NON-PROFIT JOINT STOCK COMPANY
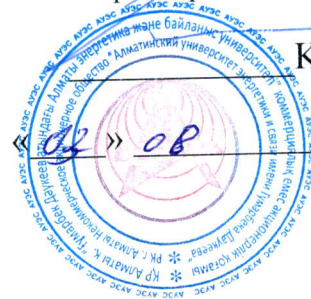
ALMATY UNIVERSITY OF POWER ENGINEERING AND TELECOMMUNICATIONS NAMED AFTER GUMARBEK DAUKEEV

INSTITUTE OF SPACE ENGINEERING AND TELECOMMUNICATIONS

THE DEPARTMENT "SPACE ENGINEERING»

Claim

Vice-principal of academic activity

Konshin S.V.

« 02 » 08 2020 year.

PROGRAM

Entrance examination to the doctoral program in the direction

"Engineering»:8D07105 - Space technique and technology

Almaty 2020

The program on the specialty "8D07105 - Space technique and technologies" was compiled on the basis of standard, working curricula and programs of disciplines.

Heads of the department of SE _____ K.A. Alipbayev

The program of the entrance examination in the specialty was approved by the educational-methodical commission of the institute of space engineering and telecommunications "__" June 201_, protocol No. __.

Chairman _____ G.K.Balbayev

The program of the entrance exam for doctoral studies in the specialty

agreed with the educational and methodical department of AUPET

Director of doctoral and master's degree Department _____ A.A. Yelemanova

Content

1.BALLISTICS

Topic 1 the Concept of undisturbed motion of the spacecraft.

The equations of the unperturbed motion of the spacecraft. The first integrals of the equations of undisturbed motion: energy integral, area integral.

Topic 2 Dependence of the orbit shape on the magnitude and direction of the initial velocity.

Circular and parabolic velocity. First and second cosmic velocities. The orbital elements and their dependence on the initial conditions of motion of the spacecraft

Topic 3 Time of the spacecraft in orbit.

Kepler equation and methods for its solution. Determination of the motion of the spacecraft on the elements of the orbit.

Topic 4 the Perturbed motion of the spacecraft.

Sources and types of disturbances. Methods correction factors and the method of osculating elements to account for disturbances.

Topic 5 Maneuvers of the spacecraft

General characteristics of maneuvers. Tsiolkovsky's Formula. Kinematics of orbit change. Coplanar maneuvers. Transition from a circular orbit to an outer elliptical orbit. Romanowski transition.

THE LIST OF RECOMMENDED LITERATURE

Major literature
1. Konshin S. V., Kim D. O. Fundamentals of the theory of motion of satellites in orbit: Textbook. – Almaty: AIEs, 2008. – 80 p.
2. Hisarov B. D., Zhilisbaeva K. S., D. T. Tulegenova Ballistics. The abstract of lectures for students of the specialty 5B074600 – Space engineering and technology. – Almaty, AUPET, 2014. – 36 p.
3. Mareev Yu. a., Goncharenko V. I., Chetin A. I. Orbital flight of spacecraft: Textbook. – Moscow: MAI, 2001. 84 p.
4. Ishmukhametova M. G., E. D. Kondrat'eva Solution of problems in celestial mechanics and astrodynamics: a Teaching manual. – Kazan: faculty of Physics, Kazan State University, 2009. – 40 p.
5. Hisarov B. D., Zhilisbaeva K. S., D. T. Tulegenova Ballistics. Guidelines for the implementation of calculation and graphic works for students majoring in 5B074600 – Space technology. – Almaty, AUPET, 2014. 23 PP.
6. Sikharulidze Yu.G. Ballistics and spacecraft guidance. - M .: Binom, 2013. - 407 p.
7. https://obuchalka.org/20190321107835/osnovi-ballistiki-i-aerodinamiki-uchebnoe-posobie-balaganskii-i-a-2017.html
8. http://bookash.pro/ru/book/188439/osnovy-ballisticheskogo-proektirovaniya-iskusstvennyh-sputnikov-zemli-vladimir-zelentsov

Additional literature
9. Ivanov N. M. Lysenko L. N. Ballistics and navigation of spacecrafts: the Textbook for high schools. - M.: Drofa, 2004. - 544 p.

10. Okhotsimsky D. E., Sikharulidze, Y. G. fundamentals of mechanics of space flight. – M.: Science, 1990. – 448 p.

11. Zelentsov V. V., Kazakovtsev V. P. Fundamentals of ballistic design of artificial earth satellites: Textbook. – M.: MGTU im. N. Eh. Bauman, 2012. – 174 p.

12. Levantovsky V. And Mechanics of space flight in elementary exposition. – Moscow: Science, 1980. – 512 p.

13. Balk M. B. Elements of space flight dynamics. – Moscow: Science, 1965. 340 p.

14. Balk M. B., Demin V. G., Kunitsyn A. L. a Collection of problems in celestial mechanics and cosmodynamics. – Moscow: Science, 1972. – 336 p.

15. Elyasberg P. E. Introduction to the theory of flight of artificial earth satellites. – Moscow: Science, 1965. – 540 p.

16. Beletsky V. V. Essays on the motion of space bodies. – M.: Science, 1977. – 432 p.

2. RELIABILITY OF AIRCRAFT CONTROL SYSTEMS

Topic 1 Purposes, objectives and brief description of the course "Reliability of aircraft control systems". Brief description of spacecraft control systems: spacecraft control tasks, classification of control systems of spacecraft, requirements of the control system of the spacecraft, disturbances acting on the control system of spacecraft, structure of the complex control system of spacecraft.

Topic 2. Basic concepts and definitions of the theory of reliability.

The concept of reliability and its properties. Objects of reliability. Technical condition of space technology objects. Classification of failures. Temporary notions of reliability.

Topic 3. The main indicators of reliability.

General characteristics of the reliability indices. Reliability indicators. Durability indicators. Indicators of persistence. Comprehensive reliability indicators. Bases of calculation of reliability of systems. Goals and objectives of reliability calculation. The concept of the structural scheme of reliability. Serial reliability scheme. Parallel reliability scheme. Structural scheme of reliability of objects with mixed connection of elements. Structural scheme of reliability of objects with arbitrary connection of elements.

Topic 4. Reservation of technical systems.

Purposes, objectives, types and methods of reservation. The reliability of non-redundant objects. Total hot reservation with integer multiplicity. Separate hot backup with integer multiplicity. Total hot spare with fractional frequency rate (a majority redundancy). Total cold reservation with integer multiplicity. Separate cold redundancy with a whole multiplicity. Sliding reservation.

Topic 5. Laws of distribution of reliability indicators.

General characteristics and features of the laws of distribution of random variables. Features and characteristics of the laws of distribution of random variables used in the theory of reliability. Determination of the type and parameters of the law of distribution of reliability indicators. Determination of reliability indicators under different laws of time distribution between failures.

THE LIST OF RECOMMENDED LITERATURE

Major

1.   Reliability of technical systems: textbook for universities/ V. Yu. Shishmarev. – Moscow: Publishing center "Academy", 2010. – 304 p.

2.   Reliability theory [Electronic resource]: Textbook for high schools / V. A. Strakowski. - M.: Outline, 2012. - http://www.studentlibrary.ru/

3.   Ostreikovskaya V. A. reliability Theory: Textbook for high schools / V. A. Strakowski. – Moscow: High school., 2003 – 463 p.

4.   Alexandrovskaya L. N., Afanasyev A. P., Lisov A. A. Modern methods of ensuring reliability of complex technical systems: Textbook. – M.: Logos, 2003. – 2008 p.

5.   Yakhyaev N. I. Fundamentals of reliability theory and diagnostics : textbook / N. Me. Yakhyaev, A.V. Korablin. - M., 2009. - 250 p.

6.   Reliability of technical systems [Electronic resource] / Puchin E. A. Lisunov E. A. - M. : Koloss, 2013. - (Textbooks and studies. benefits for students of higher education. and middle school. institutions'.) - http://www.studentlibrary.ru/

7.   Sugak E. V., Vasilenko N. In. Nazarov G. G., and others Reliability of technical systems. Textbook for students of technical universities /Under the General editorship of Sugak E. V., Vasilenko N. In. - Krasnoyarsk: Institute SUITT, 2000. – 608 p.

8.   Ismail E. E. Characteristics of quality of space software: monograph. Saarbrücken: Lap LAMBERT Academic Publishing, 2015. - 213 p. (ISBN: 978-3-659-79520-6).

Additional

1.   GOST 27.002-15. Reliability in technology. Basic concept. Terms and definitions. – 20 p.

2.   GOST 27.203-83. Reliability in technology. Technological system. General requirements for methods of reliability evaluation.

3.   GOST 27.301-95. Reliability in technology. Reliability calculation. Fundamentals.

4.   Reliability of organizational and technical systems: textbook/ V. A. KERNOZHITSKY, V. A. Sannikov, I. A. Ledova; Balt. state tech. UN-T. – SPb., 2010.

5.   Volkov L. I., Shishkevich A. M. Reliability of aircraft. Textbook for aviation universities. M.: Higher school, 1975, - 296 p.

6.   The onboard systems of spacecraft control: a tutorial / A. G. Brovkin, Burdigala B. G., gordeno S. V. et al., edited by A. S. Syrov — M.: Izd-vo MAI-PRINT, 2010. – 304 p.: Il.

7.   Reliability of aviation equipment and flight safety: [textbook for universities in the specialty 160901] / S. I. Snisarenko [et al.]; novosib. state tech. UN-T. - Novosibirsk, 2008. - 227 p.: Il., diagrams, tables.

8. https://moluch.ru/archive/88/17163/

3 SPACECRAFT CONTROL SYSTEMS.

Topic 1. Introduction. General properties and classification of automatic control systems.

Use feedback. Tasks solved by the flight control system. Navigation systems. Ground-based measurement of the parameters of the motion of the spacecraft. Optical measuring instruments. Autonomous navigation systems

Topic 2. Flight control system as part of a single information management system.

The choice of reference systems. Optoelectronic devices of orientation and navigation. Vertical builders. The sensors orientation to the Sun

Topic 3. Star sensors.

Gyroscopic devices of orientation and stabilization systems. Inertial measurements of linear accelerations and velocities. Inertial measurements of linear accelerations and velocities. Gyroscopic integrators of linear accelerations. Steering engine.

Topic 4. Equations of motion of Spacecraft relative to the center of mass.

Disturbing effects on the spacecraft. Gravitational stabilization. Magnetic stabilization. Stabilization by rotation. Aerodynamic stabilization. Solar stabilization. Gravitational-magnetic stabilization.

Topic 5. Principles of construction of gas-reactive systems.

Equations of motion of the gas-reactive system. Interaction of spacecraft control systems.

THE LIST OF RECOMMENDED LITERATURE

Major literature
1.   The onboard systems of spacecraft control: a tutorial / A. G. Brovkin, Burdigala B. G., gordeno S. V. et al., edited by A. S. Syrov - M.: Izd-vo MAI-PRINT, 2010. - 304 p.: Il.
2.   The process of designing space systems. Group of authors. E-book.
3.   Popov V. I. the System of orientation and stabilization of spacecrafts. - 2nd ed., pererab. I DOP. - M.: mechanical engineering, 1986. - 184 p., Il.

Additional literature
1.   Information processing in navigation systems / O. A. Babich. - Moscow: Mechanical Engineering, 1991. 512 p. - ISBN 5-217-0160-6.

2.   Raspopov V. Ya. Microsystem avionics: textbook. Tula: "Grif I K, 2010. 248 p.: Il. ISBN 978-5-8125-1467-9.

3. http://bookash.pro/ru/book/120365/modelirovanie-situatsii-pri-raspredelenii-sredstv-upravleniya-kosmicheskimi-apparatami-v-m-artyushen

4. https://www.twirpx.com/file/1222024/