Federal State Autonomous Educational Institution of Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA NAMED AFTER PATRICE LUMUMBA

RUDN University

Academy of Engineering

educational division - faculty/institute/academy

COURSE DESCRIPTION

27.04.05 Innovatics

field of studies / specialty code and title

Digital transformation in production management

higher education programme profile / specialization title

2024

Disciplines are studied as part of the curriculum hire educational program «Digital transformation in production management» in the field of training 27.04.05 Innovatics

Course title	Professional Russian (as a Foreign Language)
Course Workload, credits / academic hours	6/216
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Introductory phonetic and grammatical course (VFGC)	Topic 1.1. The Russian alphabet: pronunciation and spelling. Vowels and consonants, pronunciation training And-E-A-O-U-S; E-E-U-Ya. A soft sign and a hard sign. Hard and soft consonants. Russian stress, reduction of O, E and I.
	Topic 1.2. Russian phonetics: vowels and consonants, hard and soft consonants, voiced and deaf consonants. Pronunciation training BA-BIYA-BIYA-BIYA. BA-PA training. Parsing words according to rhythmic patterns ta, ta-ta, ta-ta, etc.
	Topic 1.3. Russian phonetics: generalization and repetition, exercises for reading words with stress, distribution by rhythmic models, reading phrases with intonation (questions and answers), dialogues with the teacher.
Section 2. Elementary-basic level (A1-A2)	Topic 2.1. Russian grammar: gender and number of nouns in the nominative case, repetition. Personal pronouns. The difference is you and you, the difference is you and you. Possessive pronouns in the nominative case. The gender and number of whose, whose, whose, whose.
	Topic 2.2. Repetition of numerals, reading phone numbers, repetition of pronouns, exercises with type questions. Adjectives in the nominative case. Gender and number of which, which, which, which. Vocabulary: numerals from 100 to 1000, days of the week and months in the nominative case, the question is when. The difference between the categories of place and time, the question is where. Examples of answers to these questions in Russian.
	Topic 2.3. Repetition of pronouns and adjectives, their categories of gender and number in the nominative case, reading questions and answers to them, exercises for distribution according to rhythmic models (stress). The Russian verb. Conjugations (models) of the Russian verb, forms to read (do) and speak (love). The endings of verb forms in the present tense (the paradigm of personal pronouns). The concept of grammatical tense, present, past and future tense. Verb forms of the past and future tense. The imperative. Vocabulary: the verb to be and its temporal forms. Phrases yesterday was – today – tomorrow will be. The words before-now-later.
	Topic 2.4. Repetition of models of verbs and verb forms. Exercises to indicate the correct ending of the verb and the correct time form in the verbs to be, to do, to work, to rest, to read, to write, to understand, to speak, to love. The accusative case of nouns (the concept of the object form after the verb). The difference between the forms of masculine (neuter) and feminine inanimate nouns in the accusative case (water-water, fish-fish). Sentences with the verbs to be and to love. Phrases I will/won't what, I love/don't love what (negative particle is not). Questions What do you like? What do you want? Vocabulary: the verb to want in the forms of the present and past tense, questions when and at what time, the expression of a request (can I use a pen?)
	Topic 2.5. Repetition of the accusative form of the object after the verbs to be, to love, to want, etc. Answers to questions, dialogues. Repetition of the forms of grammatical tense of the Russian verb. Intermediate control. Prepositional case of nouns (place category). Answers to the question where, the difference between prepositions in and on. Exception words (parsing). Vocabulary: repetition-activation of forms of numerals, names of monetary units (ruble, kopeck). Adverbs of the place (here, there, on the right, next to), a little story about yourself (who are you, what is your name, how old are you, who do you have, etc.).
	Topic 2.6. Repetition of the prepositional case form with the meaning of place. Answers to the question where with prepositions in and on, dialogues. Repetition of the forms of

	grammatical tense of the Russian verb. Repetition of the accusative form with the meaning of the object. The genitive case of nouns with the meaning of belonging. Answers to the questions of who has, who does not, the forms of questions of whom / what, who. The genitive case with the meaning of belonging, answers to the questions whose, whose, whose (student's book, Irina's notebook). The answer to the question where did you come from, the difference between prepositions from and from. Vocabulary: cities and countries, family, food, stationery, clothes.
	Topic 2.7. Repetition of genitive forms with the meaning of belonging. Answers to questions. A story about yourself. The dative case of nouns. The concept of perfect and imperfect verbs (categories of process and result, single and multiple) Verbs give, give, call, write and question to whom. Vocabulary: activation of numerals, the concept of age, analysis of grammatical forms year, year, years, activation of the genitive case, questions how old are you? What do you like?
	Topic 2.8. Repetition of the studied forms of the genitive and dative cases, answers to questions, a story about yourself and about a friend / girlfriend. The perfect and imperfect form of the verb (NSV and SV). Expanding and consolidating the topic using the example of verbs with the dative case. A perfect view of the past and future tense. Vocabulary: Constructions with the words need, can, cannot, must (must + infinitive). Adverbs of time that answer the question when? (often, etc.), negative pronominal adverbs (never, nowhere). The use of the demonstrative pronouns this, this.
	Topic 2.9. Repetition of the types and tenses of the verb, exercises with questions and answers. The concept of a double verb (I want to eat, I don't like to drink cola). The verbs to learn, to teach, to study, to engage in the present, past and future tenses. The construction of time with the preposition before (before 10.30). Activation of the genitive, accusative and prepositional cases. Reading adapted texts on the topics "My free time", "My day" and "My studies". Analysis, discussion, answers to questions. Vocabulary: sports, hobbies, food, food, words breakfast-lunch-dinner, verbs breakfast-lunch-dinner.
	opic 2.10. Students' short stories about themselves on the topics of My day, my studies and free time. Repetition of the studied verb and case forms, answers to questions. Intermediate control. The creative case of nouns and its meanings in the Russian language. Answers to the questions of being /becoming who of the past and future tense. Phrases I want/wanted to become/be/work as someone.
	Topic 2.11. Repetition of the meanings of the creative case, performing exercises and answering questions, activating verb forms. Prepositional case of nouns (topic category). Answers to questions about whom / what, activation and repetition of the prepositional form with the meaning of the place where. Vocabulary: verbs to live, to be born, to think, to remember, to remember, to forget, to tell, to experience, etc. in the form of NSV and SV.
	Topic 2.12. Repetition of the studied meanings of the prepositional case, answers to questions, a story about yourself or about a friend / girlfriend. The accusative case of nouns in the meaning of the direction of movement. The answer to the question of where. The difference between prepositions in and on. Verbs of movement in Russian. Vocabulary: sights and popular places in Moscow/Of Russia.
	Topic 2.13. Repetition of the studied case and verb forms. Reading educational texts. Answers to questions. Verbs of movement. Expanding and consolidating the theme. Repetition of verb forms of type and tense. Vocabulary: activation of previously learned vocabulary.
	Topic 2.14. Repetition of the forms of verbs of movement in the Russian language. Intermediate control. Direct and indirect speech in Russian. Reading dialogues and their transformation into monologue statements. Independent work of students, direct and reverse transformation of educational dialogues and monologues.
	Topic 2.15. Some verbs with a particle. The difference between the verbs to begin-to begin, to continue-to continue, to end-to end. Activation of case forms (questions) when and at what time. What is the name of the structure.
	Topic 2.16. Ordinal numbers. Activation and repetition of the forms of gender and number which, which, which, which in the nominative case. What is the date of the construction

	of time? And on what date? Grammatical forms of the answer to the question when (what date, what year, in what month, in what year, in what week). Prepositional case of adjectives.
	Topic 2.17. The genitive case and its main meanings. The genitive case with prepositions for, without, from, about, from, at, with, around, by. The genitive case of adjectives.
	Topic 2.18. The dative case with the preposition to (to whom?). Activation and repetition of verb forms of movement. The dative case of adjectives.
	opic 2.19. The accusative case of the direction. The verbs leave – leave, come – come, enter – enter, exit – exit, leave – leave, come – come. The accusative case of adjectives.
	Topic 2.20. Verbs to be interested, to get carried away. Activation and repetition of the creative case. The creative case of adjectives.
	Topic 2.21. Systematization of cases. Intermediate control.
	Topic 2.22. The topic is "Telephone conversation etiquette". The formation and use of forms of the imperative mood with the word let. A conversation with friends and with an official.
	Topic 2.23. The topic is "Health". Names of body parts and some diseases. The reflexive pronoun of self. A conversation with a doctor.
	Topic 2.24. The topic is "My country and my city". Names of cities and countries in Russian. Information on regional studies.
	Topic 2.25. The theme is "Traditions and holidays". Names of national holidays and dishes of national cuisine in Russian. Culture and regional studies.
	Topic 2.26. The topic is "Me and my family". Activation of the forms "what is the name of whom", "how old is who", "who likes what", "who is interested in what", "works / studies where", etc. The name of hobbies, hobbies, colors and shades in Russian.
	Topic 2.27. The topic is "My friends and my free time". Activation of the forms "what is the name of whom", "how old is who", "who likes what", "who is interested in what", "works / studies where", etc. The name of hobbies, hobbies, colors and shades in Russian.
	Topic 2.28. The topic is "Learning the Russian language". The topic is "My (future) profession". The name of professions and specialties in Russian. Activation of the forms "to teach what", "to study what", "to study where", "to do where", "to do what with whom", etc.
Section 3. Subtest	Topic 3.1. Subtest "Vocabulary-grammar" level A2. Here and further – preparation and execution.
	Topic 3.2. The A2 level Listening subtest.
	Topic 3.3. The A2 level Reading subtest.
	Topic 3.4. The A2 level Letter subtest.
	Topic 3.5. The A2 level Speaking subtest. Training with a teacher.
	Topic 3.6. The subtest "Speaking" A2. An oral exam with a panel of three teachers.

Course title	Methodology of scientific research
Course Workload, credits / academic hours	2/72
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Scientific research and its specifics	Topic 1.1. Specificity of the object and subject of research. Subject of research. Rational, objective, true in science. Rationality and rationalism. Classical and non-classical concepts of truth in science. Characteristics of scientific research: objectivity, reproducibility, evidence, accuracy. Explanation, understanding, interpretation.
	Topic 1.2. Nature and types of explanation. Major research programs: naturalistic and anti-naturalistic research program. The criteria of scientific character are empirical verifiability, verifiability, falsifiability, the presence of a paradigm, the development of a specialized language. Methodological research strategy as a holistic system of interpretation of principles, concepts, key definitions and justification of hypotheses.

	Topic 1.3. Problem field and problem situation. Theoretical and methodological prerequisites and research program, formulation of its goals and objectives. Logical system and composition of scientific research. Types of compositions. Compositional errors.
Section 2. Conceptual development of the problem	Topic 2.1. Review, relevant, abstract information. Scheme and sequence of scientific research. Research theses as an explication of the topic. Methods of scientific research and their specificity in economic science. Methods of scientific research, their specificity and classification.
	Topic 2.2. Empirical and theoretical methods. Methodology of scientific research: general philosophical, general scientific, specific branches of science. General philosophical methodology as a system of general principles, conditions, guidelines in research activities.
	Topic 2.3. General logical methods: analysis, synthesis, induction, deduction, abstraction, idealization, analogy ¸generalization, etc. Methods used in economic research: modeling, methods of literature analysis, method of selection of facts, statistical-probabilistic method, etc. Specificity of observation, experiment, measurement in economic science.
Section 3. The concept and its role in scientific research	Topic 3.1. Logical analysis of concepts. The scope of the concept. Operations with volumes of concepts. Conceptual and terminological situations in scientific research and their resolution. Selection of defined concepts in scientific research. Selection of basic and auxiliary concepts.
	Topic 3.1. Definition of the concept, the choice of the type of definition used in scientific research. In formativeness, scientific adequacy and cognitive simplicity of definition. Typical mistakes in the definition of concepts. Division of the concept as the basis of the structure of scientific research. Division and classification of concepts.

Course title	Design of automated control systems
Course Workload, credits / academic hours	4/144
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Tools and technologies for integrated automation of the design stage of control systems (CS)	Topic 1.1. Problems of design, computer-aided control systems. The subject and objectives of the discipline. Formulation of the problem of designing the automation of the control system. A systematic approach to the design of the control system. Structural, block-hierarchical, characteristic equations, object-oriented approaches in the formulation of the problem of computer-aided design of the control system. Structuring the design process of the control system. Problems of computer-aided design and control systems.
	Topic 1.2. Functions of CAE/CAD/CAM systems. Composition of integrated CAD systems. Integrated CAE/CAD/CAM systems. Functions of CAM (ERP systems). Functions of SCADA systems. The fundamental principle of management: feedback. Tools and control systems for complex automation.
Section 2. Models and methods of CS analysis in the automation of the design stage	Topic 2.1. Model representation of tools and control systems (CS). Model representation of control systems and control elements as design objects. Formulation of the problem of analysis of the control system as an object with distributed parameters. Formal methods for obtaining models of control systems. Mathematical representation of the control system.
	Topic 2.2. Computer-aided design methods: methods of CS analysis. Performance evaluation. Methods for the analysis of CS in the time domain. Methods of analysis of technical systems in CAD. Features of the mathematical description of the control system in computer-aided design. Methods of analysis in the frequency domain, their main characteristics. The main statistical characteristics of the output parameters of the control system. Evaluation of the accuracy of the statistical test method.

Section 3. Methods for the synthesis of control systems and verification of design solutions in the automation of the design stage	Topic 3.1. Methods of computer-aided design: methods of synthesis of control systems. Quadratic assignment model. Methods and algorithms of technical optimization of tools and control systems, their main characteristics. Methods of artificial intelligence as a means of automating the tasks of structural synthesis of control systems. Adaptive Genetic Algorithms as Algorithms for Solving Problems of Synthesis of SU Devices.
	Topic 3.2. Automation of design of control systems. Automation of design in the framework of complex automation of the design stage of the control system. Levels and tasks of design and technological design of control systems. Mathematical models of control elements in design automation.
	Topic 3.3. Automation of control system tests. CS test methods: based on semi-natural modeling; physically real equipment of the control system. Test algorithms. Methods and algorithms for processing test results.

Course title	Big Data Mining
Course Workload, credits / academic hours	6/216
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Introduction to the Mathematical Foundations of Blockchain Distributed Database Technology	Topic 1.1. Types and properties of distributed systems. Information systems software architecture.
	Topic 1.2. Managing the interaction of heterogeneous applications (middleware).
Section 2. The concept of a distributed information processing system.	Topic 2.1. The concept of a remote procedure (RPC model). Transactional monitors. Transaction confirmation algorithms.
Section 3. The main mechanisms of distributed object technologies	Topic 3.1. Remote access to object methods (RMI model). Object brokers (CORBA specification).
Section 4. The main models of distributed object technologies	Topic 4.1. Messaging-based communication (MOM model). Message queues and transactional queues. Point-to-point interaction model.
Section 5. Internet Technologies	Topic 5.1. The concept of a network service (Web Service). Service and application integration. The core components of network services. Protocols and standardization.
	Topic 5.2. Problems publishing data and finding network services. Coordination of network services. Composite network services.
Section 6. Component model technology	Topic 6.1. Fundamentals of component software systems. COM and COM+, EJB for high-level programming languages.
Section 7. Types of distributed applications	Topic 7.1. Cloud technology. Definition of cloud computing. Multi-layered cloud application architecture. Components of cloud applications. Advantages and disadvantages of cloud computing.
	Topic 7.2. Classification of clouds. The most common cloud platforms. GRID-technologies. GRID architecture. GRID Standards. Parametric GRID Performance Models.
	Topic 7.3. Comparison of GRID and Cloud Computing. Agent-based systems. The concept of a software agent. Multi-agent systems. Security in mobile agent systems.
Section 8. Application integration issues	Topic 8.1. End-to-end application integration (EAI). Message brokers. Publish/subscribe model. Worker Management Systems thread (WorkflowMS). Application Servers.

Course title	Information Technology in Mathematical Modelling
Course Workload, credits / academic hours	3/108
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Basic concepts of simulation modeling	Topic 1.1. General characteristics of the problem of modeling systems. Principles of a systematic approach to modeling.
	Topic 1.2. Classification of system models. Basic concepts of the theory of systems modeling.
Section 2. Methodology of mathematical modeling	Topic 2.1. Features of system development and modeling: the principle of a systems approach; general characteristics of the problem; classification of types of system modeling; Provision and efficiency of machine modeling.
Section 3. Simulation models of queuing systems	Topic 3.1. The role of modeling in the analysis of economic objects. The concept of an object model.
	Topic 3.2. Classification of models. Static and economic models.
Section 4. Simulation of stochastic processes	Topic 4.1. Mathematical and simulation models. Simulation modeling on a computer. The concept of a service device and service requests in the system. The object of the economy as a queuing system. Purpose of simulation models of queuing systems.
	Topic 4.2. Random characteristics of queuing systems. Selection of the distribution law of a random characteristic. Uniform, normal, exponential, and beta laws. The effect of random processes on queue latency. Pollachek-Khinchin formula
Section 5. Model Management and Simulation Results Mathematical schemes of system modeling	Topic 5.1. Node management commands. Parameters of transactions.
	Topic 5.2. Node state settings. Sensors of pseudorandom variables. The results of the model.
Section 6. Mathematical schemes of simulation modeling	Topic 6.1. The transition from a meaningful description of the system to a mathematical scheme. Mathematical schemes of general form. Typical mathematical schemes. Continuously-deterministic models (D-schemes).
	Topic 6.2. Discrete-deterministic models (F-schemes). Discrete-stochastic models (P-schemes). Continuous-stochastic models (Q-schemes). Network models (N-circuits). Combined models (A-schemes).
Section 7. Mathematical approaches in simulation modeling	Topic 7.1. Construction of conceptual models and their implementation.
	Topic 7.2. Algorithmization of models and their machine implementation. Obtaining and analyzing simulation results.
Section 8. Formalization of the process modeling	Topic 8.1. The main approaches to building models; continuously-deterministic models; discrete-deterministic models; discrete-stochastic models; continuous-stochastic models; network models; combined models.
Section 9. Formalization and algorithmization of the processes of functioning of systems	Topic 9.1. Methodology for the development and machine implementation of models; construction of conceptual models and their formalization; algorithmization of models and their machine generation; obtaining and interpreting simulation results.
Section 10. Modeling the business process of a manufacturing company	Topic 10.1. Structural diagram of the business process. The relationship between order flows and financial resource flows. Its display on the diagram of the simulation model.
	Topic 10.2. Payment modeling. Simulate transactions from the same source account to different target accounts. Modeling of a bank loan. Forecast of the company's performance indicators. Simulation of parallel and spawned processes.
Section 11. Synthesis of mathematical models of optimal control systems	Topic 11.1. The problem of choosing the structure of a mathematical model. Linear models. Analytical design of optimal regulators (ACOR).
	Topic 11.2. Numerical methods for the synthesis of control systems. Selection of parameters of the mathematical model. Regression analysis. Least squares method. Recurrent methods.

Section 12. Statistical modeling of computer systems	Topic 12.1. General characteristics of the method; machine generation of pseudorandom sequences; checking and improving the quality of random sequences; modeling of stochastic effects.
Section 13. Simulation tools	Topic 13.1. Systematization and comparative analysis of simulation languages; system simulation application packages; system modeling databases; Hybrid simulation systems.
Section 14. Simulation software	Topic 14.1. Features of the choice of simulation software. Classification of simulation software Opportunities when using simulation programs.
	Topic 14.2. Random number generators. Generation of random variables.
Section 15. Evolutionary modeling	Topic 15.1. The main attributes of evolutionary modeling. Genetic algorithms. Evolutionary algorithms. Population algorithms. Genetic programming. Method of grammatical evolution. Analytical programming. Network Operator.

Course title	Numerical methods for solving mathematical modeling problems
Course Workload, credits / academic hours	5/180
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Methods for minimizing the functions of a single variable	Topic 1.1. Statement of the problem. The classic method. Bisection method. The method of the golden section. The method of broken.
	Topic 1.2. Coating method. Convex functions of a single variable. Tangent method
Section 2. Classical theory of the extremum of functions of many variables	Topic 2.1. Statement of the problem. Weierstrass theorem. The classical method of solving problems at an unconditional extremum.
	Topic 2.2. Conditional extremum problems. Necessary conditions of the first order. Second-order prerequisites. Sufficient extremum conditions.
Section 3. Methods for minimizing the functions of many variables	Topic 3.1. Gradient method. Gradient projection method. Conditional gradient method. Method of possible directions. Proximal method. Linearization method. Quadratic programming. The method of conjugate directions. Newton's method. Continuous methods with a variable metric. Method of coordinate descent. Coverage method in multidimensional problems.
	Topic 3.2. Method of modified Lagrange functions. The method of penalty functions. Proof of the necessary conditions of the extremum of the first and second orders using penalty functions. Method of barrier functions. Method of loaded functions. Random search method.
Section 4. Dynamic programming	Topic 4.1. Bellman's scheme. Synthesis problem for discrete systems. Scheme of Moiseev’s.
	Topic 4.2. Synthesis problem for systems with continuous time. Sufficient optimality conditions.
Section 5. Pontryagin's maximum principle	Topic 5.1. Formulation of the problem of optimal control. Formulation of the maximum principle. Proof of the maximum principle.
	Topic 5.2. The maximum principle for optimal control problems with phase constraints. Relationship between the maximum principle and the classical calculus of variations.
Section 6. Application of the maximum principle to the problems of optimizing the trajectories of spacecraft flights	Topic 6.1. Reduction of the optimization problem to the boundary value problem of the maximum principle.
	Topic 6.2. Shooting method for numerical solution of the boundary value problem of the maximum principle.
	Topic 6.3. Modifications of Newton's method: Isaev-Sonin modification, Fedorenko normalization. Runge-Kutta method for solving Cauchy problems. Study of the problems of minimizing the flight time and the mass of fuel consumed.
	Topic 7.1. Statement of the problem. The classic method. Bisection method. The method of the golden section. The method of broken.

Section 7. Methods for minimizing the functions of a single variable	Topic 7.2. Coating method. Convex functions of a single variable. Tangent method.
Section 8. Classical theory of the extremum of functions of many variables	Topic 8.1. Statement of the problem. Weierstrass theorem. The classical method of solving problems at an unconditional extremum.
	Topic 8.2. Conditional extremum problems. Necessary conditions of the first order. Second-order prerequisites. Sufficient extremum conditions.

Course title	Management of business operations of hi-tech industries
Course Workload, credits / academic hours	2/72
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Business reengineering	Topic 1.1. The concept of reengineering. The definition of "business reengineering" proposed by M. Hammer and D. Ciampi are the four key words of this definition.
Section 2. Basic concepts of process management in enterprise restructuring	Topic 2.1. Definition of "business process", its characteristics. The main indicators for assessing the effectiveness of business processes.
	Topic 2.2. Which is not business reengineering. The concept of the value chain.
Section 3. Knowledge management system	Topic 3.1. Results of identification of business processes. Interface business processes with a requirement.
	Topic 3.2. Interface of business processes using a schedule.
Section 4. Business Process Reengineering Technology	Topic 4.1. Objectives of business process reengineering. Features of enterprises where business process reengineering is most effective. Conditions for successful business process reengineering.
	Topic 4.2. The concept of a knowledge management system. Typical mistakes in reengineering.
	Topic 4.3. System design technology. Stages of the system development life cycle. Basic requirements of design technology. Methodologies for modeling business processes. Technological network for business process reengineering.

Course title	Strategic development of an innovative enterprise
Course Workload, credits / academic hours	10/360
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Formation of strategic intentions of the organization	Topic 1.1. The content of the strategic vision and mission of the organization. Requirements for the formation of the mission. The main approaches to the definition of the mission of the organization: mission as a philosophy, as a detailed characteristic, as a motto. Strategic goals and their relationship with the mission.
	Topic 1.2. The main areas of development of strategic goals. Criteria for the effectiveness of goals. Requirements for the development of strategic goals. The main directions of strategic goals. Structure of strategic goals. The procedure and methods of establishing strategic goals. The hierarchy of goals ("goal tree"), the levels of goal decomposition and the basic rules for its construction. Goal-based management method.
Section 2. Strategic analysis of the organization's environment	Topic 2.1. Analysis of the functioning of the organization's environment. Analysis of the external environment: analysis of the external environment of the far and near environment. Key elements of macro environment segments. PEST analysis of trends that are essential to the organization's strategy.
	Topic 2.2. Analysis of the main economic indicators of the development of the industry. Diagnostics of the main competitive forces according to the model of 5 Porter forces. The strategic meaning of the five competitive forces. Driving

	forces causing changes in the structure of competitive forces. Strategic groups of competitors and prediction of their possible behavior.
	Topic 2.3. Key Success Factors (KFU) and assessment of the prospects for the development of the industry. Analysis of the internal environment. Analysis of competitive advantages: SWOT analysis, unweighted and weighted assessments of competitive strength, Strategic analysis of production costs and the "chain" of values by M. Porter. Analysis of key (core competencies).
Section 3. Strategic position of the organization	Topic 3.1. The concept of strategic business zones. Formation of a portfolio of types of business. Objectives and main stages of portfolio analysis. Matrix analysis of the business portfolio.
	Topic 3.2. The Boston Advisory Group (BCG) Matrix and the McKinsey Model: Advantages and Disadvantages. Assessment of the attractiveness of the industry and the strategic position (competitive position) of the business unit. Porter matrix and Ansoff matrix. Strategy Set Management.
Section 4. The organization's strategy	Topic 4.1. The content of the strategy. Types of strategies. The main strategies of competition, their essence, advantages and risks. The use of offensive and defensive strategies to maintain and protect a competitive advantage. Basic (reference) business development strategies.
	Topic 4.2. Strategies for concentrated, integrated and diversified growth, their varieties and conditions of use. Reduction strategies. Combined strategies. Functional strategies. Production strategy, marketing strategy, personnel management strategy, innovation strategy, investment strategy, foreign economic activity strategy, financial strategy. The process of choosing a strategy.

Course title	Innovation technologies of personnel management
Course Workload, credits / academic hours	3/108
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Personnel in the management system of the organization	Topic 1.1. Personnel management as an educational and scientific discipline. The place of personnel management in the management system.
	Topic 1.2. Personnel as an object and subject of management. Personnel policy in personnel management.
Section 2. Methodological foundations of personnel management	Topic 2.1. Scientific foundations and principles of personnel management.
	Topic 2.2. Scientific approach and methods of personnel management. Leadership and personnel management styles.
Section 3. Organization, functioning and improvement of the personnel management system	Topic 3.1. Personnel management system: concepts, purpose, structure, principles of construction.
	Topic 3.2. Organizational design and implementation of the project of the personnel management system. Improvement of the personnel management system
Section 4. Formation of the organization's personnel	Topic 4.1. Planning and forecasting of personnel needs. Organization of personnel marketing.
	Topic 4.2. Registration of labor relations, selection, placement, career guidance and labor adaptation of personnel.
Section 5. Use of the organization's personnel	Topic 5.1. Organization of labor of personnel. Motivation and stimulation of labor activity of the organization's personnel.
	Topic 5.2. Business assessment and certification of personnel

Course title	Digital technologies of innovative production
Course Workload, credits / academic hours	6/216
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Digital Economy: Concept,	Topic 1.1. Basic concepts of the digital economy. Goals and

Goals and Objectives, Structure	objectives of the digital economy.
Section 2. Tendencies and prospects for the development of the digital economy	Topic 2.1. Global trends in the digital economy.
Section 3. Features of management and interaction in the digital economy	Topic 3.1. Legal regulation of the digital economy.
Section 4. Industrial Internet. Big data	Topic 4.1. Digitalization as a factor in the formation of new economic technologies.
Section 5. Components of robotics and sensors	Topic 5.1. Architecture of management and regulation systems in the digital economy.
Section 6. Virtual and augmented reality technologies. Wireless communication technologies.	Topic 6.1. Industrial Internet: Definition and Evolution of Technology. Data mining. Machine learning. Wireless communication technologies. Product lifecycle management.
	Topic 6.2. Simulation and supercomputer modeling of products. The life cycle of the introduction of digital technologies, Additive technologies and rapid prototyping. Assessment of the economic efficiency of the introduction of digital technologies.
Section 7. Neurotechnologies and artificial intelligence	Topic 7.1. Methods for assessing digital transformation.
Section 8. Experience of foreign countries in the development of the digital economy	Topic 8.1. Digital Transformation Assessment Indices.

Course title	Geoinformation Systems and Applications
Course Workload, credits / academic hours	3/108
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Introduction to remote sensing and HS. Types of remote sensing and HS and areas of application	Topic 1.1. Definition and review of the history of remote sensing and the evolution of remote sensing and remote sensing systems.
	Topic 1.2. Electromagnetic radiation: terms, definitions, physical laws, spectrum, sources of electromagnetic radiation.
Section 2. Physical foundations of remote sensing and HS. Sensors & Platforms	Topic 2.1. Active and passive systems, mapping and other systems.
	Topic 2.2. The concept of resolution in remote sensing: spatial, spectral, radiometric and temporal. Earth observation orbits and platforms.
Section 3. Acquisition and preprocessing of remote sensing and HS data. Methods for interpreting remote sensing and HS data	Topic 3.1. Obtaining, processing and creating information products. Stages of remote sensing and data analysis.
	Topic 3.2. Decryption. Deciphering signs. Digital Image Processing.

Course title	Strategic controlling at innovative enterprise
Course Workload, credits / academic hours	6/216
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. The essence, tasks and functions of controlling. History of controlling. Basic interpretations.	Topic 1.1. The role of controlling in the enterprise management system. The history of the emergence and development of controlling in business structures
	Topic 1.2. American and German controlling models. Tasks and tools of controlling. Catalogue of controlling tasks
	Topic 1.3. Systematization of definitions of the term “controlling”. Interpretation of controlling as a “management system”
	Topic 1.4. Organization of the formation of strategic management.
Section 2. Differences between operational and strategic controlling	Topic 2.1. Strategic and operational controlling in the management system. The essence of strategic effectiveness. Strategic management tools.
	Topic 2.2. Controlling the external environment. Objects of controlling in the enterprise

	Topic 2.3. Classification of objects of controlling. Creation of a controlling system at the enterprise.
Section 3. The main tasks and functions of strategic controlling.	Topic 3.1. Tasks of strategic controlling.
	Topic 3.2. Identification of critical external and internal strategic positions. Control of the main indicators in accordance with strategic goals. Participation in setting strategic goals. Participation in the development of strategies. Analysis of strategic effectiveness. Strategic reflection. Controlling functions.
	Topic 3.3. Collection and processing of information on different "tiers" of the control system. Formation of a system of strategic and operational planning; Coordination of management activities to achieve the set goals; Ensuring the rationality of the management process; Study of trends in the development of an enterprise in a market economy.
Section 4. Fundamental Principles of Justification of Management Decisions in Innovation Controlling	Topic 4.1. The concept of costs for the entire life cycle of the product.
	Topic 4.2. Target costing and continuous.
	Topic 4.3. Cost improvement. Establishment of samples. Improvement of business processes. Process controlling. Business Process Management: Description Replaced by Controlling.
	Topic 4.4. The idea of controlling a business process through information systems.
Section 5. Basic concepts of justification of management decisions in strategic controlling.	Topic 5.1. Balanced Scorecard of the Balanced Scorecard.
	Topic 5.2. A modern concept of strategic analysis. A Strategic Approach to Cost Behavior Analysis.
	Topic 5.3. Strategic positioning. The concept of the value chainи.
Section 6. Strategic Controlling Tools	Topic 6.1. Portfolio analysis. BCG Matrix, Porter 5C. Potential analysis. Growth curve.
	Topic 6.2. SWOT analysis. Strategic gaps (GAP analysis). Balanced Scorecard. Balanced Scorecard (BSS) Scenario development, etc.
Section 7. Goal-setting and planning. Strategic planning in the enterprise.	Topic 7.1. Fundamentals of planned activities at the enterprise. Target picture and targets.
	Topic 7.2. Profit target indicators. Budgeting.
Section 8. Fundamentals of integrated cross-functional enterprise management	Topic 8.1. Management process and structure of the enterprise, cost controllability.

Course title	Economy of Hi-tech Production Branches
Course Workload, credits / academic hours	5/180
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Introduction to the discipline "Economics of high-tech industries"	Topic 1.1. The term "high-tech", modern approaches to its understanding
	Topic 1.2. Classification of knowledge-intensive industries.
	Topic 1.3. Innovation process as an object of control. Innovation process: concept, structure, content of work in high-tech industries
Section 2. Innovations as the content of a science-intensive industry and a factor in economic growth	Topic 2.1. Preliminary analysis of innovations and preparation of a pricing business plan. Macroeconomic prerequisites for innovation.
	Topic 2.2. Product selection and competitive strategy. Evaluation of sales markets. Assessment of competitors. Product life cycle.
	Topic 2.3. Analysis of trends in the development of science-intensive industries. Place of the enterprise in the science-intensive industry.
Section 3. The structure of the high-tech sector of the Russian economy	Topic 3.1. Features of market relations of high-tech firms.
	Topic 3.2. Supply, demand and price patterns.
Section 4. Macroeconomic	Topic 4.1. Factors influencing the development strategy of high-tech

factors and trends influencing the development strategy of high-tech enterprises	enterprises.
	Topic 4.2. Possibilities of economic science and successful management practices of high-tech enterprises.
Section 5. System of dynamic optimization of economic and technological development of a high-tech enterprise	Topic 5.1. The concept and patterns of development of the economic and technological complex of firms.
	Topic 5.2. The origin of firms and their development. High-tech production personnel.

Course title	Marketing of innovative products
Course Workload, credits / academic hours	3/108
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Strategic Management Process and Marketing of Innovative Products	Topic 1.1. Strategic management and marketing; Management of marketing; Study of the product in the marketing activities of the organization; Analysis of the effectiveness of marketing activities.
	Topic 1.2. Building a strategic pyramid; Marketing strategies of competition; Analysis of the general situation in the industry and competition in it.
Section 2. Marketing strategies in the overall strategy of the company. Types of marketing strategies	Topic 2.1. Methods of collecting marketing information; Evaluation of the effectiveness of the current strategy; Strengths and weaknesses of the organization. Market opportunities and threats; Competitiveness of prices and costs of the organization; Assessment of the company's competitive position.
	Topic 2.2. Assessment of strategic problems; General characteristics and basic concepts of foreign economic activity; Organization of international cooperation in innovative industries; General characteristics and features of the market of space products and services.
Section 3. Marketing research in the field of innovative industries	Topic 3.1. Analysis of the general situation in the industry and competition in it; Marketing research in the field of innovative industries.
	Topic 3.2. Analysis of the state of the company. Fundamentals of foreign economic activity in innovative industries.

Course title	Management of Supply Chains at Innovative Enterprise
Course Workload, credits / academic hours	6/216
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Management of material flows on the basis of logistics costs breakdown accounting	Topic 1.1. Volume of total material flow. Cost of materials handling work at the warehouse of a wholesale distributor.
	Topic 1.2. Factors, influencing a total material flow at the warehouse, methods of accounting
Section 2. An order of products acceptance according to quality and quantity	Topic 2.1. An analysis of standards, being subject to an order of products acceptance. Substantiation of an order of products acceptance by shipping companies. Substantiation of products acceptance terms.
Section 3. Calculation of parameters of resources management systems. Management of resources by ABC-analysis	Topic 3.1. Calculation method of resources management systems parameters. Analysis of an aim and tasks of ABC - analysis.
	Topic 3.2. Qualitative and quantitative criteria of differentiation in ABC - analysis.
Section 4. Assessment and choice of supplier	Topic 4.1. Rating of suppliers by quality, prices and reliability of deliveries
Section 5. Ways of shipping. An optimal term of carrier vehicle replacement	Topic 5.1. Analysis of inner and outer factors, influencing ways of shipping and an optimal term of a carrier vehicle replacement for various business cases.

Course title	Run-time Controlling at Innovative Enterprise
Course Workload, credits / academic hours	5/180
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Controlling function of management. How to setup a controlling department. Financial controlling.	Topic 1.1. Essence, tasks and functions of operational controlling.
	Topic 1.2. How to setup a controlling department.
	Topic 1.3. Controlling objects. Financial controlling.
	Topic 1.4. Fundamentals of finance in controlling. Management accounting system.
Section 2. Applied controlling. Information support. Planning and budgeting. Internal control system.	Topic 2.1. Marketing Controlling. Controlling innovation projects.
	Topic 2.2. Information support of controlling. Planning and budgeting in the controlling system.
	Topic 2.3. Internal control system. Internal control and audit.

Course title	Ecological Management at Innovative Enterprise
Course Workload, credits / academic hours	3/108
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Economic development and environmental factors. Sustainable development. From technogenic to sustainable development.	Topic 1.1. Stages of the Club of Rome. Goals and objectives of the Stockholm Conference and the Conference in Rio de Janeiro
	Topic 1.2. The principles of sustainable development. Nat. sustainable development programs
Section 2. Use and protection of renewable natural resources	Topic 2.1. Use, protection and renewal of water, air resources, soil and biota
Section 3. Use and protection of non-renewable natural resources	Topic 3.1. Use, renewal and protection of subsoil
Section 4. Key environmental management tools	Topic 4.1. Environmental audit, environmental insurance, environmental labeling
Section 5. Greening sectors of the economy	Topic 5.1. The economic mechanism of the eco-economization of the economy. The state and the market in environmental protection.
	Topic 5.2. Greening the economy and overcoming environmental crises. The effectiveness of environmental protection measures.

Course title	Innovative technologies of ecological management in industries
Course Workload, credits / academic hours	3/108
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Economic development and environmental factors. Sustainable development. From technogenic to sustainable development.	Topic 1.1. Stages of the Club of Rome. Goals and objectives of the Stockholm Conference and the Conference in Rio de Janeiro.
	Topic 1.2. The principles of sustainable development. Nat. sustainable development programs.
Section 2. Use and protection of renewable natural resources	Topic 2.1. Use, protection and renewal of water, air resources, soil and biota
Section 3. Use and protection of non-renewable natural resources	Topic 3.1. Use, renewal and protection of subsoil.
Section 4. Key environmental management tools	Topic 4.1. Environmental audit, environmental insurance, environmental labeling.
Section 5. Greening sectors of the economy	Topic 5.1. The economic mechanism of the eco-economization of the economy. The state and the market in environmental protection.
	Topic 5.2. Greening the economy and overcoming environmental crises. The effectiveness of environmental protection measures.

Course title	Assessment of innovative-investment projects effectiveness
Course Workload, credits / academic hours	3/108
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Theoretical foundations for evaluating the effectiveness of innovative projects	Topic 1.1. Innovation project. The concept of an innovative project. Life cycle of innovative projects. Types of efficiency of innovative projects.
	Topic 1.2. Preliminary analysis of innovations and preparation of a business plan. Product selection and competitive strategy. Evaluation of sales markets. Evaluation of competitors.
Section 2. Methodological bases for making investment decisions	Topic 2.1 Investment evaluation methodology. Financial viability of the recipient enterprise and investment attractiveness of the project.
	Topic 2.2. Criteria for making investment decisions. Principles for evaluating the effectiveness of investments. Assessment of the financial viability of an innovative project. Rules for the financial and economic evaluation of innovative projects.
	Topic 2.3. Preparation of a cash flow forecast for operating, production and financial activities, a profit and loss statement, a forecast balance sheet. Commercial efficiency of projects, budgetary efficiency of projects.
Section 3. Methods of financing innovative projects	Topic 3.1. Financing of innovative projects. Investment resources. Characteristics of the sources of financing of innovative projects: own and borrowed funds, external and internal in relation to the project. Leasing, factoring, credit, venture financing.
	Topic 3.2. Determining the cost of investment resources: the cost of individual elements of the firm's capital. Marginal price of capital.
	Topic 3.3. Choice of innovative projects in case of short-term deficit of funds, in case of long-term deficit of funds.
Section 4. Analysis and expertise of an innovative project	Topic 4.1. Analysis and expertise of an innovative project.
	Topic 4.2. Sources of information for the analysis of an innovative project. Stages of analysis, reasons and content of the analysis.
Section 5. Innovation Project Evaluation Software	Topic 5.1. Software for the process of making innovative decisions. Overview of the market for software products for calculating business plans for innovative projects.
	Topic 5.2. Automation of business planning processes. Software products of the company "Proinvestkolsanting" (Project Expert 7).

Course title	International sci-tech cooperation
Course Workload, credits / academic hours	3/108
COURSE CONTENTS	
Course Module Title	**Brief Description of the Module Content**
Section 1. Current state and trends in the development of Russian science	Topic 1.1. A brief overview of the main indicators of the development of Russian science; Cross-country comparisons.
	Topic 1.2. The main modern problems of Russian science, the solution of which can be facilitated by the active development of ISTS.
Section 2. The role and place of the ISTC in the system of state scientific and technical policy of Russia	Topic 2.1. Ensuring Russian interests in the implementation of the ISTC. The main goals and objectives of the ISTC of the Russian Federation.
	Topic 2.2. Cooperation in the field of basic research, including participation in multilateral scientific and technical projects and programs.
Section 3. The main goals and objectives of the ISTC of the Russian Federation	Topic 3.1. Cooperation in the field of applied research and commercialization of the results of intellectual activity;
	Topic 3.2. International exchanges of scientific information, scientists, graduate students and doctoral students.
Section 4. Priority areas of participation of the Russian	Topic 4.1. Attracting foreign investment in science and technology; Participation in the work of international organizations;

Federation in the ISTC	Topic 4.2. Cooperation in the field of solving global problems; The role of the Russian scientific diaspora in the development of the ISTS of Russia.
Section 5. Promotion and dissemination of the results of the ISTC in Russia	Topic 5.1. Promotion and dissemination of the results of the ISTC in Russia. The main risks and ensuring the scientific and technical safety of Russia in the implementation of the ISTC.
	Topic 5.2. Measures to promote Russian interests within the framework of the ISTC.

HEAD OF HIGHER EDUCATION PROGRAMME:

Associate professor, Innovation management in industries chair	**E.A. Kovaleva**
position, department	name and surname