TOMSK STATE UNIVERSITY OF CONTROL SYSTEMS AND
RADIOELECTRONICS (TUSUR)

INSTITUTE OF INNOVATION

BACHELOR OF ENGINEERING AND TECHNOLOGY

COURSE CATALOGUE
INTRODUCTION

This Information Package / Course Catalogue is meant as an information source for all students who wish to take one of the three variants of study programs offered by the Institute of Innovation at Tomsk State University of Control Systems and Radioelectronics (TUSUR): Bachelor of engineering and technology, Diploma Specialist of Innovation Management and Master of Innovation. For the Innovation program a new curriculum has been developed recently in order to implement the new Bachelor-Master structure of higher education. It consists of a 4-year Bachelor program and a 2-year Master program. Although the new curriculum is introduced, traditional 5-year University Diploma degree program is still available for those who wish to pursue more conventional academic approach.

The main part of this guide, which has been written in English, gives a condensed overview of the Bachelor program in Innovation mentioned above. There may be issues in the text that are not treated in depth. In case students are left with questions, they may contact International Cooperation Office of TUSUR by phone or e-mail. Apart from an overview of the Bachelor program, this guide also contains a complete list of all specialization courses.

It utilizes a so-called European Credit Transfer System (ECTS) and United States Semester Credits (USSC), which provides an instrument to create transparency, to build bridges between institutions and to widen the choices available to students. Systems make it easier for institutions to recognize the learning achievements of students and it also provides means to interpret national systems of higher education.

The Course Catalogue is designed to also provide information for exchange students and their advisors while choosing proper programs and courses of study at TUSUR and to ensure recognition of international study achievements upon students’ return to their home institutions.

Every care has been taken to provide the most accurate information. Shall any further questions arise, please contact TUSUR Division of International Cooperation.
1. INSTITUTE OF INNOVATION

1.1 General Information
Name: Institute of Innovation
Tomsk State University of Control Systems and Radioelectronics (TUSUR)

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Institute Director: Alexander F. Uvarov
Candidate of Science

Majors:
030501 – Jurisprudence
(Bachelor and Diploma Lawyer Degree)
210100 – Electronics and microelectronics
(Master Degree)
220600 - Innovations
(Bachelor and Master Degrees)
220601 - Innovation management
(Diploma Engineer Degree)
230100 – Informatics and computer engineering
(Master Degree)

1.2 Brief description
Institute of Innovation is a system project aimed at developing university innovation infrastructure. Its strategy is associated with further development and application of new technologies to production, management and education. Institute of Innovation is comprised of educational and scientific departments, which provide foundation for successful realization of science intensive commercialization projects at the Student Business Incubator (SBI) of Tomsk State University of Control Systems and Radioelectronics (TUSUR). Technological Business Incubator is also a part of the Institute of Innovation designated to host short-run production facilities of SBI companies. Significant direction of the Institute activities is intensification of international cooperation to ensure integration into global innovative community.
Innovation is considered interdisciplinary science, therefore, students at the Institute of Innovation are trained in various fields – Engineering, Entrepreneurship, Economics, Psychology, Sociology, etc.

As a result of educational process students additionally gain the following traits and skills:

- Solid Leadership Skills,
- Strategic Thinking and Implementation Abilities,
- Commitment and Accomplishment Orientation,
- Good Business Sense and Judgment,
- Positive Interpersonal Skills,
- Maturity and Self-Reliance.

Institute of Innovation alumni work in the field of innovation management, electronics, applied mathematics, mechatronics and training systems. They can implement engineering projects and create advanced hi-tech products; they qualify for work at engineering and innovative companies.
2. BACHELOR OF ENGINEERING AND TECHNOLOGY

2.1 Structure of Degree Programs
Although traditional five-year university diploma degree is still utilized, two-level degree programs with international final degrees of Bachelor and Master of Science have also been introduced in the Institute (4 years and 2 years of study, respectively).

In the main study stage, examinations throughout the studies count towards the final degree. Normally, any degree program ends with a State examination.

<table>
<thead>
<tr>
<th>Degree Program</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Bachelor of Science</td>
<td>4 years</td>
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<tr>
<td>Diploma Engineer / Lawyer / Specialist</td>
<td>5 years</td>
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<tr>
<td>Master of Science</td>
<td>2 years (after B.Sc.)</td>
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</tbody>
</table>

The period of Bachelor degree program amounts 208 weeks. It includes:
- theoretical teaching, students researches, practical work, laboratory (136 weeks);
- examinations (32 weeks);
- practice (5 weeks):
  - academic practice (2 weeks),
  - practical training (3 weeks);
- state attestation including preparation and presentation of qualification work (3 weeks);
- vacation (32 weeks).

2.2 Program objectives
Fields for professional activities of university graduates with degrees of Bachelor of engineering and technology include innovation processes of countries, regions, territories and businesses, including:
- Innovative projects of establishing competitive production of goods and services;
- Innovative projects of reengineering of business processes;
- Scientific and technological development of small enterprises;
- Projects of innovative development for territories;
- Hardware and software for management of innovative projects;
- Theoretical foundations of Innovation management, development of Innovation as a branch of science and a field of scientific and technological activities;
- Innovative training technologies.
Graduates of major 220600 - Innovations perform the following types of professional activities: Production management; Experimental research.

Graduates can easily adapt to various types of activities based on system analysis, modeling, automated control and other types of information computer technologies.

2.3 Examinations
Examinations in most subjects are written or even computerized ones and take place at the end of each semester. In some classes, though, some kind of oral exam / interview with an instructor may be an alternative. Students should ask the Professor which kind of examination he/she will choose and when it will take place. The exact examination dates and times are announced officially by the Academic Administration of the University. You do not have to register for any examination or test. It is assumed that all students, who attend classes, arrive at the final exam.

2.4 Academic Calendar (academic year 2010/2011)
Academic year consists of two semesters:

<table>
<thead>
<tr>
<th>Month</th>
<th>Event</th>
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<tbody>
<tr>
<td>Sept 1</td>
<td>beginning of autumn semester</td>
</tr>
<tr>
<td>Oct 27 - Nov 2</td>
<td>academic performance check</td>
</tr>
<tr>
<td>Nov 4</td>
<td>National Unity Day, public holiday</td>
</tr>
<tr>
<td>Jan 4</td>
<td>last day of classes</td>
</tr>
<tr>
<td>Jan 5 - Feb 1</td>
<td>examination period</td>
</tr>
<tr>
<td>Feb 2 - 15</td>
<td>winter vacation</td>
</tr>
<tr>
<td>Feb 16</td>
<td>beginning of spring semester</td>
</tr>
<tr>
<td>Feb 23</td>
<td>Defender of Fatherland Day, public holiday</td>
</tr>
<tr>
<td>Mar 8</td>
<td>International Women’s Day, public holiday</td>
</tr>
<tr>
<td>Apr 6 - 12</td>
<td>academic performance check</td>
</tr>
<tr>
<td>May 1</td>
<td>Labor Day, public holiday</td>
</tr>
<tr>
<td>May 9</td>
<td>Victory Day, public holiday</td>
</tr>
<tr>
<td>June 12</td>
<td>Day of Russia, public holiday</td>
</tr>
<tr>
<td>June 15 - July 12</td>
<td>examination period</td>
</tr>
<tr>
<td>July 27 - Aug 31</td>
<td>summer vacation</td>
</tr>
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</table>

2.5 Language of Instruction
All courses at the Institute are taught in Russian language, so a good knowledge of the Russian language is essential for success in studying. For those, who wish and/or need to increase their language proficiency, preparatory language courses are conducted. It is certainly advisable to attend preparatory language courses in your home country.
3. COURSE DESCRIPTIONS

Courses are presented in alphabetical order. Summary table for “Bachelor curriculum for 220600 - Innovation” is provided at the end of course description module. The table holds information on each semester, course and workload in ECTS and USSC points.

3.1 ACCOUNTING

General course info
Name of course: Accounting
Course level: upper
Code: elective, students selection
Number of ECTS points: 4
US semester credits: 2,5
Place in curriculum: 7th semester, fourth year.

Overview content
Active and passive accounts. Connection between accounts and internal transactions. Systematic and chronological entry in accounting. Working and balance sheets.
Classification of accounts. Single chart of enterprises accounts. Assessment and calculation.
International accounting standards. The concept of international standards.
Main objectives of the course
Formation of clear understanding of accounting foundations and principles.
Formation of knowledge on theoretical and practical basis of accounting.
Practical skills in organization of accounting process in enterprise, preparation of financial statements.

Educational form and structure
Lectures and practical classes - 63 hours,
Self-study - 69 hours.
3.2 ADVANCED COURSE OF INFORMAL FOREIGN LANGUAGE (ENGLISH OR GERMAN)

General course info
Name of course: Advanced course of informal foreign language (English or German)
Course level: lower
Code: elective, students selection
Number of ECTS points: 4
US semester credits: 2.5
Place in curriculum: 3rd, 4th semester, second year.

Overview content
Listening: perception and understanding of general content of speech segments (dialog and monolog), spoken in fluent speech rate approximate to rate of native speaker on domestic and cross-cultural themes.
Speaking: ability to initiate and maintain conversations on everyday and cross-cultural themes; ability to discuss social events. Pronunciation and rhythm of speech approximate to pronunciation and rhythm of native speaker.
Reading: ability to understand contents of written communications in details, ability to understand general content of announcements (fair housing, jobs, contests, etc.), ability to read fluently necessary sources (for study, work).
Letter: the ability to transmit heard information in details; ability to correspond to domestic, social and cross-cultural themes, ability to write announcement for job, services, etc.

Main objectives of the course
Formation of clear understanding of features of foreign speaking.
Formation of knowledge on rules in such fields as a grammar, stylistics, listening, reading, writing to reach communication goals by means of available foreign vocabulary.
Practical skills in informal foreign languages.

Educational form and structure
Lectures and practical classes - 70 hours,
Self-study - 68 hours.
3.3 BUSINESS PROCESSES AUTOMATION

General course info
Name of course: Business processes automation  
Course level: upper  
Code: elective, university selection  
Number of ECTS points: 2.5  
US semester credits: 1.5  
Place in curriculum: 3\textsuperscript{rd} semester, second year.

Overview content
Key stages of business process management and methods of automation.  

Main objectives of the course
Formation of clear understanding of business processes and automation methods.  
Formation of knowledge on elements and procedures of automation.  
Practical skills to use necessary tools for business processes automation.

Educational form and structure
Lectures and practical classes - 40 hours,  
Self-study - 45 hours.
3.4 COMPUTER GRAPHICS

General course info
Name of course: Computer graphics
Course level: lower
Code: elective, university selection
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 3rd semester, second year.

Overview content

Main objectives of the course
Formation of clear understanding of mathematical and algorithmic basis of computer graphics.
Formation of knowledge on fundamental methods of computer graphics and geometrical modeling of graphic objects.
Practical skills in development of software for realistic images visualization (complex three-dimensional scenes).

Educational form and structure
Lectures and practical classes - 54 hours,
Self-study - 48 hours.
3.5 CULTURE STUDIES

General course info
Name of course: Culture studies
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 2\textsuperscript{nd} semester, first year.

Overview content
The structure and composition of modern culture studies; culture and
history of study. Philosophy of culture, sociology of culture, cultural
anthropology. Theoretic and applied culture science.
Methods of researches in the sphere of culture studies.
Main notions: culture, civilization, morphology of culture, function of
culture, subject of culture, dynamics of culture, language and symbols of
culture, cultural values and regulations, cultural traditions, social
institutes of culture, cultural modernization, cross-cultural
communication.
Main concepts in culture. Types of culture: ethnic and national cultures,
elite and mass-culture, Eastern and Western culture types. Specific
cultures. Local cultures. Place and role of Russia in the world culture.
Culture and nature. Culture and society. Culture and universal problems
in modern world. Culture and personality.

Main objectives of the course
Formation of clear understanding of culture development.
Formation of knowledge on modern culture, different kinds of cultures.
Practical skills in the field of culture researches.

Educational form and structure
Lectures and practical classes - 59 hours,
Self-study - 39 hours.
3.6 DATABASES

General course info
Name of course: Databases
Course level: lower
Code: elective, students selection
Number of ECTS points: 2
US semester credits: 1.5
Place in curriculum: 4th semester, second year.

Overview content
Logical data models. Hierarchical model of data. Relational data model. Types of segments in hierarchical presentation of data: such as sources and generated segments. Network data models. Language of manipulating data to the relational model. Advantages of relational database.
Elements of the relational algebra. Samples of the relational algebra. Relational scheme. Basic and additional operations of relational algebra. Examples of operations for the creation of RA requests. Relational calculus.
Technologies of procession and publication of databases. Creation and modification of databases. Objectives: Request, Response and Session.
Basics of ODBC and BDE. Technology of publications database on the Internet. Technology ASP-Active Server Pages. The access to databases. Object model. Components of the access to the database using ADO. Examples of ASP-grafics. Additional methods of the technology ADO.

**Main objectives of the course**
Formation of clear understanding of theoretical basis of technology storage and processing.
Formation of knowledge on methods of conceptual design model database to build optimal and stable systems.
Practical skills in the field of applying the CASE-technology and software with the development of automated databases.

**Educational form and structure**
Lectures and practical classes - 51 hours,
Self-study – 17 hours.
3.7 ECOLOGY

General course info
Name of course: Ecology
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 2.5
US semester credits: 2
Place in curriculum: 3rd semester, second year.

Overview content
The interrelation of organisms and the environment, environment factors and resources, population, community, ecosystems, biospheres, ecological principles of environmental protection and effective using of its resources, engineer protection of the environment.
Biosphere and mankind; biosphere structure, ecology and health. Global environmental problems; resources of saving technologies and environmental protection; environmental law basics; professional responsibilities; international ecology collaboration. The role of lithosphere, hydrosphere and atmosphere in the biosphere.
Interaction of flora and fauna with inanimate nature. Main components and laws of the biosphere.
The impact of economic activities in the biosphere.

Main objectives of the course
Formation of clear understanding of main laws of ecology.
Formation of knowledge on methods of interaction of people and nature.

Educational form and structure
Lectures and practical classes - 45 hours,
Self-study – 42 hours.
3.8 ECONOMICS

General course info
Name of course: Economics
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 4
US semester credits: 2.5
Place in curriculum: 1st semester, first year.

Overview content
Introduction to economic theory: economic agents (market and non-market), property and management, cost and results; economic restrictions.
History of Economic Teachings: especially economic attitudes in traditional societies (property, employment, wealth, money, loan percent), systematization of economic knowledge, the first theoretical system. The formation and evolution of modern economic thought: Austrian school, monetarism, institutionalism.
The contribution of Russian Scientists in the development of world economic thinking, especially the development of economic science in Russia.
Macroeconomics: social reproduction; macroeconomic indicators, national wealth, industry and sector of national economy, cross-sectional balance, national income and personal income, state budget and taxes, duties and types of money, inflation and its causes; macroeconomic policy of state; technological culture and long wave; theory of economic growth and economic cycles.
Microeconomics: the law of supply, the law of demand, balance, market, equilibrium price, the theory of consumer behavior and producer (enterprise).
Monopoly, natural monopoly, price discrimination, oligopoly, monopolistic competition, barriers to entry and exit (the industry). Comparative advantage; production function, factors of production, labor, physical capital, inflation and unemployment; factor markets, rents, wages; budgetary constraints, curve, the effect of income and substitution effect.
Companies: classification, external and internal environment, diversification, concentration and centralization of production; opening and closures, reorganization and bankruptcy, gross receipts and costs, profits and economic accounting, the net cash flow, reduced
(discounted) value, internal rate of return; variable and fixed costs; general costs.

**Main objectives of the course**
Formation of clear understanding of the history of economics study.
Formation of knowledge on economic development and its main directions in Russia.
Practical skills in the field of economic analysis.

**Educational form and structure**
Lectures and practical classes - 72 hours,
Self-study – 58 hours.
3.9 ECONOMICS AND FINANCIAL SUPPORT OF INNOVATIVE ACTIVITY

General course info
Name of course: Economics and financial support of innovative activity
Course level: upper
Code: compulsory, federal component
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 6th semester, third year.

Overview content
The market of innovation: commercialization of innovation; competitiveness of organizations; investment relish of innovation in comparison with traditional forms of financial operations.
Value of economic results of innovation (methods and instruments).
Influence of indirect factors on economic results of innovation.
Innovation’s inputs: classification and methods of value; estimate of inputs for project.
Time factors in the process of value of innovation economic activity.
Discounting. Discount and its basing. Macroeconomic factors, influencing on the size of discount. The price of capital as a factor, defining discount (the price of proper capital, the price of attracted capital, general price of capital). Risk of innovation and its influence on discount.
Emission of securities as a means of investment’s attracting in the
sphere of innovation. Types of securities and conditions of its emissions and circulation.
Economic activity of innovation effectiveness: clear current cost (clear discounted income), index of yield, average annual profitability of investments, term of payback, internal norm of yield. The break-even point.
Innovation-investment mechanism.

Main objectives of the course
Formation of clear understanding of main development directions of innovation activity.
Formation of knowledge on effective innovation activity, main components of efficiency.
Specific skills in the field of value of innovation economic results.

Educational form and structure
Lectures and practical classes – 48 hours,
Self-study – 54 hours.
3.10 ELECTRICAL ENGINEERING AND ELECTRONICS

General course info
Name of course: Electrical engineering and electronics
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 3,5
US semester credits: 2,5
Place in curriculum: 3rd semester, second year.

Overview content

Main objectives of the course
Formation of clear understanding of modern electronic equipment and systems.
Formation of knowledge on features of equipment and systems.

Educational form and structure
Lectures and practical classes – 63 hours,
Self-study – 56 hours.
3.11 ELECTRICAL MACHINERY AND ELECTRIC DRIVE

General course info
Name of course: Electrical machinery and electric drive
Course level: upper
Code: elective, university selection
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 5th semester, third year.

Overview content
Basics of electromechanical energy conversion in electric machinery; transformer; induction machines; micro machines; synchronous machines; DC machines.
General laws of electric machinery. The law of electromagnetic induction.
Electromagnetic fields. Properties interaction of magnetic fields and electrical conductor.
Electrical machinery of constant current. Devices and principles.
Simultaneous electrical machinery. The device and principles of synchronous electric machinery. Synchronous motors with permanent magnets. Contact less electrical machinery of constant current. The principle of contact less engine. Principles of the rotor position sensor.
Basics of building electric direct action. Automated systems as functional machinery.

Main objectives of the course
Formation of clear understanding of devices principles and various types of electric machinery.
Formation of knowledge on basic characteristics, principles of electric machinery.
Practical skills in electromechanical energy conversion processes, the design of electric machinery and its properties, characteristics, rules of operation.

Educational form and structure
Lectures and practical classes – 54 hours,
Self-study – 48 hours.
3.12 ELECTRONIC CIRCUITS AND MICROCIRCUITS ENGINEERING

General course info
Name of course: Electronic circuits and microcircuits engineering
Course level: upper
Code: elective, university selection
Number of ECTS points: 5,5
US semester credits: 3,5
Place in curriculum: 4th semester, second year.

Overview content

Main objectives of the course
Formation of knowledge on analysis of physical and electrical processes in major nodes of electronic circuits. Practical skills in projecting of industrial electronic devices.

Educational form and structure
Lectures and practical classes - 80 hours,
Self-study - 100 hours.
3.13 ENGINEERING GRAPHICS

General course info
Name of course: Engineering graphics
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 2.5
US semester credits: 1.5
Place in curriculum: 3rd semester, second year.

Overview content
The system of constructions, technical and programming documentation; conditional characters and simplifications, provided of standards ESKD, ESTD, ESPD; elaboration of designs and drafts of details and assembly units; general lay-out designs.

Main objectives of the course
Formation of clear understanding of designs laws.
Formation of knowledge on features of different standards.

Educational form and structure
Lectures and practical classes - 45 hours,
Self-study – 40 hours.
3.14 FISCAL ACCOUNTING

General course info
Name of course: Fiscal accounting
Course level: upper
Code: elective, students selection
Number of ECTS points: 4
US semester credits: 2.5
Place in curriculum: 7th semester, fourth year.

Overview content

Main objectives of the course
Formation of clear understanding of main directions and elements of fiscal accounting.
Formation of knowledge on features and elements of fiscal accounting.
Practical skills in information collecting, registration and its generalization to make accounts.

Educational form and structure
Lectures and practical classes - 63 hours,
Self-study - 69 hours.
3.15 FOREIGN LANGUAGE

General course info
Name of course: Foreign language
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 10
US semester credits: 2.5
Place in curriculum: 1\textsuperscript{st}, 2\textsuperscript{nd} semesters, first year, 3\textsuperscript{rd}, 4\textsuperscript{th} semesters, second year.

Overview content
Specifics of sound articulation, inflexion, rhythm of neutral speech. Main features of pronunciation style, typical for sphere of professional communication. Reading of transcription; familiarity with main dialogical variants of pronouncing. Lexical minimum in size 8000 lexical units. Differentiation depending in the sphere of use (common, terminological, scientific, official, technical, business). Free and stable phrases, phraseological units, combinative compatibility of lexical units. Main methods of word-formation.
Grammatical skills, providing communication without distortion of meaning in written and oral communication. Main grammatical events, typical for professional speech. Learning absentee or not in current use events in Russian language (infinite forms of verbs, conjunctive mood, phrasal verbs etc.). Illustration of learning grammatical event with help of text examples (fragments of art’s work, articles (in newspapers and Internet)).
Regional geography. Culture and traditions of English speaking countries, rules of speech etiquette, national features of business leading, culture of business truck.
Conversation.
Dialogical and monologue speech with use of common lexical-grammatical means in different communicative situations. Bases of public speech (oral report, lecture, presentation of product, introduction of visual information).
Listening. Comprehension of dialogical and monologue speech in the sphere of common and professional communication. Fulfillment of
exercises, directed to identification of studied grammatical and lexical events.
Reading. Kind’s of texts: pragmatic texts and texts in type of specializations different complexity. Abstracting of professional articles.

Main objectives of the course
Formation of clear understanding of rules in such fields as a grammar, stylistics, listening, reading, writing.
Formation of knowledge on features of foreign linguistics.
Practical skills in foreign languages.

Educational form and structure
Lectures and practical classes - 166 hours,
Self-study - 174 hours.
3.16 FOUNDATIONS OF CIRCUIT THEORY

General course info
Name of course: Foundations of circuit theory
Course level: lower
Code: elective, university selection
Number of ECTS points: 4,5
US semester credits: 2,5
Place in curriculum: 4th semester, second year.

Overview content

Main objectives of the course
Formation of clear understanding of system of coupled oscillating circuits.
Formation of knowledge on frequency characteristics of system with two coupled oscillatory circuits.
Practical skills in solving of analysis tasks in circuits.

Educational form and structure
Lectures and practical classes - 85 hours,
Self-study - 59 hours.
3.17 FOUNDATIONS OF MECHATRONICS AND ROBOTICS

General course info
Name of course: Foundations of mechatronics and robotics
Course level: upper
Code: elective, students selection
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 7th semester, fourth year.

Overview content
Bases of mechatronics. Mechatronics development and using of mechatronic systems: in automated technological process; using in car, consumer electronic equipment, peripherals computer and medical technology; in special and aggressive ambience.

Main objectives of the course
Formation of clear understanding of bases of the theory and practice of mechatronics and robotic systems
Formation of knowledge on features of mechatronic technology and applications mechatronic and robotic systems.
Practical skills in business planning.

Educational form and structure
Lectures and practical classes - 54 hours,
Self-study – 48 hours.
3.18 FOUNDATIONS OF MICROELECTRONICS

General course info
Name of course: Foundations of microelectronics
Course level: upper
Code: elective, university selection
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 5th semester, third year.

Overview content
The subject, principles, functional elements of microelectronics. History of electronics.
Classification of integrated circuits: semi-conductor and hybrid on bipolar and MOS-elements; digital and analog with small, medium, large and very large ratio of integration, active and passive elements of integrated circuits; elements of functional electronics.
The principle of integration. Concepts: integrated chip (IC), and an element of IC. Main parameters of IC. IC classes: solid state, hybrid, BJT and MOSFET based, digital and analog; small, medium and large scale of integration; passive and active IC components; IC circuitry and topologies, functional electronic blocks.
Methods of isolation elements, ways of switching. Elements of bipolar IC. Resistors and capacitors of bipolar IC. Varieties of integral transistors on gallium arsenide. Elements of hybrid IC.
Physical integration.
Elements of optoelectronics. Optoelectronic IC and integrated optics.
Cylindrical magnetic domains. Piezoelectric effect.
Terms and conditions of reliability theory. Intensity of denials, the likelihood of trouble. Indicators of reliability. Gradual and catastrophic waivers. Tests of reliability. Ways to improve the quality and reliability of IC.
Main objectives of the course
Formation of clear understanding of physical processes in solids defining - principle, properties, characteristics and parameters, various instruments and devices in discrete semiconductor electronics.
Practical skills of IC using, basic properties and parameters of solid electronics in the discrete and integral performance, selecting of semiconductor devices and integrated circuits for use in electronic equipment.

Educational form and structure
Lectures and practical classes – 54 hours,
Self-study – 48 hours.
3.19 FOUNDATIONS OF TECHNOLOGICAL PROCESSES AND PRODUCTION AUTOMATION

General course info
Name of course: Foundations of technological processes and production automation
Course level: upper
Code: elective, university selection
Number of ECTS points: 6
US semester credits: 4
Place in curriculum: 8th semester, fourth year.

Overview content
Characteristics and models of equipment. Automation of technological processes based on local resources. Selection, development and implementation of local automation systems.
Integrated system of automation and control. Hierarchical control system. Stages of development and implementation of automated control systems of technological processes and productions.

Main objectives of the course
Formation of clear understanding of general schemes of technological objects automation.
Formation of knowledge on functions of automated control systems.
Practical skills in analysis of technological processes as a control object.

Educational form and structure
Lectures and practical classes - 84 hours,
Self-study - 114 hours.
3.20  GROUP PROJECT TRAINING

General course info
Name of course: Group project training
Course level: upper
Code: elective, students selection
Number of ECTS points: 24
US semester credits: 6
Place in curriculum: 5th, 6th semester, third year, 7th, 8th semester, fourth year.

Overview content
Connection between marketing and patent and information researches.

**Main objectives of the course**
Formation of knowledge on general approaches to production control, definition of project tasks, planning methods.
Formation of practical skills of business planning, marketing research, production organization and control.

**Educational form and structure**
Lectures and practical classes - 396 hours,
Self-study – 420 hours.
3.21  HISTORY OF RUSSIA

General course info
Name of course: History of Russia
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 4
US semester credits: 2.5
Place in curriculum: 1st semester, first year.

Overview content
Essence, forms, functions of historical importance, history ages.
Methodology as an approach to the history cognition. The concept and classification of the historic sources.
Byzantine-Old Russian connection. Features of the social structure of Ancient Russia. Ethno-cultural and socio-political processes of Russian statehood formation.
The adoption of Christianity. The spread of Islam.
Russia and Horde: problems of interaction. Russia and medieval states of Europe and Asia.
The rise of Moscow. Formation class system of social organization.
Reforms of Peter I.
The century of Catherine. Prerequisites and particularities of the folding of Russian absolutism.
Discussions about the genesis of autocracy.
Features and main stages of economic development of Russia. Serfdom in Russia.
The emergence of industrial society in Russia: general and special.
Especially social movement in Russia XIX. Reforms and reformers in Russia.
Russian culture of the nineteenth century and its contribution to world culture. Russia in the early twentieth century.
Modernization in Russia. Russian reform in the context of global development.
Political parties in Russia: genesis, classification, program's tactics.
Socio-economic changes in the 30's. Strengthening Stalin's regime of personal power. Resistance to Stalinism. USSR on the eve and during the initial period of World War II. Great Patriotic War.
Socio-economic development, social and political life, culture, foreign policy of the Soviet Union in the postwar years.
The Cold War. Restructuring.
Foreign policy in the new geopolitical situation.

Main objectives of the course
Formation of clear understanding of stages, features and forms of historical development.
Formation of knowledge on details, events and methods of native history.

Educational form and structure
Lectures and practical classes - 63 hours,
Self-study - 67 hours.
3.22 HISTORY OF TECHNOLOGICAL REVOLUTIONS

General course info
Name of course: History of technological revolutions
Course level: upper
Code: elective, university selection
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 7\textsuperscript{th} semester, fourth year.

Overview content
The first technological revolution: invention of writing.
XVI century: invention of printing. Industrial applications of electricity and chemistry. Formation of monopolies. Invention of the steam engine
XX century: invention of microprocessor technology, personal computer, computer networks, data transmission systems (information communication).

Main objectives of the course
Formation of clear understanding of stages, features and forms of technological changes.
Formation of knowledge on details, events and methods of technological revolutions.

Educational form and structure
Lectures and practical classes - 42 hours,
Self-study - 56 hours.
3.23 INDUSTRIAL ENGINEERING AND INNOVATION

General course info
Name of course: Industrial engineering and innovation
Course level: upper
Code: compulsory, federal component
Number of ECTS points: 5.5
US semester credits: 4
Place in curriculum: 6th semester, third year.

Overview content

Main objectives of the course
Formation of clear understanding of notions, meaning, production bases and control systems of industrial technologies.
Formation of knowledge on features and applications of industrial engineering.

Educational form and structure
Lectures and practical classes - 80 hours,
Self-study – 107 hours.
3.24 INFORMATICS

General course info
Name of course: Informatics
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 9
US semester credits: 6
Place in curriculum: 1st, 2nd semesters, first year.

Overview content
The notion of information, general characteristic of information collection, transmission, processing and accumulation; models of solving functional and computing problems; algorithmization and programming, high level languages, programming technologies, databases, software and software technology, local and global networks, technologies of Internet, basics of data protection, data protection means, computer lab.
Operational systems: organization of operational systems, overview of operational systems and operational appearance, types of operational systems, principle of management of resources, organization of file-oriented systems, loaders and process of fulfillment of programs, compiler and interpreter of languages, macro generators, attendant programs, safety of program systems, interface and main standards in the sphere of system software.
Data bases: foundations of construction. Relational model of data.
Computer engineering graphic: geometric modeling, introduction of video information and its machine generation, graphical languages, metafiles.

Main objectives of the course
Formation of clear understanding of bases of different information processes.
Formation of knowledge on features of data processing.
Practical skills in the field of informational and operational systems.

Educational form and structure
Lectures and practical classes - 157 hours,
Self-study – 149 hours.
3.25 INFRASTRUCTURE FOR INNOVATIONS

General course info
Name of course: Infrastructure for innovations
Course level: upper
Code: compulsory, federal component
Number of ECTS points: 3,5
US semester credits: 2,5
Place in curriculum: 7th semester, fourth year.

Overview content
The notion of infrastructure for innovation activity. The role of infrastructure for support of innovation activity inside country (region, branch). Types of infrastructure and its main elements.
Industrial infrastructure for innovation activity: structure and features.
Financial infrastructure for innovation activity: structure and features.
Role and function of financial and credit organizations in innovation activity. Organizational infrastructure for innovation activity.
Social-demography infrastructure for innovation activity: structure and features.
Information infrastructure for innovation activity. Source and forms of information propagation in the sphere of innovation. Special transactions and mass media in the sphere of innovation. Information safety of innovation organization. Net innovation infrastructure: the notion of innovation net, principles of net forming; standard structure of net, interaction of net elements in the process of realization different technologies of innovation.
Fusion with international innovation structures: survey of international structure of innovation support and its national features, mechanism of fusion with international innovation structures, standard tasks of fusion.

Main objectives of the course
Formation of clear understanding of innovation activity as a complete process.
Formation of knowledge on features, rules and forms of innovation

Educational form and structure
Lectures and practical classes – 72 hours,
Self-study – 47 hours.
3.26 INNOVATION ACTIVITY MANAGEMENT

General course info
Name of course: Innovation activity management
Course level: upper
Code: compulsory, federal component
Number of ECTS points: 5,5
US semester credits: 4
Place in curriculum: 5th semester, third year.

Overview content
The main theory of management: regularities of management of different systems; management of social-economical systems (organizations); methodological bases of management; infrastructure for management; socio-factors and ethics of management; integration processes in management; modeling of situations and elaboration of decisions; character and structure of management’s functions; strategic and tactical plans in the system of management; organization cooperation in the system of management; organization forms of management; motivation of activity in management; regulation and control in the system of management; movement of groups and leaderships in the system of management; management of people and management of group; style of management and image of manager; conflicts in management.
Features of innovation strategic conduct of organizations: role strategic function of organizations; the method of classification of innovation strategic conduct of organizations.
Indexes of innovation activity and innovation competitiveness of organizations: dynamic activities; activities of innovation; activities of renovation; structural activities.
Characteristic of innovation potential. Strategic amount of innovation.
Definition of product’s science intensity. The level of science intensity of production. The role of organization culture in innovation potential.
Features of organization innovation. Engineering and reengineering inner organizations.
The notion and content of innovation management: substance of innovation management. Tasks and functions of innovation management, social-psychological aspects, technologies and methods of innovation management, strategic management of innovation, personal management in the course of innovation introduction.
Main objectives of the course
Formation of clear understanding of main rules of innovation management.
Formation of knowledge on innovation activity as an object of management (essence, features, factors, etc.).

Educational form and structure
Lectures and practical classes - 72 hours,
Self-study – 115 hours.
3.27 INNOVATION PROCESSES AND SYSTEMS ASSESSMENT

General course info
Name of course: Innovation processes and systems assessment
Course level: upper
Code: elective, university selection
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 8th semester, fourth year.

Overview content
Concept of a systemic approach. Properties of systems. Systems and systems model.
Socio-economic system and market. Notion of innovation.
Innovation system. Innovation cluster. Synergistic effects. Federal and regional innovation system in Russia.
Continuous generation of innovation. Main characteristics of innovation process. Innovation cycle. Role of innovations.
Development and application of complex assessment methodologies: innovative project, innovation potential of organizations, innovation infrastructure, etc.
Assessment of an innovative project: general approaches, methods.
Assessment of enterprise innovation potential. Innovative potential.
Assessment of scientific, educational and innovation potential of University.
Assessment of innovation infrastructure organizations.
Regional innovation profile. Classification of regional innovation systems in Russian Federation. Assessment of regional innovative system (Tomsk Oblast).
Main objectives of the course
Formation of clear understanding of innovation process and economic systems.
Formation of knowledge on methods of innovation projects complex assessment.
Practical skills in assessment of innovation projects, enterprise, university.

Educational form and structure
Lectures and practical classes - 42 hours,
Self-study - 54 hours.
3.28 INNOVATION SYSTEMS

General course info
Name of course: Innovation systems
Course level: upper
Code: elective, university selection
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 8\textsuperscript{th} semesters, fourth year.

Overview content
Formation of innovation systems. Main theoretical concepts. Functional elements of innovation systems. Statistical characteristics of innovation processes. Russian innovation system. Forms and methods of budget funding for science and innovation activity, tax incentives. Features of Russian research and innovation policies.
Science and innovation in large companies: scale, structure and trends of R&D funding in business sector, companies - leaders of innovative development.
Small innovation business: role of small businesses in the innovation systems, forms and methods of small innovative businesses state support, start-ups, technology parks, incubators. Technological clusters.
Innovation processes in higher education: scale, structure and priorities. Types and mechanisms of funding for science and innovation: state budget funding – programs, contracts, grants, support for enterprise projects, venture financing, stock market, crediting. Forecasting of innovation processes: methods and parameters, resources, priorities.

Main objectives of the course
Formation of clear understanding of innovation systems structure and elements.
Formation of knowledge on features of Russian innovation system in business and education.

Educational form and structure
Lectures and practical classes - 42 hours,
Self-study – 56 hours.
3.29 INTRODUCTION TO INNOVATION

General course info
Name of course: Introduction to innovation
Course level: lower
Code: elective, university selection
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 1st semester, first year.

Overview content
Purposes. Main notions. Relations between “old” and “new”. Dynamic balance of “old” and “new” as a condition for sustainable development. Progress and regress.
The culture of inter-relations. New socio-economic space of Russia. Innovation as a science and a sphere of activity, an engine of social and economic development. Formation and development of innovation as an area of scientific knowledge. The subject of innovation.
Human resources in innovation organization. The role of innovation team. Reasons of non-innovation behavior.
Legal protection of intellectual property and its role in innovation activity. Copyright as a part of civil law. Intellectual property as an object of copyright protection.
Innovative psychology. Innovative behavior and innovative minds. The relationship between creative and critical thinking. The role of creativity in innovative thinking.

**Main objectives of the course**
Formation of knowledge on principles and instruments of support of innovation activity.
Practical skills to build innovation activity in conditions of innovation economy.

**Educational form and structure**
Lectures and practical classes - 36 hours,
Self-study - 74 hours.
3.30 LEGAL PROTECTION OF INNOVATION ACTIVITY

General course info
Name of course: Legal protection of innovation activity
Course level: upper
Code: compulsory, federal component
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 7th semester, fourth year.

Overview content

Main objectives of the course
Formation of clear understanding of Russian legal system bases in the field of innovation. Formation of knowledge on features, tools of legal system in the sphere of innovation.

Educational form and structure
Lectures and practical classes – 54 hours,
Self-study – 48 hours.
3.31 LEGAL STUDIES

General course info
Name of course: Legal studies
Course level: lower
Code: elective, university selection
Number of ECTS points: 2.5
US semester credits: 2
Place in curriculum: 2nd semester, first year.

Overview content
Law and state. Russian law system. The constitution of Russia. Features of the federal structure of Russia. Civil legal relationships. Legal persons and entities.
International law as a special system of law.
Right property.
Inheritance rights.
Family law.
Labor law.
Administrative law.
Environmental law.
Regulations of information protection.

Main objectives of the course
Formation of clear understanding of legal system.
Formation of knowledge on features, types, rules, specific character of legal system.

Educational form and structure
Lectures and practical classes - 68 hours,
Self-study - 22 hours.
3.32 LOGISTICS

General course info
Name of course: Logistics
Course level: upper
Code: compulsory, federal component
Number of ECTS points: 3,5
US semester credits: 2,5
Place in curriculum: 8th semester, fourth year.

Overview content

Main objectives of the course
Formation of clear understanding of terminology, bases and specific character of logistics.
Formation of knowledge on types and using of logistics in different ways.

Educational form and structure
Lectures and practical classes – 42 hours,
Self-study – 77 hours.
3.33 MARKETING IN INNOVATIVE SPHERE

General course info
Name of course: Marketing in innovative sphere
Course level: upper
Code: compulsory, federal component
Number of ECTS points: 5
US semester credits: 4
Place in curriculum: 6\textsuperscript{th} semester, third year.

Overview content
Main questions of marketing: the role of marketing in the sphere of economical development of country; article in marketing activity; complex research of trade market; market segmentation; forming of trade policy and market strategy; elaboration of pricing policy; forming of demand and stimulation of sale; organization of activity of marketing services. Strategic innovation marketing: regular innovation marketing.
Tactical innovation marketing: purposes and tasks; marketing research of a new product and its positioning; prior distribution of a new product on the market and its advertising.
Organization of sale system of a new product; providing of product supply on more competitive terms and fastening it on market; planning of price and volume of a new product; marketing of new technologies.
Information providing of marketing: marketing information system; information providing of marketing researches; information support of advertising and sale; features of information providing of external economic activity.
Direct and interactive marketing: advantages of direct marketing; forms of direct marketing; interactive marketing and e-commerce; integrated direct marketing; social opinion and ethical questions in the sphere of direct marketing.

Main objectives of the course
Formation of clear understanding of role and importance of marketing in the field of innovation.
Formation of knowledge on features, methods, marketing types and systems.

Educational form and structure
Lectures and practical classes - 64 hours,
Self-study – 123 hours.
3.34 MATHEMATICS

General course info
Name of course: Mathematics
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 17.5
US semester credits: 12
Place in curriculum: 1st, 2nd semesters, first year, 3rd semester, second year.

Overview content
Mathematic analysis: confines, numerical consecutions and series; differential and integral calculus; elements of function theory and functional analysis; the theory of functions of complex variable; differential equation; operational calculus.
Analytical geometry and algebra: systems of lineal equations; determinant; linear operators and matrixes; vectorial spaces and linear reflections; geometry of curves and surfaces; elements of topology.
Discrete mathematics: bases of mathematics logic; the theory of algorithms; automates and combinative analysis; numerical methods. The fuzzy logic. Models of nonlinear dynamics. The theory of relative and statistic: accidental quantities; laws of probability distribution; accidental processes; statistic methods of experimental data handling. Research of operations.

Main objectives of the course
Formation of clear understanding of bases, theorems and kinds of mathematics.
Formation of knowledge on features, rules and main elements of mathematics.

Educational form and structure
Lectures and practical classes - 282 hours,
Self-study – 313 hours.
3.35 MECHANICS

General course info
Name of course: Mechanics
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 4\textsuperscript{th} semester, second year

Overview content
Main principles of engineering accounts, construction of rated model, standard elements; main notions of deformable hard solid mechanics; mechanical properties of constructive materials, having ability of standard elements.
Kinematics. The notion of kinematics. Vectorial method of movement’s getting of point. Notion of absolute hard solid.
Dynamics and elements of statistics. The object of dynamics and statistics.
Mechanical system. Mass of system.
Differential equation of mechanical system movement. Quantity of movement of material point and mechanical system. Quantity moment of movement of material point relatively centre and axis.
Kinetic energy of material point relatively centre and axis. Kinetic energy of material point and mechanical system. Notion of power field.
System of power.
Analytical conditions of balance of arbitrary power system. The centre of hard solid gravity and its co ordinations. The principle of Dalamber for material point.
Differential equation of movement of mechanical system in generalized co ordinations or equations Lagrange of second type. The principle of Hamilton Ostrogradsky. The notion of balance stability.
Main objectives of the course
Formation of clear understanding of main principles and elements of mechanics.
Formation of knowledge on features, types and theorems of mechanics.

Educational form and structure
Lectures and practical classes – 59 hours,
Self-study – 43 hours.
3.36 METROLOGY, STANDARDIZATION AND CERTIFICATION

General course info
Name of course: Metrology, standardization and certification
Course level: upper
Code: compulsory, federal component
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 5th semester, third year.

Overview content
Metrology, metrological support, standardization, certification, relationship between them.
Methods and means of measurements and the system of measurement uniformity provision. Direct and indirect measurements.
Metrological structural schemes of direct and indirect measurements, sources of errors, classification of errors.
Examples of application errors of measurement. Characteristics of measurement results error.
National and international mechanism of provision the uniformity of measurements. Interstate and local metrological organizations.
Methods and means of determination of measurement error characteristics. Principles of basic checking measurement systems.
Standardization state system. Standardization in Russia, international system and cooperation.
Basic principles of standardization, standards types, model content.
Standardization in the field of innovation.
Certification: goals, objectives and types of certification. Certification in the field of innovation. Organizational structure, state accreditation and licensing of certification bodies

Main objectives of the course
Formation of clear understanding of metrology, standardization and certification as a complete process of measurement.
Formation of knowledge on types, systems, methods, elements and principles of metrology, standardization and certification

Educational form and structure
Lectures and practical classes - 63 hours,
Self-study – 39 hours.
3.37 MICROPROCESSOR DEVICES AND SYSTEMS

General course info
Name of course: Microprocessor devices and systems
Course level: upper
Code: elective, university selection
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 7th semester, fourth year.

Overview content
Classification, principles of microprocessor devices and systems structure, one-chip microcomputers and controllers, organization of processing subsystems, control, memory, input and product, multi- and microprocessor systems. Overview of state and perspective projects of microprocessor systems.
The main target of the course is the introduction of microprocessor systems’ (MPS) construction principles, organization and peculiarities of systems design on their basis, accomplishment of the main MPS design problems, overview of possible application domains.

Main objectives of the course
Formation of clear understanding of principles, targets and possibilities of microprocessor devices and systems
Practical skills of microprocessor devices and systems using.

Educational form and structure
Lectures and practical classes – 54 hours,
Self-study – 48 hours.
3.38 PHILOSOPHY

General course info
Name of course: Philosophy
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 3rd, 4th semester, second year.

Overview content
The notion of philosophy. Place and role of philosophy in culture. Features of civilization in the making of philosophy. Historical types and directions of philosophy, main phases of philosophy historical development, the structure of philosophic knowledge.
Objective reality. Notions of spirit, substance and awareness; space and time, movement. Scientific, philosophic and religious picture of the world.
Person, society, culture. Person and nature. Producing and its role in the people’s life. Society and its structure. Person in the system of social bonds. Person as a creator and creation of culture. Person and historical process; person and masses; freedom and necessity.
Cognitive, ethic and esthetic values. The sense of mankind’s existence.

Main objectives of the course
Formation of clear understanding of principles, targets, methods of philosophy as an element of culture.
Formation of knowledge on features and structure of cognition.

Educational form and structure
Lectures and practical classes - 59 hours,
Self-study - 39 hours.
3.39 PHYSICAL EDUCATION

General course info
Name of course: Physical education
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 14
US semester credits: 0
Place in curriculum: 1st, 2nd semester, first year, 3rd, 4th semester, second year, 5th, 6th semester, third year, 7th, 8th semester, fourth year.

Overview content
Physical education of person. Bases of healthy mode of students life.
Features of use physical education means for optimization of efficiency.
General physical and special trainings in system of physical education.
Sport. Individual choice of kinds of sport or systems of physical training. Professional-applied physical training of students.
Methodological bases of independent exercises and self-control over organism.

Main objectives of the course
Formation of clear understanding of socio – biological bases of physical education.
Formation of knowledge on sport as a kind of physical and special training.
Practical skills of control over organism with different types of physical education.

Educational form and structure
Lectures and practical classes - 408 hours.
3.40 PHYSICS AND CONCEPTIONS OF MODERN NATURAL SCIENCE

General course info
Name of course: Physics and conceptions of modern natural science
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 7.5
US semester credits: 5
Place in curriculum: 1st, 2nd semesters, first year.

Overview content
Natural-science and humanitarian cultures; scientific method; history of natural science; panorama of modern natural science; the tendency of development.
Corpuscular and continued conceptions of nature’s description; order and disorder in nature; chaos; structural levels of matter’s organization.
Micro-, macro- and mega worlds; space, time; principles of relativity; principles of symmetry; laws of preservation; interaction, long-range action; principles of superposition, uncertainty, subsidiarity.
Dynamic and static rules in nature; laws of energy preservation in macroscopic processes; the principle of entropy increase.
Chemical processes, reactionary ability of matters; inner structure and history of Earth geologic development.
Modern conceptions of geosphere’s shells development; lithosphere as an abiotic base of life; ecological functions of lithosphere: resort, geodynamic, geophysical-chemical; geographical cover of Earth.
Features of biological level of matter’s organization; principles of evolution, reproduction and development of alive systems; variety of living organisms – base of organization and stability of biosphere; genetic and evolution; people.
Biosphere and cosmic cycles: noosphere, irreversibility of time, self organization in living and lifeless nature; principles of universal evolutionism; the way to united culture.
Modern level of development of science and technique. Vision of major scientific discoveries of the present.
Main objectives of the course
Formation of clear understanding of scientific methods and conceptions of physics.
Formation of knowledge on different types of scientific and technical development.
Practical skills of using of scientific methods in everyday life.

Educational form and structure
Lectures and practical classes - 140 hours,
Self-study – 115 hours.
3.41 POLITICAL SCIENCE

General course info
Name of course: Political science
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 1.5
US semester credits: 1
Place in curriculum: 4th semester, second year.

Overview content

Main objectives of the course
Formation of clear understanding of world political life. Formation of knowledge on different aspects of political life. Practical skills of political reality cognition.

Educational form and structure
Lectures and practical classes - 25 hours, Self-study - 31 hours.
3.42 PROGRAMMING

General course info
Name of course: Programming
Course level: lower
Code: elective, students selection
Number of ECTS points: 2
US semester credits: 1,5
Place in curriculum: 4th semester, second year.

Overview content
The course “Programming” consist of two parts: realization of automatic computational process in the environment of mathematical process MathCAD and the fundamentals of programming at high language level C++. Acquisition of methods and techniques of automatic symbolic and numerical computation MathCAD will allow students to automate computation process for wide range of tasks both of learning and research character to create interactive computational environment for the accomplishment of engineering tasks. Programming at C++ provides students with modern and effective means for the creation of working programs for microcontrollers and program drivers of different machines.

To provide students of work fundamentals with mathematical processor MathCAD in order to be able to automate mathematical computations of high complexity while designing, analysis and modeling electronic circuits and their elements. To provide fundamentals of high language level C++ programming in order to accomplish tasks of multifunctional software creation, using modern high-tech procedure and object-oriented base.

Main objectives of the course
Formation of clear understanding of elements and main principles of programming.
Formation of knowledge on existing programming systems.
Practical skills of using of different programming systems.

Educational form and structure
Lectures and practical classes - 51 hours,
Self-study – 17 hours.
3.43 PSYCHOLOGY AND PEDAGOGY

General course info
Name of course: Psychology and pedagogy
Course level: upper
Code: elective, university selection
Number of ECTS points: 2
US semester credits: 1.5
Place in curriculum: 7th, 8th semester, fourth year.

Overview content
Psychology: subject, object and methods. Psyche, behavior and activity. Main functions of psyche. Brain and psyche, psyche structure. Main psychical processes; mind structure; cognitions; feelings and emotions, psychology of the personality.
Pedagogy: object, subject, problems, functions, methods. Main pedagogical categories: education, bringing-up, teaching, pedagogical activity, pedagogical interrelation, pedagogical technology, pedagogical task.

Main objectives of the course
Formation of clear understanding of principles of psychology and pedagogy.
Practical skills of using psychological and pedagogical methods in everyday life.

Educational form and structure
Lectures and practical classes - 41 hours,
Self-study – 37 hours.
3.44 RUSSIAN LANGUAGE AND SPEECH CULTURE

General course info
Name of course: Russian language and speech culture
Course level: lower
Code: elective, university selection
Number of ECTS points: 1.5
US semester credits: 1
Place in curriculum: 2nd semester, first year.

Overview content
Russian language as a way of existing of Russian national thought and Russian culture, types of speech situations. It introduces to conversational speech and literature language, Russian written culture, parts of speech, and also main types of business and commercial documents.
Styles of modern Russian literary language. Language norms, its role in becoming and functioning of literary language; speech interaction.
Basic units of dialogue; oral and written versions of literary language; normative, communicative, ethical aspects of oral and written speech.
Functional styles of modern Russian language; interaction between functional styles; scientific style.
Spec character of elements of various language levels in scientific speech; speech norms of educational and scientific lines of business; unofficial, official styles, spheres of its functioning, a genre variety.
Language formulas of diplomas. Unification of language in service documents; multi-national properties of Russian officially - business written speech.
Language and the style of circumspect documents; language and style of commercial correspondence; language and style of instructive-methodological documents.
Advertising in business speech; rules of official papers registration; speech ethics in the documents. Genre differentiation and selection of language means in journalistic genre; features of public speech; a speaker and his audience.
Basic kinds of arguments; a preparation of speech: a choice of a theme, a purpose of speech, search of a material, beginning, expansion and completion of speech.
Basic methods in search of supplementary material types; verbal decor in public speech; comprehension, expressiveness of public speech.
Informal conversation in system of functional versions of Russian literary language; conditions of informal conversation functioning, the role of non-lingual factors; speech culture.
Basic directions of skills perfecting for qualified writing and speech.

**Main objectives of the course**
Formation of clear understanding of different styles, methods, kinds of Russian language and speech culture.  
Formation of knowledge on rules of Russian language. 
Practical skills of using of main rules of Russian language and speech culture.

**Educational form and structure**
Lectures and practical classes - 34 hours, 
Self-study – 24 hours.
3.45 SAFETY STUDIES FOR VITAL ACTIVITY

General course info
Name of course: Safety studies for vital activity
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 8th semester, fourth year.

Overview content
Person and the environment; characteristic conditions of systems “person – the environment”; safety of vital activity as a constituent of anthropogenic bionomics.
Fundamentals of labor physiology and comfortable conditions of vital activity in techno sphere; measure of comfort; negative factors of techno sphere, its influence on human, techno sphere and environment; safety criteria; international and domestic standards and norms of vital activity safety.

Main objectives of the course
Formation of clear understanding of safety methods, techniques.
Formation of knowledge on reduction of danger in different situations, methodological bases.
Practical skills of safety rules using.

Educational form and structure
Lectures and practical classes - 35 hours,
Self-study – 67 hours.
3.46  SOCIOMETRY

General course info
Name of course: Sociology
Course level: lower
Code: elective, university selection
Number of ECTS points: 1
US semester credits: 1
Place in curriculum: 7.\textsuperscript{th} semester, fourth year.

Overview content
Pre-history and socio philosophical premises of sociology as a science; society and social institutions; universal systems and globalization processes.
Social groups and communities; types of communities; community and personality; personality as a social type; small groups and collectives; social organizations; social movements; social inequality.
Background and social - philosophical preconditions of sociology as a science.
Society and social institutes; global society and globalization. Social groups and generality; generality types. Small groups and collectives.
Personality as a social type.
Social organization. Social movements.
Social inequality, stratification and social mobility. The concept of the social status. Social control and deviation. Social changes. Social revolutions and reforms.
The concept of a social progress. Place of Russia in the global society; methods of sociological researches.

Main objectives of the course
Formation of clear understanding of the role of sociology in society.
Formation of knowledge on methods, stages and types of sociology.
Practical skills of using of sociological researches as an element of public opinion cognition.

Educational form and structure
Lectures and practical classes - 27 hours,
Self-study – 17 hours.
3.47 STATISTICS

General course info
Name of course: Statistics
Course level: upper
Code: elective, university selection
Number of ECTS points: 3
US semester credits: 2.5
Place in curriculum: 5th semester, third year.

Overview content

Main objectives of the course
Formation of clear understanding of statistic as a science discipline. Formation of knowledge on methods of statistic indexes calculating. Practical skills in analysis of important statistic indexes to solve different tasks.

Educational form and structure
Lectures and practical classes - 54 hours,
Self-study - 57 hours.
3.48 SYSTEM ANALYSIS AND DECISION MAKING

General course info
Name of course: System analysis and decision making
Course level: upper
Code: compulsory, federal component
Number of ECTS points: 5
US semester credits: 3.5
Place in curriculum: 6th semester, third year.

Overview content
Main principles of system analysis and decision making, optimization methods of determinate values getting (methods of lineal programming, quadratic programming, theorem of Cune - Takker, dynamic programming, the principle of maximum, optimization in functional spaces), optimization with many criteria (principle of Pareto, lexicographical optimization), variation methods of determinate values getting, statistical methods of values getting, the structure and methods of decision making with use of different values; the method of system matrixes (space "variants-conditions"): minimal method, the method of Bayes - Laplas, the method of Gamer, combined methods; combinative methods, statistic methods, statistic methods of decision making (methods of hypothesis’s control, methods of minimization of dispersion), an optimality in conflict situations, gaming dynamic tasks, a stability of balance’s points.

Main objectives of the course
Formation of knowledge on different methods and ways of finding correct decision.
Practical skills of using of system analysis methods to make decision.

Educational form and structure
Lectures and practical classes - 88 hours,
Self-study – 82 hours.
3.49 TECHNOLOGIES AND SCIENCE OF MATERIALS

General course info
Name of course: Technologies and science of materials
Course level: lower
Code: compulsory, federal component
Number of ECTS points: 3,5
US semester credits: 2,5
Place in curriculum: 3rd semester, second year.

Overview content
Solution, properties, purpose of modern constructional materials; materials used in mechanical engineering and instrument-making.
Main methods of hard solid getting; classification of methods of storages getting (castings, plastic warping); production of all-in-one junction (welding, brazing, conglutination).
Bases of getting of composite and powdered materials; metal details production, powdered and polymeric composite materials.

Main objectives of the course
Formation of clear understanding of production cycle of materials.
Formation of knowledge on every stage of materials production (features, characteristics, composition).

Educational form and structure
Lectures and practical classes – 72 hours,
Self-study – 47 hours.
3.50 TECHNOLOGY OF COMPLEX SYSTEMS MODELING

General course info
Name of course: Technology of complex systems modeling
Course level: upper
Code: elective, students selection
Number of ECTS points: 3
US semester credits: 2
Place in curriculum: 7th semester, fourth year.

Overview content
Methods of modeling. General information about mathematical models of complex systems. Approaches to building models. Basic methods of input data preparation, operation conditions, actions modelling, registration and eliminations of uncertainties.

Main objectives of the course
Formation of clear understanding of basis for using existing hardware and software for computational experiment. Formation of knowledge on modeling techniques used for system researches. Practical skills of input data preparation and processing for modeling complex systems.

Educational form and structure
Lectures and practical classes – 54 hours,
Self-study – 48 hours.
3.51 THEORY OF FUZZY SETS

General course info
Name of course: Theory of fuzzy sets
Course level: upper
Code: elective, university selection
Number of ECTS points: 4
US semester credits: 2.5
Place in curriculum: 4th semester, second year.

Overview content
Mathematical aspects of the theory. Main notions, functions. Operations with fuzzy sets.
The distance of Hamming. The theorem of decomposition. Basic concepts. The concept of linguistic variable.
Notions of linguistic variable. The using of fuzzy sets.
Practical using of the theory. Management of electro mechanical objectives.

Main objectives of the course
Formation of clear understanding of main directions of development and practical application of the theory.
Formation of knowledge on notions, concepts, application of the theory, sustainability analysis methods, synthesis, configuration, classification and model of fuzzy systems.
Practical skills of design fuzzy quantities’ mathematical models, using of theoretical knowledge in such areas as management, economy, emergencies predicting.

Educational form and structure
Lectures and practical classes - 68 hours,
Self-study – 68 hours.
3.52 THEOREY OF INNOVATION

General course info
Name of course: Theory of innovation
Course level: upper
Code: compulsory, federal component
Number of ECTS points: 6
US semester credits: 4
Place in curriculum: 5th semester, third year.

Overview content
Introduction to the theory of innovation: main notions, terminology in the sphere of innovation; survey of development of innovation activity; national support of innovation activity in industrial-developed countries; strategy of Russian innovation development; infrastructure for innovation activity; active problems of innovation, socio-technical direction of innovation development; international innovation activity.
The theory of innovation management: formalized methods of generation and selection ideas of innovation activity; forming of database about ideas generation; management of innovation process; innovation process as an object of management. Flexibility and adaptability of infrastructure for innovation realization; information technologies in the sphere of innovation; modeling of innovation processes and projects; standard models conformably to processes, programs, objectives. The theory of competitiveness and value of risks; reliability and diagnostic in the sphere of innovation management; problems of automation in innovation.
Theories of innovation development: long term prediction of development of economic and methods of dynamic analysis of technological changes; the Kondratiev’s theory of long waves; contribution of Schumpeter in the theory of innovation.
Main factors of innovation development; periodization of social development in the view of innovation, scientific-technical epochs; motive forces of development and reasons of replacement; life cycle of technical way, product, technology; diffusion of innovation; commercialization of innovation; S – figurative logical curves and innovation strategies of organizations; investment in innovation processes; recurrence of innovation processes; regulation of innovation processes at macro- and micro level of management; invariant of innovation and forming of innovation sphere for switching to a new technological way.

**Main objectives of the course**
Formation of clear understanding of the process of innovation management and innovation development.
Formation of knowledge on methods, stages of innovation development and Russian features.

**Educational form and structure**
Lectures and practical classes - 90 hours,
Self-study – 114 hours.
### Bachelor curriculum for 220600 – Innovation

**ECTS - European Credit Transfer System**

<table>
<thead>
<tr>
<th>№</th>
<th>Name of the course</th>
<th>Number of points</th>
<th>Number of credits for each semester ECTS/USSC</th>
<th>Form of assessment</th>
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