Study Course Title	***Astronomy and physics of the universe***
Study Course Code	Astr1001
Credits	3
European Credit Transfer and Accumulation System Credits	4.50
Total Number of Contact Hours	**48**
Number of Lecture Hours	32
Number of hours for seminars	16

Course Developer

Antonijs Salītis

There is no prerequisite knowledge required for this course

Study Course Abstract

The course is designed to:

1. deepen knowledge of the basic laws of physics and astronomy;

2. study the Earth motion and the basic research-techniques of its shape;

3. present the tasks of celestial mechanics; 4. study the diversity of forms of the matter and its evolution in time.

Course Plan

Course structure: lectures - 32 KS., seminars -16 KS.

Topics of lectures.

1. Position star catalogs and their mistakes. Fundamental coordinate system. Basic directories.
2. Transitional problem to inertial reference system. Long Baseline Interferometer use in fundamental astronomical tasks.
3. Earth's shape exploration techniques. Earth geometric shapes detection method using magnetic pole observations. Land shapes dynamic determination method by magnetic pole observations.
4. Earth's flexibility factor. Earth tides. Liuvill's equation and its solution. Free and forced oscillations, the factors that lead to forced oscillations. Geographic coordinates changes and pole motion.
5. Ten known n-body problem integrals and their physical meaning. Force function. Virial's theorem. Jakobi integral.
6. Zero-speed surface. Libration point stability. Solar system evolution and stability.
7. Average parameters inside star. Energy transfer by radiation. Energy transfer by convection. Thermo nuclear reactions inside star.
8. Star models, which are based on proton-proton reactions. Stars giants and stellar evolution. White dwarfs, neutron stars and black holes.
9. Occurrence of chemical elements. Variable Pulsars. Stellar pulsation theory. Variable eruptive stars.
10. Crab Nebula. Diffuse nebulae. Planetary nebulae. Dust and gas in the space between the stars.
11. Interstellar dust. Interstellar gas density and composition. Interstellar medium kinetic temperature and role of radiation pressure.
12. Star Formation.
13. Kinematics and dynamics of stars in our galaxy. Distribution of stars in ours and similar galaxies.
14. The spatial distribution of galaxies. Cosmological principle (homogeneity, isotropy).
15. Cosmological equations. Models of the universe. The Big Bang.
16. Cosmology and elementary particles

Topics of seminars.

1 Star catalog research. Interferometry.

2. Earth's figure, its determination methods. Tide effects on Earth.

3. Causes of geographic coordinates change.

4. Problem of N-bodies. Solar system stability.

5. Physical parameters and processes in stars.

6. Stellar evolution models. The formation of the chemical elements.

7. Interstellar space, nebulae, gas. Interstellar nature. Star formation processes.

8. Our galaxy and stellar dynamics in it. Other galaxies, their clusters. Models of the universe.

Students' independent work Study of scientific literature, problem solving, taking part in seminars.

Learning Outcomes

Students will

•have the knowledge of astronomical patterns.

•be able to explain the movement of celestial bodies in relation to their parameters.

•be able to discuss the topics of astronomy, to argue their views. •be able to independently study scientific literature.

Requirements for Awarding Credits

Study course examination forms - exam and test

Requirements:

Differentiated test: regular attendance - 50%, presentation in seminars - 50%

Exam: an oral presentation - 80% , attendance of lectures - 20%.

Students can take an exam after successful passing of differentiated test. Study methods and forms - lectures, tutorials, practical work, problem solving, laboratory assignment, presentations, discussion, argumentation.

Compulsory Reading List

1.Žagars J., Vilks I. Astronomija augstskolām. LU Akadēmiskais apgāds. 2005.

2.Subbotin M.F. Vvedenije v teoretičeskuju astronomiju. M. Nauka, 1968 (krievu valodā).

3.Frank K. Shu. Physical Universe: An Introduction to Astronomy. Un.Sc. Books. 1982., 584 p.

4.B. May, P.Moore, C.Lintoot. Bang! The Complete History of the Universe, Publ. CARLTON, 2006,. 5.Подобед В.В., Нестеров В.В. Общая астрономия. - М.: Наука, 1982.

Further Reading List

1.Ahnert P. Kleine praktische Astronomie. Leipzig, 1974.

2.Keller H.U. Kosmos Himmelsjahr. Kosmos, 2003, 2004, 2005, 2006.

3.Hobson. A. Physics. Concepts and connections. – New Jersey: Prentice-Hall, 1999., 536 pp.

4.Merken. M. Physical science with modern application. 5-th edition. – Saunders College Publish, 1993, 680 pp.

5.Serway. R.A. Physics For Scientists & Engineers with Modern Physics, 3-rd edition - Orlando, Florida: 1992, 1444 pp. 6.Wolfson., R..Pasachoff J.M. Physics. – Printed in USA: Little, Brown & Company, 1987, 1081 pp.

Periodicals and Other Sources

1.Nature.

2. Scientific American.

3. Zvaigžņotā debess.