



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
Fizika, 1. stopnja	/	2	3
Physics, 1st cycle	/		

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		60	4

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

Senzorski sistemi: uporovni potenciometer, uporovni listič, diferencialni transformator,

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 .

Sensor systems: of displacement: potentiometer, strain gauge, differential transformer, condenser, piezoelectrical sensor Temperature sensors:

kondenzatorski senzor, piezoelektrični senzor, temperaturni senzorji na raztezek, uporabni senzorji, termočlen, bolometer, piroelektrični senzorji.

extensible sensors, resistance, thermocouple, bolometer, piroelectically sensors.

Temeljni literatura in viri / Readings:

- A.Likar: Osnove fizikalnih merjenj 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 merjenj 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:

Predavanja
Eksperimentalna predavanja

Learning and teaching methods:

Lectures
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): ustni izpit Opravljene lab. vaje in izdelan dnevnik laboratorijskih vaj so pogoj za pristop k ustnemu izpitu.	100	Type (examination, oral, coursework, project): oral exam Done experiments and logbook of laboratory work are required to access the oral exam.
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Reference nosilca / Lecturer's references:

<ul style="list-style-type: none"> • HAVRDOVÁ, Markéta, URBANČIČ, Iztok, BARTOŇ TOMÁNKOVÁ, Kateřina, MALINA, Lukáš, POLÁKOVÁ, Kateřina, ŠTRANCAR, Janez, BOURLINOS, Athanasios B. Intracellular trafficking of cationic carbon dots in cancer cell lines MCF-7 and HeLa—time lapse microscopy, concentration-dependent uptake, viability, DNA damage, and cell cycle profile. <i>International journal of molecular sciences</i>. 2022, vol. 23, no. 3, str. 1077-1-1077-13. ISSN 1661-6596. DOI: 10.3390/ijms23031077. [COBISS.SI-ID 95168003] • LEROUX, Mélanie, KOKOT, Boštjan, KOKOT, Hana, KOKLIČ, Tilen, ŠTRANCAR, Janez, et al. Aerosol–cell exposure system applied to semi-adherent cells for aerosolization of lung surfactant and nanoparticles followed by high quality RNA extraction. <i>Nanomaterials</i>. [Online ed.]. 2022, vol. 12, no. 8, str. 1362-1-1362-23. ISSN 2079-4991. DOI: 10.3390/nano12081362. • PODLIPEC, Rok, MUR, Jaka, PETELIN, Jaka, ŠTRANCAR, Janez, PETKOVŠEK, Rok. Method for controlled tissue theranostics using a single tunable laser source. <i>Biomedical optics express</i>. 2021, vol. 12, no. 9, str. 5881-5893. ISSN 2156-7085. DOI: 10.1364/BOE.428467. • KOKOT, Hana, KOKOT, Boštjan, SEBASTIJANOVIĆ, Aleksandar, PODLIPEC, Rok, KRIŠELJ, Ana, ČOTAR, Petra, PUŠNIK, Mojca, UMEK, Polona, PAJK, Stane, URBANČIČ, Iztok, KOKLIČ, Tilen, ŠTRANCAR, Janez, et al. Prediction of chronic inflammation for inhaled particles : the impact of material cycling and quarantining in the lung epithelium. <i>Advanced materials</i>. [Online ed.]. 2020, vol. 32, no. 47, str. 2003913-1-2003913-15. ISSN 1521-4095. DOI: 10.1002/adma.202003913. • PODLIPEC, Rok, ARSOV, Zoran, KOKLIČ, Tilen, ŠTRANCAR, Janez. Characterization of blood coagulation dynamics and oxygenation in ex- vivo retinal vessels by fluorescence hyperspectral imaging (fHSI). <i>Journal of biophotonics</i>. 2020, vol. 13, no. 8, str. e202000021-1-e202000021-12. ISSN 1864-0648. DOI: 10.1002/jbio.202000021. •
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