, coursework, project):

- practical tasks of six sections of practical education

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

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