Study program	Level of studies	Third cycle
	Title of the study program	Science and mathematics education

COURSE

Course title	**Gravitation, Cosmology and Astrophysics**

Course ID	Semester	Course status	ECTS credits	Contact hours
PTH597	I	Elective	4	45

Lecturers	Lecturer in charge	
	Other lecturers	
Course aims	Deepening knowledge about gravitation, cosmology and astrophysics.	

CONTENT

#	Teaching units	Contact hours		
		L	E/S	C
	The basic principle of General relativity. Key experiments. Tensors. Gravitational fields. Gravitational forces. Gravitational redshift. Einstein's equation. Gravitation and geometry of space-time. Schwarzshild's metrics. Black holes. Robertson-Walker's metrics and applications in cosmology. A short history of astrophysics and cosmology development. The processes of star formation – interstellar dust and gases, formation of protostars, stars on the main sequence, Hertzsprung-Russell's diagram. Processes within the stars – hydrostatic equilibrium, pressure inside the stars, sources of energy, energy transfer, degenerate state of matter. Modeling of stars. Remnants of stars – white dwarfs, Chandrasekhar's limit, neotron stars, pulsarsi. Black holes – an interpretation of Schwarzschild's solution of Einstein's gravitational field equations. Galaxies, categorization and properties. Active galaxies, quasars, Seyfert's galaxies. Expansion of the universe, Hubble's law, the cosmological principle. The relationship between geometry and gravitation – Einstein's general theory of relativity. The Friedmann cosmological models. The Standard Big Bang model and corresponding experimental tests, early universe. The relationship between particle physics and cosmology. Contemporary experiments in astrophysics and cosmology.	30	15	

LITERATURE

1. Ray d' Inverno, Introducing Einstein relativity, Oxford University Press, Oxford, 1992.
2. B. Hartle, An introduction to Einstein's General relavity, Addison Wesley, 2003.
3. V. Vujnović, Astronomija 2-Metode astrofizike, Sunce, zvijezde i galaktike, Školska knjiga, Zagreb, 1990.
4. B. W. Carroll, D. A. Ostlie, An Introduction to Modern Astrophysics, 2nded. , Benjamin Cummings, Upper Saddle River, New York, 2006
5. J. V. Narlikar, An Introduction to Cosmology, 3rd ed., Cambridge University Press, New York, 2002.

ASSESSMENT OF LEARNING

	Assessment method	Points	Threshold
1.	First partial exam	30	16
2.	Second partial exam	30	17
3	Final exam	40	22
4.			
	Total	100	55