



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION

Predmet:	Razvoj medpredmetne povezave tehnike in fizike
Subject Title:	Development of cross-curricular connections of Engineering and Physics

Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
Tehnika – področje izobraževanja		2	zimski/poletni ali
		3	poletni
Education in Engineering		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:

dr. Robert Repnik

Jeziki /
Languages:

Predavanja / Lecture: Slovenščina / Slovene
Vaje / Tutorial:

Pogoji za opravljanje študijskih obveznosti:

Osnovno znanje računalništva.

Prerequisites:

Basic knowledge of computer science.

Vsebina:

Vsebina:
1. Pregled fizikalnih vsebin v učnih načrtih fizike v osnovni in srednji šoli.
2. Dnevi dejavnosti ter strokovne ekskurzije v šoli s poudarkom na medpredmetnem povezovanju fizike in tehnike.
3. Raziskovalna orodja za spremljanje razvoja kvalitete in kvantitete medpredmetne povezave fizike in tehnike.
4. Poznavanje primerov dobre prakse medpredmetnega povezovanja fizike, astronomije in tehnike v osnovni in srednji šoli.
6. Načrtovanje in izvedba raziskave na področju razvoja medpredmetnega povezovanja fizike, astronomije in tehnike v osnovni ali srednji šoli.

Content (Syllabus outline):

Contents:
1. Overview of physics content in the curriculum of physics in primary and secondary school.
2. Days of special activities and school excursions with an emphasis on cross-curricular connections of physics and engineering.
3. Research tools for monitoring development in the quality and quantity of cross-curricular connections of physics and technology.
4. Examples of good practice of cross-curricular connections in teaching physics, astronomy and engineering in primary and secondary school.
6. Design and execution of research in the development of cross-curricular connections in teaching physics, astronomy and technology in primary or secondary school.

Temeljni literatura in viri / Textbooks:

Burton, Diana, Bartlett, Steve. Key issues for education researchers, Sage Publications Ltd., London UK, 2009

Fraenkel, Jack r., Wallen, Norman E., Hyun, Hellen H.. How to design and evaluate Research in Education, McGraw-Hill Companies Inc., New York, USA, 2012

Newby, Peter. Research Methods for Education, Pearson Education Ltd., Harlow, Essex, UK, 2010

Cohen, L., Manion, L. in Morrison, K. (2005). *Research methods in Education* (5th ed.). London, New York: RoutledgeFalmer.

Čagran, B. (2004). *Univariatna in multivariatna analiza podatkov: zbirka primerov uporabe statističnih metod s SPSS*. Maribor: Pedagoška fakulteta.

Aktualni učni načrti za fiziko, oziroma za predmete z vključenimi fizikalnimi vsebinami v osnovni in srednji šoli.

Aktualni učni načrti za tehniko, oziroma za predmete z vključenimi tehniškimi vsebinami v osnovni in srednji šoli.

Na spletnih straneh Oddelka za fiziko in Oddelka za tehniko objavljena elektronska gradiva / teaching material published on websites of Department of Physics

Literatura in spletni viri projekta Razvoj naravoslovnih kompetenc

Spletni viri o aktualnih in zaključenih raziskavah in projektih s področja izobraževanja fizike v Sloveniji in EU, predvsem s področja medpredmetnih povezav.

Znanstvene in strokovne revije relevantnih področij.

Slovenski in tuji elektronski in tiskani visokošolski učbeniki za fiziko in tehniko ter predmete z vključenimi fizikalnimi in/ali tehniškimi vsebinami v osnovni in srednji šoli.

Cilji:

Cilj predmeta je podrobno poznavanje učnih načrtov fizike in tehnike ter predmetov z vključenimi fizikalnimi in/ali tehniškimi vsebinami v osnovni in srednji šoli.

Poznati in razumeti namen in cilje medpredmetnega povezovanja fizike in tehnike.

Znati koristno uporabljati medpredmetno povezovanje fizike in tehnike pri pouku in pri dnevih dejavnosti ter strokovnih ekskurzijah.

Znati načrtovati in izvesti raziskave na področju razvoja medpredmetnega povezovanja fizike, astronomije in tehnike v osnovni in/ali srednji šoli.

Objectives:

The aim of the course is detailed knowledge of the curriculum of physics and engineering and subjects with included physical and / or engineering content in primary and secondary school.

To understand the purpose and goals of interdisciplinary teaching of physics and engineering.

Knowing how to use a cross-curricular connections of physics and technology in the classroom and in the days of special activities and school excursions.

Ability to design and execute the research in the development of i cross-curricular connections in teaching physics, astronomy and technology in primary and/or secondary school.

Predvideni študijski rezultati:

Znanje in razumevanje:

Poznavanje učnih načrtov fizike in tehnike ter predmetov z vključenimi fizikalnimi in/ali tehniškimi vsebinami v osnovni in srednji šoli.

Razumevanje namena in ciljev medpredmetnega povezovanja fizike in tehnike.

Uporabljati raziskovalne metode v izobraževanju za spremljanje razvoja kvalitete in kvantitete medpredmetne povezave fizike in tehnike.

Intended learning outcomes:

Knowledge and understanding:

Knowing the curriculum of physics and engineering and subjects with included physical and / or engineering content in primary and secondary school.

Understanding the purpose and goals of cross-curricular connections in physics and engineering.

Use research methods in education for monitoring the development of quality and quantity of cross-curricular connections in physics and technology.

Prenesljive/ključne spretnosti in drugi atributi:
 Sposobnost analize informacij in sinteze zaključkov na podlagi primerjave učnih načrtov fizike in tehnike.
 Razvoj sistematičnega in analitičnega razmišljanja na podlagi poznavanja raziskav in dobrih praks.
 Sposobnost izbire in uporabe ustreznih raziskovalnih metod na različnih področjih.
 Načrtovati in uporabljati kompetence, potrebne za prenos znanstvenih dognanj v pouk (fizike in tehnike).
 Zmožnost oblikovanja medpredmetnih povezav pri pouku, dnevih dejavnosti in strokovnih ekskurzijah.

Transferable/Key Skills and other attributes:
 Ability to analyze information and synthesize conclusions on the basis of a comparison of curriculum in physics and engineering.
 The development of systematic and analytical thinking on the basis of knowledge of research results and best practices.
 The ability to select and to apply appropriate research methods in different areas.
 Designing and implement the competences needed to transfer scientific discoveries into teaching (physics and technology).
 The ability to design cross-curricular connections in the classroom, the days of special activities and excursions.

Metode poučevanja in učenja:

frontalna predavanja,
 izdelava seminarske naloge,
 diskusije v elektronskem forumu,
 e-učenje.

Teaching and learning methods:

frontal lectures,
 seminar work,
 discussion in electronic forums,
 e-learning.

Načini ocenjevanja:

Način (pisni izpit, ustno izpraševanje, naloge, projekt):
 diskusije v elektronskem forumu,
 seminarska naloga,
 pisni izpit,
 ustni izpit.

Delež (v %) /
 Weight (in %)

Assessment methods:

Type (examination, oral, coursework, project):
 discussion in electronic forums,
 seminar work,
 written examination,
 oral examination.

10 %
 30 %
 40 %
 20 %

Reference nosilca / Lecturer's references:

REPNIK, Robert, MATHELITSCH, Leopold, SVETEC, Milan, KRALJ, Samo. Physics of defects in nematic liquid crystals. *European journal of physics*, ISSN 0143-0807, 2003, 24, str. 481-491, ilustr. [COBISS.SI-ID [12755208](#)], [JCR, SNIP, WoS do 10. 5. 2014: št. citatov (TC): 20, čistih citatov (CI): 16, normirano št. čistih citatov (NC): 27, Scopus do 5. 11. 2014: št. citatov (TC): 21, čistih citatov (CI): 14, normirano št. čistih citatov (NC): 24]

JAGODIČ, Uroš, STAINES, Jacob, KRALJ, Samo, REPNIK, Robert. Teaching complex fields of soft mater, proposal of a new liquid crystal analogy. V: LAMANAUSKAS, Vincentas (ur.). *Philosophy of mind and cognitive modelling in education - 2014*, (Problems of education in the 21st century, ISSN 1822-7864, vol. 61). Siauliai: Scientific Methodological Center Scientia Educologica, 2014, str. 37-45, ilustr. [COBISS.SI-ID [20972552](#)]

REPNIK, Robert, RANJKESH SIAHKAL, Amid, ŠIMONKA, Vito, AMBROŽIČ, Milan, BRADAČ, Zlatko, KRALJ, Samo. Symmetry breaking in nematic liquid crystals: analogy with cosmology and magnetism. *Journal of physics, Condensed matter*, ISSN 0953-8984, 2013, vol. 25, no. 40, str. 404201-1-404201-10, doi: [10.1088/0953-8984/25/40/404201](#). [COBISS.SI-ID [20050952](#)], [JCR, SNIP, WoS do 18. 6. 2014: št. citatov (TC): 1, čistih citatov (CI): 1, normirano št. čistih citatov (NC): 0, Scopus do 28. 11. 2014: št. citatov (TC): 2, čistih citatov (CI): 1, normirano št. čistih citatov (NC): 0]

REPNIK, Robert, POPA-NITA, Vlad, KRALJ, Samo. Mixtures of nanoparticles and liquid crystal phases exhibiting topological defects. V: *Proceedings of the 14th International Topical Meeting Optics of Liquid Crystals (OLC 2011)*, (Molecular crystals and liquid crystals, ISSN 1542-1406, vol. 560, iss. 1). Philadelphia: Taylor and Francis, 2012, vol. 560, iss. 1, str. 115-122, ilustr. <http://www.tandfonline.com/doi/full/10.1080/15421406.2012.663187>, doi: [10.1080/15421406.2012.663187](#). [COBISS.SI-ID [19420936](#)], [JCR, SNIP, WoS do 5. 11. 2012: št. citatov (TC): 0, čistih citatov (CI): 0, normirano št. čistih citatov (NC): 0, Scopus do 16. 10. 2012: št. citatov (TC): 0, čistih citatov (CI): 0, normirano št. čistih citatov (NC): 0]
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PLOJ VIRTič, Mateja, REPNIK, Robert. Improving quality of the educational process by raising teachers' communication skills. V: LAMANAUSKAS, Vincentas (ur.). *Philosophy of mind and cognitive modelling in education*

- 2012, (Problems of education in the 21st century, ISSN 1822-7864, vol. 46). Siauliai: Scientific Methodological Center Scientia Educologica, 2012, str. 109-115. [COBISS.SI-ID [19493128](#)]