Federal State Autonomous Educational Institution of Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
NAMED AFTER PATRICE LUMUMBA
Agrarian and Technological Institute
educational division - faculty/institute/academy

COURSE DESCRIPTION

35.04.09 "Landscape Architecture"
Management and design of urban green infrastructure
field of studies / speciality code and title

Course Title	Advances in environmental monitoring
Course Workload	6 ECTS (216 hours)
Course contents	
Course Module Title	**Brief Description of the Module Content**
Principles of environmental monitoring and assessment	Aims, methods and objects of environmental monitoring. Spatial and temporal variability of environmental parameters. Environmental monitoring systems and networks. Sources of monitoring data
Climate and air quality monitoring	Urban climate and air quality. Monitoring air pollution. Air quality index. Microbiota of urban air. Pathogenic microorganisms in urban air. Particle matters (PM 2.5 and PM 10) – sources, chemical and microbial properties
Monitoring soil quality and soil health	Soil properties, functions and ecosystem services. Soil quality assessment. Assessing soil pollution by heavy metals (potential toxic elements). Soil health. Microbial activity, diversity and functions in urban soils. Assessing pathogenic microorganisms in soils. Interactions between air quality and soil quality.
Monitoring water quality	Monitoring quality of surface, ground and drinking water. Sampling, preparation and in situ assessment of water quality. Measuring water quality parameters in laboratory. Interpretation of water quality.
Monitoring urban green infrastructure	Urban green infrastructures: typology, properties, functions and ecosystem services. Visual tree assessment (VTA). Russian and Italian approaches for VTA. Vegetation indices. Assessing tree health by remote sensing. Internet of things (IoT) technologies for monitoring urban green infrastructures.
Monitoring noise and soundscape	Soundscape: definitions, parameters, approaches to measure. Noise and noise pollution. Sources of noise pollution. Proximal sensing of biodiversity based on acoustic sensors. Interpretation of the data.

Citizen science	Principles of citizen science. Advantages and constrains of citizen science. Citizen science networks for monitoring urban climate. Sensor.community – citizen science approach to monitor air quality. Tea bags – a citizen science approach to monitor soil health.

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Federal State Autonomous Educational Institution of Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
RUDN University
Agrarian and Technological Institute

educational division - faculty/institute/academy

COURSE DESCRIPTION

35.04.09 "Landscape Architecture"
Management and design of urban green infrastructure

field of studies / speciality code and title

Course Title	Data analysis and statistics
Course Workload	8 ECTS (288 hours)
Course contents	
Course Module Title	**Brief Description of the Module Content**
Data organization, description and visualization	Introduction to the DAS in ecology and landscape studies. Introduction to the R – program for data analysis. Types of data in R. Types of variables and approaches to data visualization. Approaches to visualization of numeric and character variables in R. Descriptive statistics. The practice of applying functions to calculate descriptive statistics: measures of central tendency and data variation.
Statistical tests	Probability and statistical hypothesis. Hypothesis testing. The practical review of the basic probability distributions in R. Data distributions, z-score. Normal distribution. Data transformation. Tests for checking the normal distribution. Confidence intervals: calculation and visualization in R. One-sample and two-sample T-test. Approaches to the comparing means of two independent and dependent samples in R. Comparing of several samples (ANOVA). One-way ANOVA in R. Correlation and regression analysis. Correlation and regression. Final work project (theory and practice).

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COURSE DESCRIPTION

35.04.09 “Landscape Architecture”
Management and design of urban green infrastructure

field of studies / speciality code and title

Course Title	Foreign language (Russian language)
Course Workload	6 ECTS (216 hours)
Course contents	
Course Module Title	**Brief Description of the Module Content**
Landscape design in urban environment	Specifics of landscape design in urban environment and ecological sustainability. Technical literature on the topic.
Pre-project analysis	Pre-project analysis: environmental and anthropogenic factors.
Functional zones in urban areas	Functional zoning plan. Planning roads and paths network. Technical literature on the topic.
Architectural forms in urban landscape planning	Planning of small architectural forms and water bodies.
Composition	Composition plan. Planning viewpoints. Technical literature on the topic
Ornamental plants for urban landscaping I (trees and shrubs)	Selecting trees and shrubs for urban landscaping. Plantation plan.
Ornamental plants for urban landscaping II (green infrastructure)	Implementing green infrastructure in urban landscaping. Dendroplan.
Financial planning	Estimating landscape projects. Making an estimate. Technical literature on the topic.

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COURSE DESCRIPTION

35.04.09 "Landscape Architecture"
Management and design of urban green infrastructure

field of studies / speciality code and title

Course Title	Green infrastructure urban, climate and carbon neutrality
Course Workload	6 ECTS (216 hours)
Course contents	
Course Module Title	**Brief Description of the Module Content**
Global climate change and carbon neutrality	Global climate change. Climate scenarios. Intergovernmental Panel on Climate Change (IPCC). Carbon neutrality. International policies and strategies on climate mitigation.
Urban climate	Introduction to urban climatology and meteorology. Meteorological parameters. Air temperature and humidity, surface temperature and moisture. Macro-, meso- and microclimate. Mesoclimatic anomalies. Urban heat island and urban drought islands effects. Wind speed and direction. Seasonal dynamics in wind events. Climate comfort. Indices of climate comfort. Modeling urban climate at different scales.
Carbon balance in urban ecosystems	Carbon balance in terrestrial ecosystems. Carbon stocks and carbon fluxes. Net ecosystem exchange. Gross primary production and net primary production. Soil and ecosystem respiration. Greenhouse gases emission. Methods to monitor and quantify carbon stocks and fluxes. Eddy covariance. Portable gas analyzer and chamber method. Seasonal dynamics and spatial variability in carbon stocks and fluxes. Modeling carbon balance in natural and urban ecosystems.
Urban green infrastructure in climate mitigation and adaptation	Climate mitigation and adaptation policies and strategies. C40 – consortium of climate-responsible cities. Urban green infrastructures for climate-resilient cities. Modeling and quantifying carbon sequestration by urban green infrastructures. The role of urban soils in carbon balance of urban ecosystems

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COURSE DESCRIPTION

35.04.09 "Landscape Architecture"
Management and design of urban green infrastructure

field of studies / speciality code and title

Course Title	International regulation in city-planning and environmental protection
Course Workload	6 ECTS (216 hours)
Course contents	
Course Module Title	**Brief Description of the Module Content**
Introduction to the course. Basic terms: city-planning, urbanizations, urban ecosystems, environmental protection History and actuality of the problem	City-planning and environmental protection as global and national trends. Connections of environmental issues with other areas in the development of cities Modern and ancient cities. Urbanization as a processes of city expansion and urban development Nature urbanization as transformation of natural landscapes into urban infrastructure Functional and formal approaches to define the term «city»
Participation of international organizations in city-planning and environmental protection. International legal framework	Main conventions, protocols, documents, agreements. International organizations in city-planning and environmental protection: possible projects to increase the value of international organizations.
Structure of regulation of city-planning (national, regional, municipal) in Russia	Current realities and trends in the development of socio-economic processes of urbanization; Opportunities, resources and limitations of urban development proper as a form of technical support for urbanization processes; Problems and perspectives of housing and communal services and the construction complex, directly related to urban development in the processes of horizontal technological cooperation.
City-planning in EU: goals, problems and principles of policy	Urban development; Urban dimension of cohesion policy; What is integrated sustainable urban development; Objectives for 2014-2020;

	The Urban Agenda for the EU; Regional Policy
Environmental protection in EU: goals, problems and principles of policy	Environmental law; Green policy: Safeguarding the health and wellbeing of people living in the EU; Global challenges;
International cooperation of Russia and EU in city-planning and environmental protection	Forms of international cooperation in the field of city-planning and environmental protection are: - international organizations for the protection of nature; - international treaties, agreements, conventions; - State initiatives on international cooperation.
Global risks in city-planning and environmental protection.	Disaster risk reduction. Possible ways to avoid the risks.

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COURSE DESCRIPTION

35.03.09 Landscape architecture
Management and design of urban green infrastructure

field of studies / speciality code and title

Course Title	Introduction in scientific research
Course Workload	6 ECTS (216 hours)
Course contents	
Course Module Title	**Brief Description of the Module Content**
1. Development of the scientific picture of the world	1.1. Stages of science development 1.2. Evolutionary and revolutionary models of science development
2. Methodology of scientific research	2.1 Scientific observation 2.2 Experiment 2.3 Models and modeling
3. Introduction into descriptive statistics	3.1 Measuring scales: ordinal, integral and ratio scales, continuous and discrete variables 3.2 Sample. Representativeness of sample 3.3 Mean, range, variance, coefficient of variance, stand deviation
4. Data analysis and prediction	4.1 Confident interval. P-level 4.2 T statistics and t-test 4.3 Correlation (Pearson and Spearmen correlation coefficients) 4.4 Regression (multiple, linear/ non-linear regression)
5. Scientific writing: thesis, publication, monograph	5.1 Conference thesis 5.2 Scientific paper 5.3 Master and PhD thesis
6. Visualization of research results – from tables towards GIS	6.1 Approaches to visualize scientific results 6.2 Tables: structural elements and design rules 6.3 Graphical visualization of research results
7. Business in science	7.1 International scientific community 7.2 Commercialization of scientific results. Sources of research funding 7.3 National and international grants and programs. Scientific foundations

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COURSE DESCRIPTION

35.04.09 "Landscape Architecture"
Management and design of urban green infrastructure

field of studies / speciality code and title

Course Title	Landscape engineering and nature-based solution
Course Workload	6 ECTS (216 hours)
Course contents	
Course Module Title	**Brief Description of the Module Content**
Natural landscape topography and artificial landforms	Natural Landscape topography – the base for landscape engineering and sustainable urban development (basic principles). Artificial landforms and their sustainability. Geohazards: assessment, prevention and mitigation practices (grey and green-blue solutions (NBS))
Surface runoff in urban and natural/semi-natural environment	Surface runoff in urban and natural/semi-natural environment: surface runoff management; erosion risk assessment and pollutions
General principles of Nature - based Solution	Sustainable development of the city's green framework: general principles and approaches. The landscape-ecological approach in urban planning - the scale of the city. The landscape-ecological approach in urban planning - the scale of the neighbourhood.
The integration of NBS into the city's urban planning	Nature-based solutions in urban landscaping. Urban water and green infrastructure: elements and design methods. Flood risk assessments and surface runoff minimisation. Green roofs as an element of water and green infrastructure.

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COURSE DESCRIPTION

35.04.09 «Landscape architecture»
Management and design of urban green infrastructure

field of studies / speciality code and title

Course Title	Landscape planning and sustainable development
Course Workload	12 ECTS (432 hours)
Course contents	
Course Module Title	**Brief Description of the Module Content**
Module 1. What to plan	Landscape as a socio-ecological system, it's components, structure, functioning, evolution, man and nature interactions, land use change, cultural landscapes.
Module 2. How to plan	Nature resource management, ecosystem services approach, mapping, modelling, assessing and valuation of ecosystem services and functions, science-policy interface.
Module 2. With and for whom to plan	Urban social studies, socio-economical analysis, participatory planning, stakeholder engagement, cultural ecosystem services.

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COURSE DESCRIPTION

35.04.09 "Landscape Architecture"
Management and design of urban green infrastructure

field of studies / speciality code and title

Course Title	**Phytopathology and Plant Protection**
Course Workload	6 ECTS (216 hours)
Course contents	
Course Module Title	**Brief Description of the Module Content**
Symptoms of plant diseases	Main symptoms on different plant groups. Possible losses from diseases/ Direct and non-direct losses
Infectious and noninfectious plant diseases	Noninfectious diseases. Environment conditions/ causing plant diseases
Mean groups of pathogens	Viruses, viroids, bacteria, fungi. Pathogenesis in different plants
Viral diseases	Symptoms, contamination, possible losses, identification
Bacterial diseases	Symptoms, contamination, possible losses, identification
Fungal diseases	Symptoms, contamination, possible losses, identification
Seeds and planting stock contamination	Identification. Possible losses
Main groups of pests	Symptoms of contamination. Possible losses
Methods of plant protection. Host plant resistance.	Cultural, physical, chemical, biological means of plant diseases, pests and weed control. Quarantine for pathogens management
Cultural control	Preparation of plant material, plant residues, fertilization, plant density
Physical method of plant protection	Cooling and freezing. Drying and desicants. Modified atmospheres
Chemical control	Main groups of chemicals. Application forms. Pests, diseases and weed chemical control
Biological control	Biological agents for diseases, pests and weed control
Plant quarantine	Main groups of quarantine pests, diseases and weeds. What is quarantine
Integrated pest management	Combination of strategies and tactics. Different means of plant protection, combined with each other. Environment pollution

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COURSE DESCRIPTION

35.04.09 “Landscape Architecture”
Management and design of urban green infrastructure

field of studies / speciality code and title

Course Title	Principles of remote sensing and modeling
Course Workload	6 ECTS (216 hours)
Course contents	
Course Module Title	**Brief Description of the Module Content**
GIS and spatial databases	— GIS fundamentals: main definitions. History of GIS; — Vector and raster data formats; — Introduction to spatial databases; — PostgreSQL/PostGIS; — Fields of GIS and remote sensing data application; — Basics of geostatistics; — Combined methods of spatial interpolation. Regression kriging; — Automatisation of GIS processes. Python spatial libraries.
Remote sensing	— Introduction to remote sensing; — Spectral signatures and spectral indexes; — Remote sensing data classification; — Atmospheric correction of raw satellite data; — Remote sensing at thermal infrared range; — Digital Terrain Models; — UAV data / stereophotogrammetry; — Soil sealing.

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COURSE DESCRIPTION

35.03.09 Landscape architecture
Management and design of urban green infrastructure

field of studies / speciality code and title

Course Title	Research planning
Course Workload	6 ECTS (216 hours)
Course contents	
Course Module Title	**Brief Description of the Module Content**
Communicating Science	— The ABC of science communication — Scientific versus popular science writing
Sections of a Scientific Paper	— Major headings — Tables and Figures
Other Types of Scientific Writing	— Literature review — Conference paper and abstract
Research proposal322222	— Getting Started in Writing — Making an outline facilitates writing — Use a computer for your writing
Improving Your Writing	— How to make your writing easier to read — Do I or don't I? — Writing correctly
Writing mathematics	— Writing numbers, dates and time — Literature Searching and Referencing — Search strategies
Manual searching	— Recording your search — Referencing published work — Referencing web addresses — Copyright
Getting a Paper into Print	— Preparing your manuscript for submission — Authorship and addresses — Submission
Editor’s and referees' reports	— Author proofs — Oral Presentation and Visual Displays — Planning the oral presentation

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COURSE DESCRIPTION

35.03.09 Landscape architecture
Management and design of urban green infrastructure

field of studies / speciality code and title

Course Title	Scientific research
Course Workload	6 ECTS (216 hours)
Course contents	
Course Module Title	**Brief Description of the Module Content**
Communicating Science	— The ABC of science communication — Scientific versus popular science writing
Sections of a Scientific Paper	— Major headings — Tables and Figures
Other Types of Scientific Writing	— Literature review — Conference paper and abstract
Research proposal	— Getting Started in Writing — Making an outline facilitates writing — Use a computer for your writing
Improving Your Writing	— How to make your writing easier to read — Do I or don't I? — Writing correctly
Writing mathematics	— Writing numbers, dates and time — Literature Searching and Referencing — Search strategies
Manual searching	— Recording your search — Referencing published work — Referencing web addresses — Copyright
Getting a Paper into Print	— Preparing your manuscript for submission — Authorship and addresses — Submission
Editor’s and referees' reports	— Author proofs — Oral Presentation and Visual Displays — Planning the oral presentation

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COURSE DESCRIPTION

35.03.09 Landscape architecture
Management and design of urban green infrastructure
field of studies / speciality code and title

Course Title	Scientific writing skills
Course Workload	6 ECTS (216 hours)
Course contents	
Course Module Title	**Brief Description of the Module Content**
The development of the scientific picture of the world. Introduction to the history and philosophy of science.	– Stages in the development of science; – Evolutionary and revolutionary models of scientific development.
Scientific research methodology: observation, experiment, model.	– Observation (monitoring); – Experiment; – Models and modelling.
Primary data processing. Introduction to descriptive statistics.	– Measurement scales: ordinal, integral and relative scales; – Ordinal, quantitative and qualitative features – Continuous and discrete variables; – The mean distribution. Features of the mean. – Sample. Representativeness of a sample; – Mean, range, dispersion, coefficient of variance, standard deviation.
Data analysis and forecasting. Introduction to regression analysis and analysis of variance.	– Confidence interval. P-level; – The null hypothesis, the alternative hypothesis, and stepwise solutions; – Confidence Interval Estimation; – Critical values for the t-distribution; – Correlation (Pearson and Spearman correlation coefficients); – Regression (multiple, linear/non-linear regression) - Non-parametric tests.
Academic writing: dissertation, publication, monograph.	– Executive Summary; – Conference abstracts; – Scientific article; – Monograph chapter; – Master's and PhD theses.

Visualisation of research results - from tables to GIS.	– Approaches to the visualisation of scientific results; – Tables: structural elements and design rules. Data to be presented in tables; – Methods for creating and editing tables in Microsoft Word, Excel; – Graphic visualization of research results; – Graphs. Structural units of graphs; – Choice between graph and table for presenting scientific data; – The most typical graphs in scientific work: box with tendrils; correlation graph, regression graph, ANOVA graphs; – Techniques for constructing and editing graphs in Microsoft Excel; – Developing maps in QGIS.
Business in science. International scientific cooperation.	– The international scientific community; – Organisation of teaching and research processes; – Scientific societies: regional, national, sectoral, international. Membership in scientific societies; – Commercialisation of scientific results. Sources of research funding.

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COURSE DESCRIPTION

35.04.09 “Landscape Architecture”
Management and design of urban green infrastructure

field of studies / speciality code and title

Course Title	Urban ecology
Course Workload	6 ECTS (216 hours)
Course contents	
Course Module Title	**Brief Description of the Module Content**
Properties and processes of urban ecosystems' components	Introduction in urban ecology. Urbanization: problems and decisions. Review of functional zoning of the cities: advantages and disadvantages. Urban green infrastructure. Benefits of urban vegetation. Approaches to evaluation of urban trees state. Urban soils: variety, properties and functioning. Assessment of pollution level in the urban soil-vegetation system (LAB1). Control and protection of the surface water quality. Data analysis and interpretation, presentations of the results (LAB 1). Urban geomorphology. Review and discussion of cases of natural-based solutions in urban environment. Urban atmosphere and air quality. Assessment of pollution level in the atmosphere (analysis of snow samples) (LAB 2).
Management practice in urban environment	Urban metabolism and waste management. Data analysis and interpretation, presentations of the results (LAB 2). Urban agriculture and food security. Urban farming mini-project. Exam and ecological assessment of the territory in urban environment (project).

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