Study programmes: BACHELOR STUDIES – Astronomy and Astrophysics

Course name: Mathematics 1

Lecturers: Branka Pavlović and other lecturers

Status: Compulsory

ECTS: 9

Attendance prerequisites: No prerequisites.

Course aims: Introduction to the basics of mathematical logic, set theory, and real analysis. Mastering of the basic techniques of differential and integral calculus which are necessary for understanding material taught in physics. Ability to solve some first order ordinary differential equations which are important in physics.

Course outcome: Ability to use differential and integral calculus in one variable in the material incountered in studying physics and ability to solve first order ordinary diferential equations which appear in standard problems in the physics curiculum.

Course content:

Lectures:

1. Introduction: basics of mathematical logic and set theory; relations and functions; equipotent sets; most important algebraic structures; fields of real and complex numbers. (4 lectures)
2. Limits of sequences: basic theorems; convergence of monotone sequences; number e; lim sup and lim inf; subsequences; Cauchy's convergence criterion. (6 lectures)
3. Convergence of functions: definition of a convergence of a function, some basic limits ($\lim_{x\to 0} (\sin x)/x$, $\lim_{x\to\infty} (1+1/x)x$), Cauchy's criterion, infinitely small functions and symbols o and O. (5 lectures)
4. Continuous functions: continuity of a composition of functions and of the inverse of a function; continuity of the elementary functions; basic theorems including Weierstrass and Bolzano-Cauchy; uniform continuity and theorem of Cantor. (5 lectures)
5. Derivative of a function: definition and its geometric interpretation; basic theorems (Fermat's, Rolle's, Lagrange's, Cauchy's); L'Hospital's rules; Taylor's formula and main Maclaurin's formulae; convexity of a function; analysis of a function and sketching its graph. (12 lectures)
6. Differential of a function: definition and its geometric interpretation. (2 lectures)
7. Indefinite integral: basic integration methods; integration of rational, trigonometric, exponential and some irrational functions. (10 lectures)
8. Definite integral: definition, criteria for integrability and its consequences (integrability of a continuous function and of a monotone function); mean value theorem; derivative on the upper limit; Newton-Leibniz rule; some applications of definite integral (length of an arc, area and volume). (8 lectures)
9. Ordinary differential equations: general concepts; first order equations (equations which separate variables, linear homogeneous equations, Bernouli's equation and Riccati's equation) (8 lectures)

Examples/ practical classes:

Teaching assistant sessions: elaboration of the material presented at the lectures; problem solving and examples encountered in physics.

Literature:

1. D. Adnadjević, Z. Kadelburg, Matematička analiza I, 10. ed., Matematički fakultet, Krug, Beograd, 2012.
2. R. Šćepanović, J. Knežević-Miljanović, Lj. Protić, Diferencijalne jednačine, 4. ed., Matematički fakultet, Beograd, 2008.
3. M. Krasnov, A. Kiselev, G. Makarenko i E. Shikin ” Mathematical Analysis for Engineers”, volume I-II, Mir Publishers Moscow 1990, udžbenik sa zadacima.

4. Ляшко И.И., Боярчук А.К., Гай Я.,Г., Головач Г.П. “Математический анализ в примерах и задачах 1 и 2”, zbirka zadataka.				
Number of hours: 8	**Lectures**: 4	**Tutorials**: 4	**Laboratory**: -	**Research**: -
Teaching and learning methods: Lectures (presentation of theory and working out of the main examples), Teaching assistant sessions (problem solving), midterm examinations.				

Assessment (maximal 100 points)			
Course assignments	**points**	**Final exam**	**points**
Lectures	5	Written exam	20
Exercises / Tutorials	15	Oral exam	40
Colloquia	20	Written-oral exam	-
Essay / Project	-		