Univerza v Mariboru
University of Maribor

Fakulteta za naravoslovje in matematiko
Faculty of Natural Sciencies and Mathematics

UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION	
Predmet:	Fizikalne lastnosti materialov
Subject Title:	Physical Properties of Materials

Študijski program **Study programme**	**Študijska smer** **Study field**	**Letnik** **Year**	**Semester** **Semester**
FIZIKA PHYSICS	-	1 ali 2	**1 ali 2**

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**
15	**10**				**125**	**5**

Nosilec predmeta / Lecturer: Zdravko Kutnjak

Jeziki / Languages:	
Predavanja / Lecture:	slovenski/Slovenian in/and angleški s slovenskim prevodom/English with translation in Slovenian
Vaje / Tutorial:	

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

Predznanje iz moderne fizike

Prerequisits:

Basic knowledge of modern physics

Vsebina:

1) struktura materialov in interakcije
2) Elektroni v kristalih: fermijeva površina, gostota stanj, energijski pasovi, prevodni pas
3) Polprevodniki: homogeni, čisti in dopirani, prevodne lastnosti, nehomogeni, p-n stik, p-n-p tranzistor
4) Mrežna nihanja: veriga atomov, optična in akustična veja, fononi, toplotna kapaciteta
5) Mrežni defekti in efekti končnih dimenzij
6)Dielektriki in Feroelektriki: dielektričnost, spontana polarizacija
7) Magnetne lastnosti, diamagneti, paramagneti, feromagneti, magnoni
8) Fazni prehodi: Landauova fenomenološka teorija, naivna teorija povprečnega polja, neklasični primeri, univerzalnostni razredi
9) superprevodniki, osnovne lastnosti, Londonova fenomenološka teorija, Cooperjevi pari, visokotemperaturni superprevodniki
10) Uvod v lastnosti mehke snovi: polimeri, tekoči kristali, koloidi

Content (Syllabus outline):

1) Structure of materials: building blocks and interactions,
2) Theory of electrons in crystals: free electrons, energy levels/bands, Fermi surface, density of states
3) Semiconductors: pure and doped, transport properties, p-n junction, laser diods, p-n-p transistor,
4) Lattice vibrations: chain of atoms, optical and acustic branch, phonons, specific heat
5) Defects of crystal lattice and finite-size effects
6) Dielectrics and ferroelectrics: dielectric constant, spontaneous polarization
7) Magnetic properties: diamagnets, paramagnets, ferromagnets, magnons
8) Phase transitions: Landau phenomenological theory, naive mean-field theory, nonclassical examples, universality classes
9) superconductors: basic properties, London theory, Cooper's pairs, high T_c superconductors
10) An introduction to soft matter properties: polymers, Liquid crystals, colloids

Temeljni literatura in viri / Textbook:

1) *Physics of Materials*, Yves Quere, Gordon and Beach Science Publishers (1998);
2) *Introduction to Solid State Physics*, C. Kittel, John Willey,1986
3) *Teorija trdne snovi*, P. Prelovšek, Ljubljana, 1999
4) *Solid State Physics*, N.W. Ashcroft, Rinehart & Winston, 1976
5) *Molekule, kristali, jedra, delci*, J. Strnad, DZS, 1982 (slovenian)
6) M. Kleman, O.D. Lavrentovich, *Soft Matter Physics*, Springer-Verlag, New York, 2003.
7) P. M. Chaikin, T. C. Lubensky, *Principles of Condensed Matter Physics*, Cambridge University Press, Cambridge, England, 1995.
8) Članki v Science, Nature, Scientific American.
9) *Soft Matter Physics*, M. Daoud, Springer, 1999

Cilji:

Izravnalni predmet, ki da določeno predznanje tistim študentom, ki nimajo dovolj predznanja iz fizike kondenzirane materije, tako, da lahko v nadaljnih semestrih sledijo bolj specializiranim in poglobljenim predmetom

Objectives:

Introductory course, which purpose is to equalize the knowledge of students. It is suitable for those students who did not acquire enough basic knowledge in condensed matter physics. Acquired knowledge within the course should allow them to be able to follow later more specialized courses.

Predvideni študijski rezultati:

Znanje in razumevanje:
Razumevanje osnovnih fizikalnih lastnosti procesov v izbranih snoveh.

Prenesljive/ključne spretnosti in drugi atributi:
Rešitev problemov z matematičnimi orodji, numeričnimi metodami, univerzalnosti v fiziki in
celosten pristop k reševanju problemov.

Intended learning outcomes:

Knowledge and Understanding:
Understanding of basic physical properties in selected materials.

Transferable/Key Skills and other attributes:
Solving of problems with mathematical tools, numerical methods, universalities in physics and
gained global approach on solving a problem.

Metode poučevanja in učenja:

Metodika obsega predavanja in samostojnega dela v obliki seminarjev, ki podajajo uvod v problematiko in trenutno razumevanja fizikalnih lastnosti snovi na uvodni stopnji.

Learning and teaching methods:

Lectures and seminars providing the introduction of current knowledge of physical properties of condensed matter materials

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Seminarji	**60**	Seminars
Ustni izpit	**40**	Oral exam