

PROGRAM

Discipline title

Urban ecology

Recommended for the educational direction

35.04.09 Landscape architecture,

profile “Management and design of urban green infrastructure”

Section I. Main part.

1.1. Goals and objectives of the discipline:

purpose

Get theoretical and practical skills in the analysis of urban ecosystems

Tasks

- to master the basic concepts and principles of ecology of cities and settlements;
- to study environmental factors in an urbanized environment;
- to master the monitoring systems, such as tracking, forecasting and making operational decisions to improve the quality of the environment;
- to develop the skills of ecological monitoring of the state of the urban environment and monitoring of the state of green spaces in the city

1.2. Место дисциплины в структуре ОП ВО:

The discipline Urban Ecology belongs to the basic part of the general scientific cycle.

Table 1 shows the previous and subsequent disciplines aimed at the formation of discipline competencies in accordance with the competence matrix of EP HE.

Таблица № 1

Prior and subsequent disciplines aimed at the formation of competencies

№	Code and name of competence	Prior disciplines	Subsequent disciplines (groups of disciplines)
Common cultural competences			
E	CCC-1,2,3	Urboecology and Monitoring	Environmental Design in an Urbanized Environment
General professional competencies			
2.	GPC-1,10, 24	Urboecology and Monitoring	Environmental Design in an Urbanized Environment

3. Requirements to the results of the discipline mastering:

The process of studying the discipline is aimed at the formation of the following competencies:

Universal competences:

- Able to search, critical analysis problem situations based on a systematic approach, strategize (UC-1);
- Able to apply modern communication technologies in the state language of the Russian Federation and foreign language (s) for academic and professional interaction (UC-4).
- Able to analyze and take into account diversity cultures in the process of intercultural interaction (UC-5).
- Able to identify and implement priorities own activities and ways to improve it self-assessment (UC-6).

General professional competencies (GPC):

- Able to analyze modern problems of science and production, to solve complex (non-standard) tasks in professional activity; (GPC-1);
- Able to analyze modern problems of science and production, to solve complex (non-standard) tasks in professional activity; (GPC-2);
- Able to develop and implement new effective technologies in professional activities; (GPC-3);
- Capable of conducting scientific research, analyze the results and prepare reporting documentation; (GPC-4);
- Able to carry out technical and economic justification of projects in professional activities; (GPC-5);
- Able to manage teams and organize production processes. (GPC-6);

professional competencies (PC):

- readiness to acquire new knowledge and conduct applied research in the field of landscape architecture (PC-16):
- readiness to develop (based on existing standards) methodological and regulatory documents for the design of landscape architecture objects (PC-24):

As a result of studying the discipline, the student must:

Know:

- methods of planning and conducting research, collecting and interpreting the data obtained and presenting research results;
- problems and trends in the development of science and technology
- basic approaches of statistical modeling;
- basic approaches to spatial modeling;
- the main approaches to process modeling.

Be able to:

- it is logical to formulate, state and reasonably defend their own vision of the problems under consideration;
- plan and conduct research, systematize and interpret the data obtained and present the results of the research;

Own:

- methods of scientific knowledge;
- methods of discussion, polemics, dialogue;
- methods of mathematical modeling;
- methods of presenting research results.

1. 4. Discipline volume and types of educational activities

General labor-intensiveness of the discipline amounts to 6 ETCS.

Educational activity	Total hours	Semesters			
		1	2	3	1
Audience hours (in total)	120	60	60		
Including:				-	
Lectures	30	15	15		
Laboratory work (LW)					
Seminars (S)	90	45	45		
Audience hours (in total)					
Individual work (in total)	168	84	84		
Total labor-intensiveness	216	108	108		
hours	6				
ETCS					

1.5. Discipline content

1.5.1. Contents of discipline sections

№	Section name	Section content
1.	Introduction to the course «Urban ecology». Basic terms: city, urbanizations, urban ecosystems	Urban ecology – city ecology. 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»
2.	Geological environment of urban ecosystems	Lithosphere as a component of geosystems. General information on the Earth planet composition. Material construction of the lithosphere. Physical and chemical feature of the lithosphere. Elements and their clarke the earth's crust. Minerals and mineral groups. Magmatic, metamorphic and sedimental rocks. Lithospheric processes. Endogenous and exogenous processes. Volcanism and post-volcanic processes. Tectonics of the Lithospheric plates. Orogenesis. Relief. Spatial and orographic relief forms. Slope, glacial, colluvial and karst processes. Interrelationships between the lithosphere with the other geosystems components. Anthropogenic sediments. Classification of anthropogenic sediments. Genesis of anthropogenic sediments. Chemical and physical features of anthropogenic sediments. Cultural layer.
3.	Water component of urban ecosystems. Water-use types.	Hydrosphere as a geosystems component. History of hydrosphere on Earth. Material composition of hydrosphere. Physical and chemical feature of hydrosphere. Water bodies, ponds and streams. Interrelation between hydrosphere and other geosystems components. Hydrosphere and migration of substances. Hydrosphere and climate. Water consumption. Water use and its categories.
4.	Atmosphere of urban ecosystems. Composition. Influence on the atmosphere	Pollution of the atmosphere. Classification of the principal atmosphere pollutants. Maximal allowance concentrations of pollutants in the atmosphere. Sources of atmospheric pollution. Classification of the industries considering risks of the atmospheric pollution. Consequences of the atmospheric pollution. Dispersion of the toxic substances in the atmosphere. Limitation of the atmospheric emissions. Monitoring of the air quality. Goals and aims of air quality monitoring. System of the air quality monitoring in Russia. Weather forecasting and meteorological

		monitoring. Prediction and modeling of air pollution and air quality dynamic.
5.	Urban climate.	Management of the air quality. Standardization of the influences on the atmosphere. Maximal permitted emissions. Sanitary-hygienic zones. Integral indicator of the air pollutions. Separate standardization of the contaminants in the atmospheric air. Heat pollution of the atmosphere. Anthropogenic change of the radiation balance. Green house gases and global warming. Heat island effect. Framework convention of the climate change. Intergovernmental panel on climate change (IPCC). Kioto protocol and post-kioto agreements. Russian Federation and Kioto protocol
6.	Urban vegetation. Functions of urban greenery.	Ecological and technogenic factors of plant growth in urban environment. Climatic factor: heat island effect, extension of the vegetation period, shifting of the plant borders, decrease in frost-resistance, prolongation of the daylight period. Atmospheric pollution: chlorosis, drying. Edaphic factor: over-compaction, cluttering up, salinization, soil sealing. Forest degradation within urban areas. Edge erosion. Composition of urban vegetation: local, introduced and added species. Specifics of urban vegetation: domination of deciduous plants, decrease in biodiversity. Cultural and ruderal grasses. Urban lawns. Urban green space's functions. Sanitary-hygienic functions. Dust-capturing function. Gas-fixating function. Intensification of air circulation. Noise-isolating function. Ionization of the environment. Ornamental and aesthetic functions. Urban greenery rules, regulations and standards.
7.	Urban soils	Anthropogenic influence on soil. Over-compaction. Soil profile disturbance. Soil degradation. Soil pollution. Soil erosion. The key contaminants of soils. Maximal allowed concentrations and preliminary allowed concentrations of substances in soil.

		Anthropogenic soils. Specifics of soil formation, peculiarities of soil physical, chemical and biological features of anthropogenic soils. Classification of anthropogenic soils. Standardizing of soil quality. Methods for quantification of ecological damage. Reclaiming and remediation of contaminated soils. Remediation activities for various contamination types. Bioremediation. Ecological certification of soils and lands. Economic, ecological and functional-ecological assessment of soil quality
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1.5.2. Разделы дисциплин и виды занятий

№	Name of the discipline section	Lect.	Pract	Lab	Sem.	Ind. work	Tot.
1.	Introduction to the course «Urban ecology». Basic terms: city, urbanizations, urban ecosystems	2			6	18	26
2.	Geological environment of urban ecosystems	4			12	22	38
3.	Water component of urban ecosystems. Water-use types.	4			12	22	38
4.	Atmosphere of urban ecosystems. Composition. Influence on the atmosphere	4			12	22	38
5.	Urban climate.	4			12	22	38
6.	Urban vegetation. Functions of urban greenery.	4			12	22	38
7.	Urban soils	8			24	20	52

1.6. Practical lessons (seminars) (if any)

№	Name of the discipline section	Name of the laboratory work	Hours
1.	Introduction to the course «Urban ecology». Basic terms:	<ul style="list-style-type: none"> – Urbanization as a current land-use change trend – Urban ecosystems, their components 	6

	city, urbanizations, urban ecosystems	and functions	
2.	Geological environment of urban ecosystems	<ul style="list-style-type: none"> – Anthropogenic sediments – Cultural layers – Geoecological risks – Waste production and management 	12
3.	Water component of urban ecosystems. Water-use types.	<ul style="list-style-type: none"> – Water bodies in urban environment – Functions of urban water bodies – Water quality – Anthropogenic influence on water quality – Estimation of total run-off from contaminated surface 	12
4.	Atmosphere of urban ecosystems. Composition. Influence on the atmosphere	<ul style="list-style-type: none"> – Atmosphere: components, composition, features and functions – Specifics of urban atmosphere – Air quality standards – Quantification of pollutant's emission from the car parking to the atmosphere 	12
5.	Urban climate.	<ul style="list-style-type: none"> – Weather and climate: feature, parameters, monitoring methods – Anthropogenic influence on climate – Heat island effect – Urban canyon effect 	12
6.	Urban vegetation. Functions of urban greenery.	<ul style="list-style-type: none"> – Urban vegetation- main features and species – Functions of urban vegetation – Anthropogenic influence on urban vegetation – Urban green lawns – Establishing green zone in urban environment 	12
7.	Urban soils	<ul style="list-style-type: none"> – Soil as a complex biotic-abiotic substance – Soil forming factors 	24

		<ul style="list-style-type: none"> – Specific features of urban soils' formation – Classification and diagnostics of urban soils – Quantification of urban soils' properties 	
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1.7. Educational and methodological support of the discipline:

a) main literature:

a) main literature:

- 1) Kurbatova A.S., Bashkin V.N., Kasimov N.S. «Ecology of a city». – M.: 2004 – 624 p (in Russian).
- 2) Denisov V.V., Kurbatova A.S., Denisova I.A., Bondarenko V.L., Gracheva V.A., Gutenev V.V., Nagnibeda B.A. «Ecology of a city». M.: Rostov on Don: 2008-832 p.(in Russia).
- 3) Alberti M. Advances in Urban Ecology: Integrating Humans and Ecological Processes in Urban Ecosystems Springer; 2008 366 p.
- 4) R.T.T. Forman. Urban Ecology: Science of Cities Cambridge University Press 2014. 474 p.
- 5) J. Niemela, J. H. Breuste, G. Guntenspergen. Urban Ecology: Patterns, Processes, and Applications. Oxford University Press; Reprint edition. 2012. 392 p.

b) additional literature:

- 1). Bandaranayake W., Qian Y. L., Parton W. J., Ojima D. S. and Follett R. F., 2003. Estimation of Soil Organic Carbon Changes in Turfgrass Systems Using the CENTURY Model. Agron. J. 95, 558–563.
- 2). Dolgikh, A.V., Aleksandrovskii, A.L., 2010. Soils and cultural layers in velikii Novgorod. Eurasian Soil Science, 43, 477–48.
- 3). Gerasimova, M.I., Stroganova, M.N., Mozharova, N.V., Prokofieva, T.V., 2003. Urban Soils. Oykumena, Smolensk.(in Russian)
- 4). Golubiewski, N.E., 2006. Urbanization Increases Grassland Carbon Pools: Effects of Landscaping in Colorado's Front Range. Ecological Applications 16, 555-571.
- 5). Ilina, I.N. (Eds.), 2000. Environmental atlas of the Moscow city. ABF. Moscow (in Russian)
- 6). Jo, H.K., McPherson E.G., 1995. Carbon Storage and Flux in Urban Residential Greenspace. Journal of Environmental Management 45, 109–133.

- 7). Kaye, J.P., McCulley, R.L., Burkez, I.C., 2005. Carbon fluxes, nitrogen cycling, and soil microbial communities in adjacent urban, native and agricultural ecosystems. *Global Change Biology* 11, 575-587.
- 8). Lorenz, K., Lal, R., 2009. Biogeochemical C and N cycles in urban soils. *Environment International* 35, 1–8.
- 10). Pickett, S.T.A., Cadenasso, M.L., Grove, J.M., Boone, C.G., Groffman, P.M., Irwin, E., Kaushal, S.S., Marshall, V., McGrath, B.P., Nilon, C.H., Pouyat, R.V., Szlavecz, K., Troy, A., Warren, P., 2011. Urban ecological systems: scientific foundations and a decade of progress. *Journal of Environmental Management* 92, 331–362
- 11). Prokofieva, T.V., Stroganova, M.N., 2004. Soils of Moscow city (soils in urban environment, their specifics and environmental significance). Moscow Biological. GEOS, Moscow.
- 12). Scalenghe, R., Marsan, F.A. The anthropogenic sealing of soil in urban areas, 2009. *Landscape and urban planning* 90, 1-10. .
- 13). Vasenev, V.I., Ananyeva, N.D., Makarov, O.A., 2012. Specific features of the ecological functioning of urban soils in Moscow and Moscow oblast. *Eurasian Soil Science* 45, 194-205.
- 14). Vasenev, V.I., Stoorvogel, J.J., Vasenev I.I., 2013b. Urban soil organic carbon and its spatial heterogeneity in comparison with natural and agricultural areas in the Moscow region. *Catena*. 107.96-102.
- 15). Vrscaj, B., Poggio, L., Marsan, F., 2008. A method for soil environmental quality evaluation for management and planning in urban areas. *Landscape and Urban Planning* 88, 81-94

1.8. Material and technical support of the discipline:

Classrooms equipped with multimedia projectors. Computer classes at ATI, the RUDN Information Library Center with access to the RUDN University electronic library system, the Internet.

1.9. Lecture notes, description of laboratory work.

Topic 1. Introduction in urban ecology. Basic concepts: city, urbanization, urban ecosystem. Urbanization problems. Ecological challenges of and urban environment.

Urban ecology – ecology of a city. City as an object of urban ecology. Ancient and contemporary cities. Urbanization as a process of city area’s expansion,

resulting in development of urban areas. Urbanization of nature as a conversion of natural landscapes into artificial ones under the influence of urban sprawl. Functional and formal definitions of the “city” term.

City in Russian Federation (RF) – a settlement with the population of at least 12000 people and 85% of the citizens involved on non-agricultural sphere. Settlement categories in US. Settlement categories in RF. City features: urban concentration, multi-functionality, dynamics, relations with suburban areas, self-development, historical multi-layeredness.

Structure of the urban area: historical centre, central zone, internal zone. Functional zoning of a city. Industrial zone. Sanitary-hygienic zone. Residential zone. Municipal and store zone. A zone of internal transport. Recreational zone: city and district parks, urban forest, sport grounds, beaches, cottage villages, resorts, tourist sights. Functions of a suburban zone: maintaining of the ecological balance between urban build-up areas and natural landscapes, sources of the natural resources, an area for recreation and rest, localization of the municipal objects, stores and services, localization of complex transport systems and infrastructure (airports, cargo ports etc.)

Models of city spatial organization: concentric, sectoral and multi-central. Cities and suburban areas: urban agglomeration, conurbation and megapolis. Urbanization problems: rising vulnerability of urban systems, migration, concentration and differentiation of citizens, low environmental quality, soil fertility loss, waste production and utilization etc. Urban ecosystem. Sub-systems: quasi-natural, landscape and architectural, social and economic and industrial. Urban environment as a totality of abiotic and social components, influencing human wellbeing jointly and directly. Anthropogenic (urban) landscape as a spatial unit, possessing the structure, formed from the natural basis as a result of artificial transformations and functioning of urban infrastructure (building constructions, service nets etc.)

Categories of urban landscapes considering the disturbance level: i) almost natural; ii) natural with artificial inclusions; iii) urban landscapes with natural inclusions and iv) typical urban landscapes. Categories of urban landscapes considering functional use and ecological structure: urbanized, industrial, communicational, devastated, agricultural, forestry, hydromorphic and recreational.

Topic 2. Geological component of urban ecosystems. Anthropogenic sediments. Cultural layer. Geocological processes.

Lithosphere as a component of geosystems. General information on the Earth planet composition. Material construction of the lithosphere. Physical and

chemical feature of the lithosphere. Elements and their clark the earth's crust. Minerals and mineral groups. Magmatic, metamorphic and sedimental rocks. Lithospheric processes. Endogenous and exogenous processes. Volcanism and post-volcanic processes. Tectonics of the Lithospheric plates. Orogenesis. Relief. Spatial and orographic relief forms. Slope, glacial, colluvial and karst processes. Interrelationships between the lithosphere with the other geosystems components.

Anthropogenic influence on the lithosphere. Physical and mechanical influence on the lithosphere. Reasons behind landslides' and mudflows formation. Karst formation and suffusion processes. Chemical influence of the lithosphere. Contamination of the lithosphere. Environmental impact of the industrial residuals and solid domestic wastes. Waste classification. Waste management. Waste burial. Waste disposal. Waste recycling and use. Waste sterilization. Passporting and certification of wastes. Waste recycling as an approach for environmental protection. Composing of organic wastes. Waste usage as secondary resources. Biodegradation of organic wastes. Specific of the thermal methods of the solid domestic waste's recycling. Role of the wasteless (zero-discharge) and low-wasted technologies in the waste management processes. Wastelessness coefficient.

Anthropogenic sediments. Classification of anthropogenic sediments. Genesis of anthropogenic sediments. Chemical and physical features of anthropogenic sediments. Cultural layer.

Topic 3. Water environment of urban ecosystems. Water consumption and water use. Standard of water quality. Sewage disposal and water treatment. Monitoring of water bodies.

Hydrosphere as a geosystems component. History of hydrosphere on Earth. Material composition of hydrosphere. Physical and chemical feature of hydrosphere. Water bodies, ponds and streams. Interrelation between hydrosphere and other geosystems components. Hydrosphere and migration of substances. Hydrosphere and climate. Water consumption. Water use and its categories.

Anthropogenic influence of the hydrosphere. Physical influence on water bodies. Transformation of the river-bed and valley, river basin area, features of the run-off surface (soil sealing, storm water sewage etc.) Water erosion. Chemical contamination of the hydrosphere. Main sources of contamination. Contamination of the hydrosphere by heavy metals and oil products. Water salinization. Contamination of the hydrosphere by radioactive wastes. Water

quality evaluation. Fishery, industrial and municipal standards of water quality. Maximal allowable concentration (health sanitary threshold). Maximal permissible discharge. Supporting environmental quality of water bodies. Maximal permissible pressures on water bodies. Organoleptic, sanitary and toxicological limiting indicators of harmfulness. Regulations controlling pollutants' inflow into water objects. Sanitary-hygienic zones. Water protection zones.

Sewage. Sources of sewage formation. Specifics of chemical and physical features of sewage waters. Pollutant content in sewage of different origin. Sewage disposal, purification and water treatment. Physical, physico-chemical, chemical, thermal and biological methods of sewage purification. Sewage purification plants. Arrangement of sewage disposal and purification plants. Consistency of the purification methods in sewage disposal and purification plants.

Monitoring of the hydrosphere quality. Goals and aims of the hydrosphere monitoring. Objects of the hydrosphere monitoring. Indicators of water quality considered in the hydrosphere monitoring. Hydrosphere monitoring systems at different spatial levels.

Topic 4. Atmospheric component of urban ecosystems. Atmospheric composition. Influences of the atmosphere. Air quality standards. Monitoring of the atmosphere.

Atmosphere as a geosystems component. History of the contemporary atmosphere. Gas composition of the atmosphere. Physics and chemical features of the atmosphere. Atmospheric processes. Weather and climate. Interrelationships between the atmosphere and other geosystems components.

Pollution of the atmosphere. Classification of the principal atmosphere pollutants. Maximal allowance concentrations of pollutants in the atmosphere. Sources of atmospheric pollution. Classification of the industries considering risks of the atmospheric pollution. Consequences of the atmospheric pollution. Dispersion of the toxic substances in the atmosphere. Limitation of the atmospheric emissions.

Management of the air quality. Standardization of the influences on the atmosphere. Maximal permitted emissions. Sanitary-hygienic zones. Integral indicator of the air pollutions. Separate standardization of the contaminants in the atmospheric air.

Heat pollution of the atmosphere. Anthropogenic change of the radiation balance. Green house gases and global warming. Heat island effect. Framework

convention of the climate change. Intergovernmental panel on climate change (IPCC). Kyoto protocol and post-kioto agreements. Russian Federation and Kyoto protocol.

Monitoring of the air quality. Goals and aims of air quality monitoring. System of the air quality monitoring in Russia. Weather forecasting and meteorological monitoring. Prediction and modeling of air pollution and air quality dynamic.

Topic5. Urban vegetation. Functions of urban green spaces. Standards and regulations of urban greenery

Biosphere as a geosystems' component. Main compounds of the biosphere. Biological cycle, its components and parameters. Net primary productivity, ecosystem productivity, phytomass. Biological soil-forming factor. Biological parameters of environmental quality. Functional and integral characteristics of the biosphere and its components.

Anthropogenic influence on the biosphere. Vegetation and technogenesis. Changes in ecological factors of plant growth: climatic, edaphic (soil), hydrological. Decrease of biodiversity. Vegetation categories considering the sustainability to anthropogenic pressure. Vegetation functions in technogenic landscape. Sanitary-hygienic zones. Choice of the plant species for the sanitary-hygienic zones. Arrangement of the sanitary-hygienic zones and green infrastructure for noise and dust protection. Natural complex.

Ecological and technogenic factors of plant growth in urban environment. Climatic factor: heat island effect, extension of the vegetation period, shifting of the plant borders, decrease in frost-resistance, prolongation of the daylight period. Atmospheric pollution: chlorosis, drying. Edaphic factor: over-compaction, cluttering up, salinization, soil sealing. Forest degradation within urban areas. Edge erosion. Composition of urban vegetation: local, introduced and added species. Specifics of urban vegetation: domination of deciduous plants, decrease in biodiversity. Cultural and ruderal grasses. Urban lawns.

Urban green space's functions. Sanitary-hygienic functions. Dust-capturing function. Gas-fixating function. Intensification of air circulation. Noise-isolating function. Ionization of the environment. Ornamental and aesthetic functions. Urban greenery rules, regulations and standards.

Topic 6. Urban soils. Soil-forming factors. Soil features. Diagnostics and classification. Environmental quality of urban soils. Influences on urban soils. Assessment and standardizing of urban soils. Urban soils' ecological functions. Monitoring of urban soils.

Soil geography. Soil zoning. Classification and diagnostic of soils. Soil types. Arctic and tundra soils. Podzols, podzolic and soddy-podzolic soils. Light and dark grey soils. Chernozems. Chernozemic facies. Chestnut soils. Brown semi-arid soils. Serozems. Brown soils. Yellow soils. Red tropical soils. Intrazonal soils. Alluvial and meadow soils. Agricultural soils. Urban soils. Soil as an ecological factor. Basic soil features and their ecological role. Soil age. Air regime of soils. Soil texture as an ecological factor. Soil texture as a result of weathering and further biological transformation of the parent material. Soil capturing capacity as an ecological factor.

Soil organic matter as an ecological factor. Ecological role of soil life phase. Ecological role of soil chemical features. Ecological role of soil acidity. Soil acidity influence on plants. Plant groups considering sustainability to soil acidity. Acidophiles and basiphyls. Ecological role of soil supply with nitrogen. Fixation of atmospheric nitrogen. Nitrogen supply of soils through mineralization of organic residuals. Influence of substrate supply with nitrogen on plants. Lack of nitrogen as a photosynthesis limitation. Ecological role of soil supply with other nutrients.

Ecological role of soil supply with calcium. Plant species, requiring for Ca-rich substrates for sustainable development. Calciphils – plant, preferring soils with high concentrations of calcium. Calciphobs – plant, avoiding lime and preferring acid soils. Ecological role of soil supply with potassium. Ecological role of soil supply with phosphorous. Ecological role of soil supply with other biogenic elements.

Ecological influence of soil toxicants. Toxic elements and toxicophytes. Self-purification of soil and plant protection from surpluses of toxic elements. Ecological role of soil salinization. Types of the salty soils. Galophytes. Eugalophytes – plants, storing salts. Ecological conditions of turf peat soils.

Multi-functionality of soils. Soil functions, determined by its physical features. Habitat. Refuge. Support. Storage of seeds. Soil functions, determined by its chemical and physico-chemical features. Nutrient source. Storage of nutrients. Stimulation/ inhibition of processes. Sorption. Informative functions of soils. Signal for seasonal and other biological processes. Regulation of biogeocoenosis structure. Starter of successions. Soil memory. Integral soil functions. Matter and energy transformation. Sanitary function. Buffer. Condition for existence and evolution of organisms. Soil fertility.

Pedosphere as a geosystems component. Soil and soil-forming factors. Elementary soil forming factors. Soil evolution. Key physical feature of soils. Morphological features of soils. Genetic and diagnostic horizons. New soil formations and inclusions. Soil profile. Soil organic matter. Nutrient cycles in

soil. Soil flora and fauna. Spatial variability in soil cover. Classification and diagnostics of soil.

Anthropogenic influence on soil. Over-compaction. Soil profile disturbance. Soil degradation. Soil pollution. Soil erosion. The key contaminants of soils. Maximal allowed concentrations and preliminary allowed concentrations of substances in soil. Anthropogenic soils. Specifics of soil formation, peculiarities of soil physical, chemical and biological features of anthropogenic soils. Classification of anthropogenic soils. Standardizing of soil quality. Methods for quantification of ecological damage. Reclaiming and remediation of contaminated soils. Remediation activities for various contamination types. Bioremediation. Ecological certification of soils and lands. Economic, ecological and functional-ecological assessment of soil quality.

Topic7. Industrial influence on urban ecosystems.

Chemical influence on the environment. Classification of the contaminants. Contamination with heavy metals. Contamination with oil products. Contamination with the pesticides. Contamination with the dioxines. Bacteriological pollution. Radioactive pollution. Pathways of pollutant into the environment. Hazard classes of contaminants. Migration of contaminants. Intensity of migration. Coefficient of dispersion. Coefficient of accumulation. Physical influence of the environment. Wave influence. General information on the waves. Noise (sound) and vibrations in the environment. Sound vibrations. Frequency and amplitude of sound vibrations. Types of sound vibrations. Sound intensity.

Noise (sound) distribution. Acoustic pressure. Acoustic resistance. Free acoustic field. Acoustic insulation. Diffusion of the acoustic field. Acoustic power. Standard thresholds of acoustic pressure and acoustic power. Equal loudness curves. Acoustic level of sound. Equipment to measure noise. Octave-band filter.

Noise influence on human and environment. Structure of organs of hearing. Frequency range, available for human hearing. Equivalent level of noise energy. Ultrasound sounding. Infrasound influence of vibration frequency. Assessment of professional noise influence (ISO). Methods to assess and measure noise pollution. Acoustic field. Standard and non-standard methods of noise measurement. Sound level meter. Vibration influence on human and environment. Vibration process and harmonic vibrations. Infrasound vibrations. Transport and industry as a source of vibration. Noise standardization. Acoustic quantification. Estimation of sound level pressure when sound distribution in

free space. Main approaches to noise reduction. Main approaches of noise protections. Sound isolation. Sound-absorbing materials. Allowed noise levels in dwelling and public houses.

Electric current. General terms. Current strength. Voltage. Resistance. Ohm law. Thermal effect of electric current. Biological effect of electrical current. Electric protection. Natural and static electricity. E-field radiation. Main terms. Electromagnetic field. E-field standardization. Regional, national and global standards. Standards for people.

Radiation. General terms. Alpha, beta and gamma emanation. Nuclear and photon emanation. Nuclear and features and structure. Radioactive effect on human. Radiation sickness. Dose of radiation. Standardization of radioactive emanation.

1.10. Information support of the discipline

a) software:

curriculum for the discipline "Mathematical modeling of urban ecosystems";
testing program "Mentor"

b) databases, information and reference and search systems:

RUDN University Electronic Library System - RUDN University Library System: <http://lib.rudn.ru:8080/MegaPro/Web>

RUDN educational portal (<http://web-local.rudn.ru>);

University library online: <http://www.biblioclub.ru>

National digital resource "RUKONT": <http://rucont.ru>

IQlib: <http://www.iqlib.ru>

Science Direct: <http://www.sciencedirect.com>

EBSCO: <http://search.ebscohost.com>

Sage Publications: <http://online.sagepub.com>

Springer / Kluwer: <http://www.springerlink.com>

Taylor & Francis: <http://www.informaworld.com>

Web of Science: <http://www.isiknowledge.com>

University Information System RUSSIA: <http://www.cir.ru/index.jsp>

RUDN educational portal: <http://web-local.rudn.ru/>

Student advisor <http://www.studmedlib.ru>

1.11. The course of video lectures "Integrated assessment of urban environment" (available on the RUDN University portal, in test mode). Includes 6 lessons.

Section II. Independent student work.

2.1. List of homework by topic

Urban ecology: problems and objects, goals and methods.

1. Urbanization as a global process: reasons and consequences.
2. A city: definitions, categories and features.
3. Urban areas structure and functional zoning.
4. City agglomerations.
5. Urban ecosystems and urban landscapes.
6. Urban atmosphere: chemical and physical features and functions.
7. Urban climate.
8. Factors of influence on the atmosphere
9. Anthropogenic impacts on the atmosphere
10. Natural and anthropic radiation balance in the atmosphere
11. Heat island effect: reasons and consequences.
12. Air pollution.
13. Contaminants of the atmosphere and sources of contamination (pollution)
14. Monitoring air quality
15. Standardization of air quality
16. Standardization of the impact on the atmosphere.
17. Hydrosphere and global water distribution
18. Water circulation.
19. Distribution of global precipitation and humidity.
20. Water use and water consumption

2.2. Requirements for writing essays, term papers.

A plan is a schematically written set of shortly formulated heading thoughts; it is the "skeleton of a work". According to the form of division and recording, plans can be subdivided into simple and complex. A complex plan, in contrast to a simple one, has subparagraphs for part or all of the main points, which detail or clarify the content of the main ones.

The plan has a number of advantages that put it, along with synopses and theses, into a completely independent, independent form of recording.

"The shortest entry." It is thanks to this that the plan is easy, redoing to improve both in essence and in form, while again and again thinking over the content of the subject.

Clearly visible and visible. No other forms of notation, except for the plan, can reflect the sequence of presentation of materials in such a vivid and easily visible form.

Summarizes the content. A well-designed plan reveals the very content of the work. This entry already contains elements of generalization that can be further developed in theses, synopses, abstracts.

Recovers what was read in memory. The plan makes it easier to understand the content, contributes to the accelerated study of the material.

The plan, drawn up for large works that work for a long time, allows you to rationally, without a big loss of time, before resuming work, to reproduce in memory what you read earlier. At the same time, it recalls the most important, essential.

Helps to compose records. Guided by the points of the plan and referring to the original, it is possible to draw up other, already more detailed and detailed records - abstracts. It is easier to draw them up with a plan.

By drawing up a detailed plan for the synopsis, you can easily and quickly identify repetitions and inconsistencies in the presentation of the text, improve the recording, making it logically clear and consistent.

All points of the plan do not have to be written only in interrogative or only in affirmative form. Either form is acceptable.

As a rule, the points of the plan are formulated in their own way. But they can partially or completely coincide textually with individual phrases of the source. The plan only benefits from this.

An approximate plan for writing an abstract:

1. Introduction
2. Main part: a)...., B)...., C)...
3. Conclusions and conclusion
4. References.

The introduction is the very first section. The introduction substantiates the choice of the topic, determined by its relevance, forms the problem and the range of questions necessary to solve it.

The content of the section of the main part must exactly correspond to the topic of the work and fully disclose it.

In almost all types of abstracts, the conclusion can be drawn up in the form of conclusions. Conclusions are prepared on the basis of the finished text. It is only important to make them short and clear. How many conclusions should be made is not a question. There are never more or less of them than it follows from the main text.

General requirements. The work is carried out in handwritten, typewritten method or using a computer on one side of a sheet of A4 white paper (210x288 to 210x297) with one and a half line spacing with the number of lines on the page no more than 30. Each line should have no more than 60 - 65 characters, including spaces between words. The minimum font height is 1.8 mm.

The text of the work should be written or printed, observing the following margins:

left - 20 mm;

right - 10 mm;

top - 20 mm;

bottom - 20 mm.

The title page is the first page of a scientific work and is filled in according to strictly defined rules.

The upper field contains the full name of the educational institution.

In the middle field, the title of the work is given without the word "topic" and is not enclosed in quotation marks. In the middle field, the title of the work is given without the word "topic" and is not enclosed in quotation marks.

Further, closer to the right edge of the title page, the surname, initials, course, group of the performer are indicated.

Below is the name and initials of the leader.

The lower field indicates the place of work and the year it was written (without the word "year") (see Appendix 1).

It is allowed to inscribe individual words, conventional signs into the text of the work with ink, ink, paste only in black, while the density of the inscribed text should be close to the density of the main text.

Typos, misspellings and graphic inaccuracies found in the process of writing a work may be corrected by erasing or painting over with white paint and applying the corrected text (graphs) in the same place by typewritten or handwritten methods. The headings of the structural parts of the work "CONTENTS", "INTRODUCTION," CONCLUSIONS "," LIST OF USED SOURCES "are printed in capital letters symmetrically to the text.

Section headings are printed in lowercase (except for the first uppercase) from a paragraph. Do not put a period at the end of the title.

If the title consists of two or more sentences, separate them with a period.

The heading of the chapter, paragraph should not be the last line on the page.

Headings of paragraphs are written in lowercase letters (except for the first uppercase) in the discharge, from the paragraph to the selection to the text. A full stop is put at the end of the heading printed in the fit to the text. The

distance between the heading (except for the paragraph heading) and the text should be equal to 3 spacing.

Each structural part of the work should be started on a new sheet.

The text material of the works is very diverse. It (the elements of the composition and rubrication considered above) usually includes numerals, letter designations, quotations, references, enumerations, etc., i.e. everything that requires knowledge of special technical and spelling rules in its design.

Ordinal numbers when written in Arabic numerals have case endings. In the case ending, ordinal numbers designated by Arabic numerals have: a) one letter, if they end in two consonants, in "and" and in a consonant letter; b) two letters if they end in a consonant and a vowel. For example: 2nd – 2nd (not: 2nd), 15th – 15th (not: 15th or 15th), 30th – 30th (not: 30th), in 53rd year (not: 53rd or 53rd year), tenth grade – 10th grade (not: 10th grade).

Ordinal numbers designated with Arabic numerals do not have case endings if they come after the noun to which they refer. For example: in Ch. 3, in Fig. 2, in Table 4.

Let us indicate the generally accepted conditional abbreviations that are made after the listing: i.e. (that is), etc. (and so on), etc. (and the like), etc. (and others), etc. (and others). Let us indicate the generally accepted conditional abbreviations that are made after the listing: i.e. (that is), etc. (and so on), etc. (and the like), etc. (and others), etc. (and others).

Conventional abbreviations used when referring: see (see), cf. (compare), e.g. (eg).

Generally accepted abbreviations when numbered for centuries and years: c. (century), centuries. (centuries), year (year), years. (years).

We will indicate a number of generally accepted abbreviations: vol. (Volume), n.st. (new style), Art. (old style), AD (AD), city (city), region. (area), gr. (citizen), p. (pages with numbers), acad. (academician), Assoc. (associate professor), prof. (Professor). The words "and others", "and the like", "and others" within the sentence are not abbreviated. Abbreviations of the words "so-called" (so-called), "since" (since), "for example" (eg), "about" (approx.), "Formula" (f-la), "Equation" (ur-tion), "diameter" (dia.).

The table represents such a way of presenting information in which digital or text material is grouped into columns, delimited from one another by vertical and horizontal rulers.

All tables, if there are several of them, are numbered with Arabic numerals within the entire text. Above the upper left corner of the table, place the inscription "Table", indicating the ordinal number of the table (for example: "Table 4") without the number sign in front of the number and no dots after it. If

there is only one table in the text, then no number is assigned to it and the word "table" is not written. Tables are provided with thematic headings, which are placed above the table on the left, without indentation in one line with its number through a dash, for example, Table 1 - Composition of gastric juice (see Appendix D).

It is allowed to number tables within a section. In this case, the table number is made up of the section number and the serial number of the table, separated by a dot (table 1.1, table 1.2, table 2.1, etc.)

When transferring a part of a table to other pages, the title is placed only above its first part. Above the continuation of the table on a new page of the note, write the words "Continuation of Table 1", "Continuation of Table 1.1".

The width of the table should not exceed the size of a standard A4 sheet. It is allowed to place the table along the long side of the sheet. In this case, the table is positioned so that the note can be rotated clockwise for ease of reading.

Tables on all sides of the page are usually delimited with lines. In general, the form of the table should have vertical columns (columns) with appropriate headings and subheadings and horizontal rows (lines) with corresponding names. The head of the table should be separated by a line from the rest of the table.

Each appendix should start on a new sheet (page) with the word "Attachment" at the top in the middle of the page and have a thematic title. The application is indicated by capital letters of the Russian alphabet, starting with A, with the exception of the letters E, Z, Y, O, H, L, Y, b. The word "Appendix" is followed by a letter denoting its sequence, for example, "Appendix A". The pagination of the pages on which the annexes are given should be continuous and continue the general pagination of the main text.

An important element of a well-formed work is the reduction of words. In the bibliographic record, words and phrases are abbreviated in all areas of the bibliographic description, except for the title and title.

Various parts of speech are subject to abbreviations. A list of special cases of word abbreviation is given in GOST 7.12-93 and GOST 7.11-78. In addition, it is allowed to use generally accepted abbreviations, for example:

- higher education institution - higher education institution;
- Institute - in-t;
- year - year;
- agricultural - agricultural;
- railway - railway;
- ministry - m-in;
- University - un-t.

Examples of abbreviations for the most common words⁶

- collection - Sat.
- scientific - tr.
- textbook - textbook.
- study guide - study guide
- conference - conf.

Abbreviation of words is not allowed:

- in the main and parallel title and description title;
- if, when decoding abbreviations, a different understanding of the text of the bibliographic record is possible;
- by discarding one (last) letter;
 - if the word is the only member of the sentence.

2.3. Methodical instructions for students on mastering the discipline (module)

The student is required to attend classes, complete the assignments of the discipline teacher, familiarize himself with the recommended literature, etc. During the certification of the student, the quality of work in the classroom, the level of preparation for independent activity in the chosen field, the quality of the assignments of the discipline teacher, the ability to independently study the educational material are assessed.

During practical classes and lectures in classrooms, the relevant topics are analyzed using multimedia technology (computer, projector).

Independent work outside the classroom can take place both in the classrooms of the department and in the computer class, where students can study material on the presentations prepared by the teachers of the department, as well as on computer tests.

Presentations on the topics of the classes can be recorded on a CD or a flash card for self-study of students on a home computer.

Textbooks in electronic form on a number of topics studied are posted on the pages of the department and employees of the Technosphere Safety Department of the Agrarian and Technological Faculty on the RUDN University Educational Portal, as well as on the local resources of the RUDN University electronic library system.

As one of the forms of independent work, preparation of abstracts for various sections of the course is provided.

Extracurricular independent work includes:

study of material from a textbook, teaching aids on paper and electronic media; preparation of an abstract message on a selected topic; preparation for the performance of tests and test tasks.

For a better assimilation of the theoretical information obtained within the framework of this course, the student is invited to carry out independent scientific work under the guidance of a supervisor. This type of activity helps the student to consolidate and expand the amount of knowledge gained, to improve practical skills in working with normative, statistical material and special literature.

In this regard, the student must be especially attentive to the choice of the topic of the relevant work. When choosing, it is recommended, first of all, to take into account the student's own interest and the planned area of his future activities. The presented list will help orient the student, determine his preferences and, together with the supervisor, formulate the topic more specifically.

The program was drawn up in accordance with the requirements of the OS VO RUDN / FGOS.

2.4. Dictionary (glossary) of basic terms and concepts (including index).

Absorption - uptake by a porous substrate (i.e. activated carbon)

Anthropic (urban) landscape —altered by human activity to a level, when initial ecosystems components and linkages are substituted by new artificial ones

Boulevard - – green zone of the linear shape, used for transit pedestrian traffic

Volcanism -- eruption of molten magma to the surface of the earth's crust resulted from active degassing

A city (town, an urban area) (in RF)- a settlement with the population above 12 thousands citizens, 85% of which are involved in non-agricultural activity

Urban agglomeration - spatially and functionally unified group of a urban settlements, incorporated in a single social, ecological and economical system

Diagnostic horizon - a soil horizon, possessing specific morphological and physic-chemical features, enabling relating soil to a classification unit (taxon)

Karst formation - a complex geological process, including leaching rocks by underground and surface waters, resulted in formation of large cavities; removal of disperse particles from covering and neighboring sediments and finally roof caving.

Cataclysm- running with a very high speed, which doesn't enable a system to adapt and thus resulted in destruction

Coagulation - осадка conjunction of disperse particles into flakes, followed by sedimentation

Constuctuzems (urban constructed soils)- soils with a complex construction more than 50 cm in depth, created on a specific purpose (i.e. sport green lawns), including a set of layers from different materials, structure and textures and a covering organic horizon

Conurbation — a group of neighboring cities (towns), strongly economically linked but with an actual boundary between in

Culturozems - soils of urban botanical gardens, arboretums, cultivated pastures and orchards with evidences of urban pedogenesis (contamination, anthropogenic inclusions etc).

Forest - totality of land, trees, shrubs and grasses, animals and other environmental components, biologically interlinked and influencing each other while developing

Megapolis —a large urban agglomeration, including multiple settlements, a functional complex of urban agglomerations (boundaries between the settlements are formal, but are not evidences in reality)

Necrozems -cemetery soils, highly mixed within 150 cm.

Landslide - sliding displacement of rock material down the natural or artificial slope, forced by gravitation

Park - green area with a multiple or specific recreational functions

Soil - complex natural body, formed as a result of interaction between soil-forming factors: parent material, climate, vegetation, relief, time and anthropic influence

Recreazems - natural-artificial urban soils with multiple adding of organic and turf fertile substrates and possessing chemical and physic features, optimal for plants growth

Remediation - set of measures to protect and restore contaminated soils. Remediation techniques are specific for various contaminants.

Replantozems - urban soils, including 10 cm top organic horizon, covering rock materials and excavations of building constructing or a special drainage layer

Public garden - small scale green area, used for every day short-term rest and transit pedestrian traffic (extent less than 2 ha)

Urban environment - totality of abiotic and social environments influencing human activity and household

Troposphere - an open dynamic system, being in permanent energy, information and matter exchange with upper atmospheric layers, outer space, biota, surface and ocean

Urbanization - a processes, leading to increase of urban settlement, rise and development of cities

Urbanization of environment - conversion of natural landscapes into artificial influenced by urban building construction

Urbochemozems – soils, characterized with irreversible chemical pollution by any contaminants (heavy metals, pesticides, organic matters, radioactive nuclides etc.) in a hazardous level following current standards.

Urbanozems - specific soils of residential areas, formed simultaneously with deposition of anthropic sediments, resulted from building construction and settlement activity and partly belonging to urban cultural layers

Urban ecology – a branch of science focused on urban environment and its interrelationships with humans

Urban ecosystem —a spatially confined natural-anthropic system, aggregating individual living organism, linked by metabolic and energy fluxes with abiotic natural and technogenic components, establishing an environment for citizens, supporting their biological, social, ethnic, labor and economic demands

2.5. Сборник задач и упражнений.

Practical work 1 Air quality monitoring in Moscow city

General info. Carbon monoxide (CO), nitrogen oxide (NO) and sulfur dioxide (SO₂) are important air pollutants, thus their concentrations are continuously controlled on more than 40 monitoring posts and mobile stations in Moscow city. Further on data is processed and generalized to air pollution maps. Though pollutants' concentrations are quite changeable over years, these maps should be verified from time to time.

Task To verify maps of air pollutions for the actual data of CO, NO and SO₂ concentrations.

Steps

- 1). Pick up 5 administrative districts of Moscow city and download air pollution maps for them.
- 2). Figure out areas with tables of observed pollutants' concentrations.
- 3). Choose at <http://www.mosecom.ru/air/air-today/> 3-5 meteorological posts and mobile stations nearest to the area of interest.
- 4). Obtain the data on morning and night concentrations of the CO, NO and SO₂ for today, previous week and previous month per each post or mobile station.
- 5). Estimate mean values of morning and night concentrations of the CO, NO and SO₂ for today, previous week and previous month per each area of interest and compare with ones obtained from the maps.
- 6). Make your conclusions on the map's relevance and on temporal (including diurnal) dynamics of pollutants' concentrations

Practical work 2 Quantifying pollutants' run-off with sewage water

General info Greenery works are planned at the train station square (total extent of 1.2 ha). In result, four new bus stations (total roof area of 0.015 ha) will be mounted as well as flower beds and shrubs will be planted instead of existing car parking (total extent 0.15 ha). Territory balance prior greenery works include the following: building roofs – 12%, green zones – 7%, a main street with intensive traffic – 20%, sealed areas (covered with asphalt and concrete) with regular automatic cleaning – all the rest.

Task To estimate changes in total pollutants' run-off and in average values for suspended matters and oil products' concentrations and biologically absorbed oxygen (BAO₅₀) resulted from the greenery work.

Additional data

1. Mean air temperature and precipitation shall be derived from long-term monitoring results (meteoinfo.ru; Fig 3.3)
2. Wet cleaning is performed on the sealed areas with 150 cleanings in average per year.

3. Coefficient of cleaning water's drainage shall be taken as 0.5
4. Relative pollutant's concentration in cleaning waters is assumed as equal to one in storm waters.

Practical work 3 Developing dendrological plan for urban environment

General info Three urban sites of the same size (square plots 50×50 m) but different in functional use are observed. The first one is located in the sanitary-hygienic zone of a petroleum factory. The second plot locates in the court yard of a primary school. The third one is a part of a park area.

Task

1. Figure out the key functions performed by the plants in each zone. What are the differences?
2. Develop a dendrological plan for one of the zones (on your own choice). Which species would give preference to? Why?
3. Prepare an assortment record and estimate the costs for plant materials and labor.

Practical 5 Estimation of urban soil quality

General info:

Three urban plots were investigated in different functional zones within the Garden ring. 5 to 15 sampling points were taken from different surfaces (green lawns, trees and flower-beds) in each of the plots. Samples from 0-10, 10-20, 20-50 and 50-100 cm layers were taken at each of the points. In each of the sample soil texture, agrochemical parameters, heavy metals and oil products were measured.

Task

- Perform a comprehensive analysis of the soil environmental state at the plots
- Compare the quality of soils and soil mixtures at the plots under different functional use.
- Check the accordance of the observed soil parameters to soil quality standards
- Distinguish occurrence and hazard of soil contamination

2.6. Вопросы для самопроверки и обсуждений по темам.

1. Urban ecology: problems and objects, goals and methods.
2. Urbanization as a global process: reasons and consequences.
3. A city: definitions, categories and features.
4. Urban areas structure and functional zoning.
5. City agglomerations.
6. Urban ecosystems and urban landscapes.
7. Urban atmosphere: chemical and physical features and functions.
8. Urban climate.
9. Factors of influence on the atmosphere
10. Anthropogenic impacts on the atmosphere
11. Natural and anthropic radiation balance in the atmosphere
12. Heat island effect: reasons and consequences.
13. Air pollution.
14. Contaminants of the atmosphere and sources of contamination (pollution)
15. Monitoring air quality
16. Standardization of air quality
17. Standardization of the impact on the atmosphere.
18. Hydrosphere and global water distribution
19. Water circulation.
20. Distribution of global precipitation and humidity.
21. Water use and water consumption

2.7. Задания для самостоятельной работы по темам.

1. Functions and services provided by urban vegetation.
2. Factors, influencing urban vegetation.
3. Urban vegetation: categories and functions.
4. Green lawns in urban areas.
5. Microclimatic function of urban green zones.
6. The role of urban vegetation in infiltration/ evaporation.
7. The features and function of urban lawns.
8. Substrates for urban green lawns' establishment
9. Requirements for soil agrochemical features to establish urban green lawns.
10. Direct and indirect anthropogenic influence on urban soil's formation.
11. Diagnostic horizons of urban soils.
12. Classification of urban soils.

13. Pollution of urban soils.
14. Temperature and water regimes in urban soils.
15. Standards of urban soil's quality

Раздел III. Контроль знаний и компетенций студента.

3.1. Паспорт фонда оценочных средств по дисциплине Urban Ecology

Специальность: 35.04.09 Ландшафтная архитектура

1 семестр

код	Контролируемой компетенции	Контролируемый раздел дисциплины	Контролируемая тема дисциплины	Наименование оценочного средства						Промежуточная аттестация	Баллы темы	Баллы раздела
				Текущий контроль								
				Коллоквиум	Тест	КР	ДЗ	Проект	Итоговая КР			
ОПК – 1 ОПК-2 ПК – 3	Introduction to the course «Urban ecology».	Basic terms: city, urbanizations, urban ecosystems				5	4			9	9	
ПК- 6 ПК – 25 ПК – 26	Geological environment of urban ecosystems	Cultural layers		10		5	5			20	20	
	Water component	Water-use types.			10	5	5		10	30	30	

	of urban ecosystems.										
	Atmosphere of urban ecosystems..	Composition				3	3			6	21
		Influence				3	3			6	
		Pollution				3	3			6	
		Climate				3				3	
			ЭКЗАМЕН								20
			ИТОГО							80	100

2 семестр

код	контролируемой компетенции	Контролируемый раздел дисциплины	Контролируемая тема дисциплины	Наименование оценочного средства						Промежуточная аттестация	Баллы темы	Баллы раздела
				Текущий контроль								
				Коллоквиум	Тест	КР	ДЗ	Проект	Итоговая КР			
ОПК – 1	Urban climate.	Urban heat island				5	4			9	9	
ОПК-2 ПК – 3 ПК- 6 ПК –	Urban vegetation. Functions of urban	Green infrastructure		10		5	5			20	20	

Соответствие систем оценок (используемых ранее оценок итоговой академической успеваемости, оценок ECTS и балльно-рейтинговой системы (БРС) оценок текущей успеваемости).

Баллы БРС	Традиционные оценки РФ	Оценки ECTS
95 - 100	5	A
86 - 94		B
69 - 85	4	C
61 - 68	3	D
51 - 60		E
31 - 50	2	FX
0 - 30		F
51-100	Зачет	Passed

Пояснение к таблице оценок:

Описание оценок ECTS

A	“ Отлично ” - теоретическое содержание курса освоено полностью, без пробелов, необходимые практические навыки работы с освоенным материалом сформированы, все предусмотренные программой обучения учебные задания выполнены, качество их выполнения оценено числом баллов, близким к максимальному.
B	“ Очень хорошо ” - теоретическое содержание курса освоено полностью, без пробелов, необходимые практические навыки работы с освоенным материалом в основном сформированы, все предусмотренные программой обучения учебные задания выполнены, качество выполнения большинства из них оценено числом баллов, близким к максимальному.
C	“ Хорошо ” - теоретическое содержание курса освоено полностью, без пробелов, некоторые практические навыки работы с освоенным материалом сформированы недостаточно, все предусмотренные программой обучения учебные задания выполнены, качество выполнения ни одного из них не оценено минимальным числом баллов, некоторые виды заданий выполнены с ошибками.

D	<p>“Удовлетворительно” - теоретическое содержание курса освоено частично, но пробелы не носят существенного характера, необходимые практические навыки работы с освоенным материалом в основном сформированы, большинство предусмотренных программой обучения учебных заданий выполнено, некоторые из выполненных заданий, возможно, содержат ошибки.</p>
E	<p>“Посредственно” - теоретическое содержание курса освоено частично, некоторые практические навыки работы не сформированы, многие предусмотренные программой обучения учебные задания не выполнены, либо качество выполнения некоторых из них оценено числом баллов, близким к минимальному.</p>
FX	<p>“Условно неудовлетворительно” - теоретическое содержание курса освоено частично, необходимые практические навыки работы не сформированы, большинство предусмотренных программой обучения учебных заданий не выполнено, либо качество их выполнения оценено числом баллов, близким к минимальному; при дополнительной самостоятельной работе над материалом курса возможно повышение качества выполнения учебных заданий.</p>
F	<p>“Безусловно неудовлетворительно” - теоретическое содержание курса не освоено, необходимые практические навыки работы не сформированы, всевыполненные учебные задания содержат грубые ошибки, дополнительная самостоятельная работа над материалом курса не приведет к какому-либо значимому повышению качества выполнения учебных заданий.</p>

Положительными оценками, при получении которых курс засчитывается обучаемому в качестве пройденного, являются оценки А, В, С, D и E.

Обучаемый, получивший оценку **FX** по дисциплине образовательной программы, обязан после консультации с соответствующим преподавателем в установленные учебной частью сроки успешно выполнить требуемый минимальный объем учебных работ, предусмотренных программой обучения, и представить результаты этих работ этому преподавателю. Если качество работ будет признано удовлетворительным, то итоговая оценка FX повышается до E и обучаемый допускается к дальнейшему обучению.

В случае, если качество учебных работ осталось неудовлетворительным, итоговая оценка снижается до F и обучаемый представляется к отчислению. В случае получения оценки F или FX

обучаемый представляется к отчислению независимо от того, имеет ли он какие-либо еще задолженности по другим дисциплинам.

(Приказ Ректора РУДН №996 от 27.12.2006г.)

3.2. Перечень рефератов и/или курсовых работ по темам

1. Urban ecology: problems and objects, goals and methods.
2. Urbanization as a global process: reasons and consequences.
3. A city: definitions, categories and features.
4. Urban areas structure and functional zoning.
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14. Contaminants of the atmosphere and sources of contamination (pollution)
15. Monitoring air quality
16. Standardization of air quality
17. Standardization of the impact on the atmosphere.
18. Hydrosphere and global water distribution
19. Water circulation.
20. Distribution of global precipitation and humidity.
21. Water use and water consumption

3.3 Вопросы к коллоквиуму/ тесту

1. *Urban ecology is*
 - A) a branch of science, focusing on urbanization
 - B) a branch of science, focusing on cities
 - C) a branch of science, focusing on interrelations between urban environment and citizens
 - D) a branch of science, focusing on environmental pollution
2. *An area is defined as urban in Russian Federation if*
 - A) total population is above 12000

- B) total population is above 12000 and 85% of citizens is involved in non-agricultural economical activity
 - C) total population is above 10000 and 85% of citizens is involved in non-agricultural economical activity
 - D) 100% of citizens in non-agricultural economical activity
3. *Which of the following Russian cities can be described by a concentric model of spatial organization*
- A) Saint-Petersburg
 - B) Moscow
 - C) London
 - S) Prague
4. *Micro district is a structural unit of*
- A) industrial zone
 - B) recreational zone
 - C) sanitary-hygienic zone
 - D) residential zone
5. *A group of neighboring and closely economically and socially interrelated cities (with a remaining evident border between them) is defined as*
- A) Urban agglomeration
 - B) Conurbation
 - C) Megapolis
 - D) Suburb zone
6. *Anthropic factors of earthquake risk include:*
- A) Age and quality of building construction
 - B) Settlement size
 - C) Location on seismic zone
 - D) Movement of lithospheric plates
7. *Young geologic sediments originating from engineering, building-construction and economical activity are defined as*
- A) Soils
 - B) Sewage waters
 - C) Alluvial sediments
 - D) Anthropic sediments
8. *Urban areas are defined as waterlogged if*
- A) ground waters get to surface
 - B) ground water are 1 m deep from the surface
 - C) ground water are 2 m deep from the surface
 - D) ground water are 3 m deep from the surface

9. *Which contaminants will be likely found in ground waters of urban residential areas*
- A) Chlorites, nitrates, oil products
 - B) oil products, heavy metals, surface-active compounds
 - C) nitrates, pesticides
 - D) organic substances and pathogenic microorganisms
10. *Physic pollution of an urban environment includes*
- A) vibration
 - B) radioactive pollution
 - B) emission of heavy metals and oil products
 - Г) salinization of urban soils
11. *Urban water reservoir with a surface extent above 50 km² is defined as*
- A) small
 - B) very large
 - C) large
 - D) moderate
12. *Water supply from river foe settlement need occurs*
- A) upstream the city boundaries
 - B) downstream the city boundaries
 - C) both upstream and downstream the city boundaries
 - D) within the city boundaries
13. *Which organization determines and controls sanitary protection zones of water supply points?*
- A) Ministry of internal affairs
 - B) Sanitary epidemiological service
 - C) Nature control service
 - D) Meteorological service
14. *Building construction in river flood-land results in the following changes in surface and groundwater run-off*
- A) surface run-off decreases and groundwater run-off increases
 - B) surface run-off increases and groundwater run-off decreases
 - C) both run-off decreases
 - D) no changes are observed
15. *Which condition is not obligatory to distinguish the 1st (the most strict) sanitary protection zone of water supply in a river?*
- A) minimum 200 m upstream
 - B) minimum 100m at the nearest river bank
 - C) minimum 200 m downstream
 - D) minimum 50 m at the opposite river bank

16. *Quality standards for which water use are the most strict?*
- A) recreational
 - B) technical
 - C) industrial
 - D) fishery
17. *Delete a superfluous category of sewage waters*
- A) household
 - B) industrial
 - C) storm
 - D) recreational
18. *Which methods to purify sewage waters are implemented at the first purification stage?*
- A) Biological
 - B) Chemical
 - C) Mechanical
 - D) Physic-chemical
19. *Which of the following methods to purify sewage waters doesn't belong to physic-chemical one?*
- A) Coagulation
 - B) Flotation
 - C) Filtering
 - D) Adsorption
20. *Which gas dominates in atmosphere?*
- A) nitrogen
 - B) oxygen
 - C) carbon dioxide
 - D) argon

Evaluation criteria: Sketch is estimated from 0 to 5 points. The maximum score for the sketch is 5 points. Model is estimated from 0 to 15 points for section 1-3 and from 0 to 5 points for section 4-8. The maximum score for the model are 15 or 5 points. Model defense is estimated from 0 to 5 points. The maximum score for the model defense is 5 points.

№	Parameters assessed	Score in points	
		Corresponds to parameters	Does not correspond to parameters
1	Sketch: - performed at a high methodological level, complies with the standards, the essence of the work is correctly disclosed - correctly made drawings and	5	0

№	Parameters assessed	Score in points	
		Corresponds to parameters	Does not correspond to parameters
	visualization. The essence of the work is not disclosed enough. - drawings are made illiterately and do not meet the standards	3	0
		1	0
2	Model from 1-3 section: - the model is made at a high methodical level, corresponds to the sketch, the essence of the work is correctly disclosed	15	0
	- the work is done carefully. The essence of the work is not disclosed enough	10	0
	- the work is done carelessly and do not meet the standards	5	0
3	Model from 4-8 section: - the model is made at a high methodical level, corresponds to the sketch, the essence of the work is correctly disclosed	5	0
	- the work is done carefully. The essence of the work is not disclosed enough	3	0
	- the work is done carelessly and do not meet the standards	1	0
4	Model defense: - the conclusions fully characterize the work, the answers are literate and structured, fully reflect the essence of the work	5	0
	- conclusions characterize the work in part, however, reflect the essence of the work	3	0
	- conclusions are not clear, answers are not complete, do not reflect the essence of the work	1	0

4. Information about the teacher leading the discipline: The course of lectures is delivered by Associate Professor of the Department of Landscape Design and Sustainable Ecosystems ATI RUDN, PhD, Vasenev Vyacheslav Ivanovich.

Leading disciplines

Associate Professor of the Department of LP&E _____ V.
Vasenev

Director of the Department of LP&E

Associate Professor _____ E.A. Dovletyarova