UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Matematična fizika 1**
Course title:	**Mathematical Physics 1**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Fizika		**2**	**3**
Physics			

Vrsta predmeta / Course type obvezni

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
45		**30**			**135**	**7**

Nosilec predmeta / Lecturer: Mitja Slavinec

Jeziki / Languages:	**Predavanja / Lectures:**	slovensko / Slovene
	Vaje / Tutorial:	slovensko / Slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
predznanje na področjih matematične analize, algebre, mehanike, elektromagnetizma.	preknowledge in the field of mathematical analysis, algebra, mechanics, electromagnetism.

Vsebina:	**Content (Syllabus outline):**
1.) Funkcije ene in več spremenljivk Posebne funkcije (trigonometrična, eksponentna, logaritemska, hiperbolična), polinomi, lastnosti in grafi funkcij, funkcije kompleksne spremenljivke. 2.) Odvod in integral Hitrost, pospešek, moč, iskanje ekstremov, integriranje in določeni integral (delo, pot, energija), parcialni odvodi, klasifikacija ekstremov funkcij dveh spremenljivk, dvojni in trojni integral (masa, težišče, vztrajnostni moment), računanje z diferenciali, Taylorjeva vrsta. 3.) Matrike in tenzorji Vektorska in tenzorska algebra, determinanta, inverzne matrike, kompleksne in hermitsko	1) Functions of one and multiple variables Special functions (trigonometric, exponential, logarithmical, hyperbolic), polynomial, function properties and graphs, functions of complex variable. 2) Derivative and integral Velocity, acceleration, power, searching of extrema, integration and definite integral (work, path, energy), partial derivatives, classification of extremes of functions of two variables, double and triple integral (mass, centre of gravity, moment of inertia), calculus with differentials, Taylor series 3) Matrices and tensors Vectorial and tensorial algebra, determinant, inverse matrices, complex and Hermitian conjugated matrices, eigenvectors, eigenvalues,

konjugirane matrike, lastni vektorji in lastne vrednosti, linearne transformacije in operatorji, sistemi linearnih enačb, fizikalna uporaba tenzorjev (vztrajnostni moment, dielektrična konstanta, toplotna prevodnost), Jonesove matrike. 4) Fourierova analiza Opis sinusnih nihanj, Fourierove vrste, Fourierova transformacija. 5) Navadne diferencialne enačbe Enačbe prvega reda, mehanska nihanja (harmonsko nihanje, dušeno nihanje, vsiljeno nihanje, sklopljeno nihanje, majhna nihanja, aharmonska nihanja).	linear transformations and operators, linear systems of equations, use of tensors in physics (moment of inertia, dielectric constants, heat conductivity), Jones matrices. 4) Fourier analysis Description of harmonic oscillations, Fourier series, Fourier transformation. 5) Ordinary differential equations Equations of first order, mechanical oscillations (harmonic oscillation, damped oscillation, forced oscillation, coupled oscillation, small oscillations, anharmonic oscillations).

Temeljni literatura in viri / Readings:

- Kuščer, A. Kodre: Matematika v fiziki in tehniki; DMFA; Ljubljana 1994.
- S. Pahor: Uvod v analitično mehaniko. DMFA, Ljubljana 1989.
- Vidav: Variacijski račun. DMFA, Ljubljana 1991.
- K.F. Riley, M.P. Hobson, S.J. Bence: Mathematical Methods for Physics and Engineering; Cambridge University Press; Cambridge 2000.
- Brešar: Matematika III; Fakulteta za elektrotehniko, računalništvo in informatiko Maribor, Maribor 1995.
- C. Harper: Introduction to Mathematical Physics. Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1976.
- Arfken: Mathematical Methods for Physicists. New York, S. Francisco, London: Academic Press, 1970.
- B. M. Budak, A. A. Samarskii, A. N. Tikhonov: A collection of problems on Mathematical Physics. New York: Pergamon Press, 1980.
- V. Bitsadze, D. F. Kalinichenko: A Collection of problems on the Equations of Mathemammtical Physics. Moscow: Mir Publishers, 1980.
- M. Slavinec, M. Ambrožič, R. Repnik, Matematična fizika 1, Fakulteta za naravoslovje in matematiko, Maribor 2016.

Cilji in kompetence:	**Objectives and competences:**
Študenti ponovijo osnovna matematična orodja in principe ter razširijo uporabo na fizikalne probleme. Tvorijo ustrezne matematične modele za fizikalne probleme, formulirajo ustrezne robne pogoje in fizikalno interpretirajo dobljene rezultate.	The students refresh their knowledge about several mathematical tools and expand their application to physical problems. They form appropriate mathematical models for physical problems, formulate boundary conditions and interpret the obtained solutions

Predvideni študijski rezultati:	**Intended learning outcomes:**

Znanje in razumevanje:	**Knowledge and understanding:**
Kompleksno razumevanje fizikalnih zakonitosti in sposobnost le-te kvantitativno opisati, napovedati in izračunati rezultate. **Prenesljive/ključne spretnosti in drugi atributi:** Reševanje fizikalnih in tehničnih problemov z matematičnimi orodji in postopki.	Complex understanding of physical laws and ability to qualitatively describe them, predict and calculate results. **Transferable/Key Skills and other attributes:** Solution of physical and technical problems using the mathematical tools and methods.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Postavitev problema, izbira potrebnih matematičnih orodij za reševanje, postavitev matematičnega modela, analitično in numerično reševanje. Interpretacija dobljenih rešitev.	Setting up of a physical problem, selection of appropriate mathematical tools, setting up a mathematical model, finding of an analytical or numerical solution. Interpretation of obtained solutions.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt)		Type (examination, oral, coursework, project):
Pisni izpit	**40**	Written exam
Ustno izpit	**40**	Oral exam
Seminarska nalog	**20**	Seminar pape

Reference nosilca / Lecturer's references:

Mitja Slavinec:

SLAVINEC, Mitja, CRAWFORD, G. D., KRALJ, Samo, ŽUMER, Slobodan. Determination of the nematic alignment and anchoring strength at the curved nematic-air interface. *J. appl. phys.*, 1997, vol. 81, str. 2153-2156. [COBISS.SI-ID 5769736]

SLAVINEC, Mitja, KRALJ, Samo. Annihilation of nematic point defects within a cylindrical tube = Anihilacija nematičnih točkovnih defektov v cilindrični kapilari. *Znan. rev. (Maribor)*, 1997, letn. 9, št. 1, str. 19-25, ilustr. [COBISS.SI-ID 77702144]

SLAVINEC, Mitja, KRALJ, Samo, ŽUMER, Slobodan. Formation of edge dislocations in the surface constrained smectic a film. *Mol. cryst. liq. cryst. sci. technol., A Mol. cryst. liq. cryst.*, 2000, vol. 351, str. 153-160, ilustr. [COBISS.SI-ID 10579464]

SLAVINEC, Mitja, KRALJ, Samo, ŽUMER, Slobodan, SLUCKIN, T. J. Surface depinning of smectic-A edge dislocations. *Phys. rev., E Stat. phys. plasmas fluids relat.*, 2001, 63, str. 031705-1-031705-6. [COBISS.SI-ID 1277796]

SVETEC, Milan, SLAVINEC, Mitja. Structural transition of nematic liquid crystal in cylindrical capillary as a result of the annihilation of two point defects. *J. chem. phys.*, 2008, vol. 128, no. 8, str. 084704-1-084704-6,

ilustr. http://link.aip.org/link/?JCPSA6/128/084704/1, http://dx.doi.org/10.1063/1.2839301. [COBISS.SI-ID 15899400]