



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Merjenje in krmiljenje z računalnikom
Course title:	Computer Based Measurement And Control Systems

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Predmetni učitelj / 1. in 2. stopnja	Izobraževalna tehnika	3	Poletni / Summer
Subject teacher / 1. and 2. level	Technical education		

Vrsta predmeta / Course type

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	15		45		90	6

Nosilec predmeta / Lecturer:

Jeziki / Languages: Predavanja / Lectures:
Vaje / Tutorial:

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

Priporočeno je osnovno znanje iz fizike.

Prerequisites:

Basic knowledge of physics is recommended.

Vsebina:

Content (Syllabus outline):

Predavanja:

- Namen, zgradba in komponente računalniško podprtih merilnih sistemov.
- Strojna in programska oprema virtualne instrumentacije. Pridobivanje, analiza in prikaz merilnih podatkov.
- Grafični programski jezik G in uporaba programskega orodja LabVIEW za izdelavo računalniško podprtih merilnih sistemov.
- Ožičenje, prilagoditev in pretvorba merilnih signalov. Zajemanje in generiranje analognih ter digitalnih signalov z večnamenskimi merilnimi karticami.
- Instrumentacijska vodila in industrijski standardi za upravljanje merilnih instrumentov.
- Modularni merilni sistemi.
- Internetne tehnologije v merilni tehniki. Uporaba podatkovnih baz v merilni tehniki.
- Načrtovanje in razvijanje večjih merilnih aplikacij.

Laboratorijske vaje:

- Laboratorijske vaje aplikativno dopolnjujejo vsebino predavanj z reševanjem praktičnih primerov v laboratoriju.

Lectures:

- Purpose, structure and components of computer-based measurement systems.
- Software and hardware components of virtual instrumentation.
- Data acquisition, analysis and presentation of measurement data.
- Graphical programming language G and usage of LabVIEW for the design of computer-based measurement systems. Wiring, conditioning and conversion of measurement signals.
- Acquisition and generation of analog and digital signals with multifunction data acquisition devices.
- Instrumentation buses and industry standards for instrument control.
- Modular instrumentation systems. Internet technologies in measurement. Usage of databases in measurement.
- Planning and development of large measurement applications.

Lab work:

- Laboratory work supplements the lectures with the solutions of the practical problems in the laboratory.

Temeljni literatura in viri / Readings:

J. Park, S. Mackay: Practical Data Acquisition for Instrumentation and Control Systems, Elsevier-Newnes, Oxford, 2003.

J. Travis, J. Kring: LabVIEW for Everyone: Graphical Programming Made Easy and Fun, Third Edition, Prentice Hall PTR, Upper Saddle River, 2007.

R. H. Bishop: LabVIEW 8 Student Edition, First Edition, Prentice Hall, Upper Saddle River, 2007.

C. F. Coombs: Electronic Instrument Handbook, Third Edition, McGraw-Hill, New York, 1999.

M. L. Chugani, A. R. Samant, M. Cerna: LabVIEW Signal Processing, Prentice Hall PTR, Upper Saddle River, 1998.

Cilji in kompetence:**Objectives and competences:**

Cilj predmeta je, da bodo študenti pridobili teoretično in praktično znanje za načrtovanje ter izdelavo učinkovitih računalniško podprtih merilnih in instrumentacijskih sistemov.

The objective of this course is that students will acquire theoretical and practical knowledge they require in order to specify and design effective computer-based measurement and instrumentation systems.

Predvideni študijski rezultati:

Znanje in razumevanje:

Po zaključku tega predmeta bo študent sposoben:

- izkazati znanje in razumevanje računalniško podprtih merilnih in instrumentacijskih sistemov,
- analizirati in izbrati strojno ter programsko opremo za računalniško podprte merilne sisteme,
- načrtati in izdelati ustrezno računalniško podprto meritev ali instrument za posamezno aplikacijo,
- primerjati zmožnosti in omejitve računalniško podprtih merilnih instrumentov z namensko izdelanimi instrumenti, vrednotiti vrsto industrijsko standardnih računalniško podprtih merilnih tehnik.

Prenosljive/ključne spretnosti in drugi atributi:

- Spretnosti komuniciranja: izražanje pri ustnem in pisnem izpitu, pisanje strokovnega poročila o laboratorijskih vajah.
- Uporaba informacijske tehnologije: uporaba programskih orodij za izdelavo računalniško podprtih merilnih sistemov. Organizacijske spretnosti: organizacija dela pri izvedbi laboratorijskih vaj.
- Reševanje problemov: načrtovanje in izdelava računalniško podprtih merilnih sistemov.

Intended learning outcomes:

Knowledge and understanding:

On completion of this course the student will be able to:

- demonstrate knowledge and understanding of computer-based measurement and instrumentation systems,
- analyse and select the hardware and software for a computer-based measurement systems,
- design and implement a suitable computer-based measurement or instrument for a particular application, compare the capabilities and limitations of computer-based instrumentation to those of purpose-built instruments, evaluate a range of industry standard computer-based measurement techniques.

Transferable/Key skills and other attributes:

- Communication skills: manner of expression at oral and written examination, technical writing of lab work report.
- Use of information technology: use of software tools for implementation of computer-based measurement systems. Organisation skills: organization of labour at realization of lab work.
- Problem solving: designing and implementing of computer-based measurement systems.

Metode poučevanja in učenja:

Learning and teaching methods:

-frontalna predavanja,
-izdelava seminarske naloge.

-Lectures
-seminar work

Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

pisni izpit	40 %	written examination
ustni izpit	40 %	oral examination
opravljene laboratorijske vaje	20 %	completed laboratory work

Reference nosilca / Lecturer's references:

1.01 Izvirni znanstveni članek

1. RIŽNAR, Matej, VALENKO, Darko, GOLOB, Marjan, MUŠKINJA, Nenad. Optimized diving velocity and depth control for diver's automatic buoyancy control device. Marine Technology Society journal, ISSN 0025-3324, Jan./Feb. 2015, vol. 49, no. 1, str. 124-130. [COBISS.SI-ID 18543894], [JCR, SNIP, WoS do 18. 4. 2015: št. citatov (TC): 0, čistih citatov (CI): 0, Scopus do 9. 6. 2017: št. citatov (TC): 0, čistih citatov (CI): 0]
2. MUŠKINJA, Nenad, RIŽNAR, Matej. Optimized PID position control of a nonlinear system based on correlating the velocity with position error. Mathematical problems in engineering, ISSN 1024-123X. [Print ed.], 2015, vol. 2015, 1-11 str. <https://dk.um.si/IzpisGradiva.php?id=66212>. [COBISS.SI-ID 18501398], [JCR, SNIP, WoS do 9. 5. 2015: št. citatov (TC): 0, čistih citatov (CI): 0, Scopus do 28. 1. 2018: št. citatov (TC): 1, čistih citatov (CI): 1]
3. BRATINA, Božidar, MUŠKINJA, Nenad, TOVORNIK, Boris. Design of an auto-associative neural network by using design of experiments approach. Neural computing & applications, ISSN 0941-0643, Mar. 2010, vol. 19, no. 2, str. 207-218, doi: 10.1007/s00521-009-0287-6. [COBISS.SI-ID 13441302], [JCR, SNIP, WoS do 28. 10. 2014: št. citatov (TC): 3, čistih citatov (CI): 3, Scopus do 6. 9. 2015: št. citatov (TC): 3, čistih citatov (CI): 3]
4. BRATINA, Božidar, MUŠKINJA, Nenad, TOVORNIK, Boris. Design of an auto-associative neural network by using design of experiments approach. V: Knowledge-Based Intelligent Information and Engineering Systems, KES 2008, 12th International Conference, Zagreb, Croatia, September 3-5, 2008 : proceedings, (Lecture notes in computer science, ISSN 0302-9743, Lecture notes in artificial intelligence, LNAI 5177, LNAI 5178, LNAI 5179). Berlin; Heidelberg: Springer. cop. 2008, vol. 5177, str. 25-32. [COBISS.SI-ID 12547606], [SNIP, Scopus do 2. 2. 2011: št. citatov (TC): 0, čistih citatov (CI): 0]
5. MUŠKINJA, Nenad, TOVORNIK, Boris. Swinging up and stabilization of a real inverted pendulum. IEEE transactions on industrial electronics, ISSN 0278-0046. [Print ed.], apr. 2006, vol. 53, no. 2, str. 631-639. [COBISS.SI-ID 10392598], [JCR, SNIP, WoS do 18. 3. 2018: št. citatov (TC): 61, čistih citatov (CI): 61, Scopus do 19. 3. 2018: št. citatov (TC): 123, čistih citatov (CI): 123]