



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: Fizikalna merjenja
Course title: Measurements in Physics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Enovit magistrski študijski program druge stopnje Predmetni učitelj	/	4	7
Five-year master's degree program Subject Teacher	/		

Vrsta predmeta / Course type

Obvezni/Compulsory

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
30			30		30	3

Nosilec predmeta / Lecturer:

Janez Štrancar

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

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

Pogojev ni.

Prerequisites:

None.

Vsebina:

Opis meritve, merjenje skalarnih in vektorskih količin. Splošni opis senzorjev, prenosna funkcija, povratni vpliv na opazovani sistem, termični šum.
Osnove elektronskih vezij
Merjenje konstantnih količin in statistika, preizkušanje hipotez. Metoda najmanjših kvadratov. Odziv sistema na periodično motnjo.

Content (Syllabus outline):

Description of the measurement of the scalar and vector quantities Tensors and transfer function, feedback to the system, thermic noise
Basic electrical circuits
Measurement of the constant quantity, statistics, tests Least squares method Respond of the system to the periodically disturbance Measurement of the time and frequency, feedback loop and standards .

Merjenje frekvence in časa, fazna povratna zanka, časovni standardi.

Senzorski sistemi: uporovni potenciometer, uporovni listič, diferencialni transformator, kondenzatorski senzor, piezoelektrični senzor, temperaturni senzorji na raztezek, uporovni senzorji, termočlen, bolometer, piroelektrični senzorji.

Sensor systems: of displacement: potentiometer, strain gauge, differential transformer, condenser, piezoelectrical sensor Temperature sensors: extensible sensors, resistance, thermocouple, bolometer, piezoelectrical sensors.

Temeljna literatura in viri / Readings:

- A. Likar: Osnove fizikalnih merenj in merilnih sistemov, DMFA, Zbirka izbranih poglavij iz fizike, Ljubljana 1992
- E.O. Doebelin: Measurement Systems, Application and Design, McGraw-Hill, International, 1983
- J. Pahor: Elektronski praktikum za fizike, Ljubljana DMFA 1989.

Cilji in kompetence:

Študentje so sposobni razlikovati rezultate merenj glede na vpliv merjenega in merilnega sistema.

Objectives and competences:

Students can differentiate the measurement results based on the effect of measured and measuring systems.

Predvideni študijski rezultati:

Znanje in razumevanje:

Pripraviti in uporabiti merilni sistem vključno z digitalno merilno shemo
Ovrednotiti in razločiti vpliv merilnega in merjenega sistema
Obdelati in razumeti rezultate meritev in na tej podlagi optimizirati merilni sistem.

Prenesljive/ključne spretnosti in drugi atributi:

Obdelati rezultate meritev
Izbrati ustrezne merilne metode in senzorske sisteme
Presoditi smiselnost uporabe senzorjev v izbranih časovnih okvirih

Intended learning outcomes:

Knowledge and understanding:

Setting up and implementing measuring system including digital measurement scheme
Evaluate and differentiate effects of measuring and measured system
Understand the results of the measurements and employ them to optimize the measuring system

Transferable/Key Skills and other attributes:

Processing of the measurement data
Choosing the right measurement method and sensor systems
Deciding if the selected sensors fit reasonable well to the defined time frame

Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja	Lectures
Eksperimentalna predavanja	Experimental lectures
Laboratorijske vaje	Laboratory work
Problemsko učenje	Problem based learning
Uporaba programskih okolij za krmiljenje in obdelavo podatkov	Using software for control and data analysis

Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (examination, oral, coursework, project):
ustni izpit	100	oral exam
opravljene lab. vaje in izdelan dnevnik laboratorijskih vaj		done experiments and logbook of laboratory work

Reference nosilca / Lecturer's references:

<ul style="list-style-type: none"> • URBANČIČ, Iztok, GARVAS, Maja, KOKOT, Boštjan, MAJARON, Hana, UMEK, Polona, ŠKARABOT, Miha, ARSOV, Zoran, KOKLIČ, Tilen, ČEH, Miran, MUŠEVIČ, Igor, ŠTRANCAR, Janez, et al. Nanoparticles can wrap epithelial cell membranes ... <i>Nano letters</i>, 2018, vol. 18, no. 8, str. 5294-5305, doi: 10.1021/acs.nanolett.8b02291. • SEDMAK, Ivan, URBANČIČ, Iztok, PODLIPEC, Rok, ŠTRANCAR, Janez, MORTIER, Michel, GOLOBIČ, Iztok. Submicron thermal imaging ... <i>Energy</i>, 2016, vol. 109, 436-445, doi: 10.1016/j.energy.2016.04.121. • PODLIPEC, Rok, ŠTRANCAR, Janez. Cell-scaffold adhesion dynamics ... <i>ACS applied materials & interfaces</i>, 2015, vol. 7, no. 12, 6782-6791 • URBANČIČ, Iztok, LJUBETIČ, Ajasja, ŠTRANCAR, Janez. Resolving internal motional correlations ... <i>The journal of physical chemistry letters</i>, 2014, vol. 5, no. 20, 3593-3600. • MLAKAR, Jana, ŠTRANCAR, Janez. Temperature and humidity profiles ... <i>Building and environment</i>, 2013, vol. 60, 185-193 • ARSOV, Zoran, URBANČIČ, Iztok, GARVAS, Maja, BIGLINO, Daniele, LJUBETIČ, Ajasja, KOKLIČ, Tilen, ŠTRANCAR, Janez. Fluorescence microspectroscopy ... <i>Biomedical optics express</i>, 2011, vol. 2, no. 8, 2083-2095
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- KVALENKA, Aleh A., URBANČIČ, Iztok, KURE, Sandra, ŠTRANCAR, Janez, et al. Conformational analysis ... *Biophysical journal*, 2010, vol. 98, no. 6, 1055-1064
- OMERZU, Aleš, ANŽELAK, Bernarda, TUREL, Iztok, ŠTRANCAR, Janez, POTOČNIK, Anton, ARČON, Denis, ARČON, Iztok, MIHAILOVIĆ, Dragan, MATSUI, Hiroshi. Strong correlations in ... *Physical review letters*, 2010, vol. 104, no. 15, 156804-1-156804-4
- BELLE, Valerie, ŠTRANCAR, Janez, et al. Mapping α -helical induced folding ... *Proteins*, 2008, issue 4, vol. 73, 973-988