Univerza v Mariboru

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Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Elektromagnetno polje
Course title:	Electromagnetic field

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Fizika 2. st.		1	2
Physics 2nd degree		1	2

Vrsta predmeta / Course type Izbirni / Elective

Univerzitetna koda predmeta / University course code:

Predavanja **Lectures**	**Seminar** **Seminar**	**Sem. vaje** **Tutorial**	**Lab. vaje** **Laboratory work**	**Teren. vaje** **Field work**	**Samost. delo** **Individ. work**	**ECTS**
15		30				5

Nosilec predmeta / Lecturer: Uroš Tkalec

Jeziki / **Languages:**	**Predavanja / Lectures:**	slovenski/slovenian
	Vaje / Tutorial:	slovenski/slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Osnovno znanje klasične fizike in vektorske analize	Basic knowledge of classical physics and vector analysis

Vsebina:	**Content (Syllabus outline):**
• Električno polje stalnih nabojev v praznem prostoru; Coulombov in Gaussov zakon, potencial in gradient potenciala, ekvipotencialne ploskve in silnice, Poissonova in Laplaceova enačba. Energija električnega polja. Tipični problemi elektrostatike. • Električno polje v snovi; Polarizacija v dielektriku (mikro in makro slika), prosta energija polja. • Magnetno polje električnih tokov;	• Electric field of stationary charges; Coulomb and Gauss law, potential and gradient of potential, surfaces with constant potential and field's lines, Poisson and Laplace equations. Energy of the electric field. Typical problems of the electrostatics. • Electric field in matter; Polarization in the dielectrics (micro and macro picture), free energy of the field. • Magnetic field of the electrical currents;

Lorentzova sila, vektorski potencial magnetnega polja, primerjava diferencialnih enačb za magnetno in električno polje. Indukcija. • Magnetno polje v snovi; Magnetizacija v snovi (mikro in makro slika), prosta energija polja. • Maxwellove enačbe. • EM valovanje; Klasični in relativistični opis.	Lorentz force, vector potential of magnetic field, comparison of the equations for the electric and magnetic field. Induction. • Magnetic field in the matter; Magnetization (micro and macro picture), free energy of the field. • Maxwell's equations. • EM waves; Classical and relativistic representation.

Temeljni literatura in viri / Readings:

- Podgornik, R. & Vilfan, A., Elektromagnetno polje, DMFA – založništvo, Ljubljana, 2012.
- Fleisch, D., A student's guide to Maxwell's equations, Cambridge University Press, Cambridge, 2008.
- Thide, B., Electromagnetic field theory, Upsilon Books, Uppsala, 2006.
- Di Bartolo, B., Classical theory of electromagnetism, World Scientific, Singapur, 2004.
- Kovetz, A., Electromagnetic theory, Oxford University Press, Oxford, 2000.
- Landau L. D. & Lifshitz E. M.: The classical theory of fields, Butterworth-Heinemann, Oxford, 1998.
- Jackson, J. D., Classical electrodynamics, Wiley International, 1998.

Cilji in kompetence:	**Objectives and competences:**
Študenti pridobijo poglobljena teoretična in praktična znanja s področja EM polja in jih znajo uporabiti na drugih področjih fizike.	Students get expanded theoretical and practical knowledge from the field of EM field and learn how to imply this knowledge in different fields of physics.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: • Opisati in razumeti električne in magnetne pojave v naravi. Prenesljive/ključne spretnosti in drugi atributi • Usposobljenost za strokovno ustrezno predstavitev primerov iz EM polja.	Knowledge and Understanding: • interpretation and understanding electrical and magnetical phenomena in the nature. Transferable/Key Skills and other attributes: • Ability of professional use of selected cases in the field of Electricity.

Metode poučevanja in učenja:	**Learning and teaching methods:**
• Predavanja • Seminarske vaje	• Lectures • Seminar work

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
• pisni izpit • ustni izpit	50% 50%	• written exam • oral exam

Reference nosilca / Lecturer's references:

MUŠEVIČ, Igor, ŠKARABOT, Miha, TKALEC, Uroš, RAVNIK, Miha, ŽUMER, Slobodan. Two-dimensional nematic colloidal crystals self-assembled by topological defects. *Science (Wash. D.C.)*, 2006, 313, str. 954-958. [COBISS.SI-ID 1929572]

ŠKARABOT, Miha, TKALEC, Uroš, MUŠEVIČ, Igor. Transport and crystallization of colloidal particles in a thin nematic cell. *The European physical journal. E, Soft matter*, 2007, vol. 24, str. 99-107. [COBISS.SI-ID 21131559]

RAVNIK, Miha, ŠKARABOT, Miha, ŽUMER, Slobodan, TKALEC, Uroš, POBERAJ, Igor, BABIČ, Dušan, OSTERMAN, Natan, MUŠEVIČ, Igor. Entangled nematic colloidal dimers and wires. *Phys. rev. lett.*, 2007, vol. 99, no. 24, str. 247801-1-247801-4. [COBISS.SI-ID 21320487]

TKALEC, Uroš, RAVNIK, Miha, ČOPAR, Simon, ŽUMER, Slobodan, MUŠEVIČ, Igor. Reconfigurable knots and links in chiral nematic colloids. *Science (Wash. D.C.)*, 2011, vol. 333, issue 6038, str. 62-65. [COBISS.SI-ID 2336868]