Course Unit Descriptor

Study Programme: Physics, Professor of Physics

Course Unit Title: Theory of gravity

Course Unit Code: F18TG

Name of Lecturer(s): Full Professor Milan Pantić

Type and Level of Studies: Bachelor Academic Degree

Course Status (compulsory/elective): Elective

Semester (winter/summer): Winter

Language of instruction: English

Mode of course unit delivery (face-to-face/distance learning): Face-to-face

Number of ECTS Allocated: 6

Prerequisites: Theory of relativity, Fundamentals of mathematical physics

Course Aims: Introduction to foundations of Einstein's theory of gravitation. Providing the basic knowledge in general tensor calculus in Rieman spaces, relation between gravitation and geometry. Sequential introduction of Rieman, Ricci and Einstein tensor. Derivation of Einstein's equations. Familiarity with applications and experimental verifications of this theory.

Learning Outcomes: After taking the course, students should have developed:
General abilities: basic knowledge of this field, following the literature, analysis of various solutions and the choice of the most adequate solution, application in practice and other subjects.

Subject-specific capabilities:
- mastering the elements of tensor calculus;
- understanding of the basic principles of Einstein's theory of the gravitational field;
- independent formulation and solution of Einstein's equations for particular problems;
- application of knowledge for higher courses.

Syllabus:

Theory

The princlipes of general relativity. Basics of Einstein theory of gravitation. Tensor calculation in Riemann space, basics of general theory of relativity, connection between gravity and geometry. Riemann, Ricci and Einstein tensor. Energy-momentum tensor. General relativity from a variational principe. The Einstein Lagrangian. Schwarzshild solution. Black holes. Experimental tersts of general relativity. Gravitational waves. Cosmological models.

Practice

Problem solving.

Required Reading:

1. J. Foster, J. D. Nightingale, A Short Course in General Relativity, Springer-Verlag, New York 1998.
2. B. J. Hartle, Gravity an Introduction to Einstein's General Relativity, Addison Wesley, San Francisco 2002.
3. C.W. Misner, K.S. Thorne, J.A. Whesler; Gravitation, W.H. Freeman, 1973.

Weekly Contact Hours:	**Lectures:** 3	**Practical work:** 2

Teaching Methods: Lectures

Knowledge Assessment (maximum of 100 points):

Pre-exam obligations	points	**Final exam**	points
Active class	5	written exam	20

participation			
Practical work		oral exam	50
Preliminary exam(s)	20	…….	
Seminar(s)	5		
The methods of knowledge assessment may differ; the table presents only some of the options: written exam, oral exam, project presentation, seminars, etc.			