Bachelor’s Track Program: Urban Studies and Civil Engineering

1. Open Doors winner’s skill set

Winning the Open Doors competition requires a firm grasp of:

- history, geography, and social science concepts defining a humanitarian understanding of urbanism and civil engineering;
- basic computational methods applied in physics, chemistry, mathematics, and computer science;
- urban environment and infrastructure elements, construction and design activities and processes;
- urban planning objects, including architectural, historical, and cultural ones;
- history of architecture and construction;
- basic physical and mechanical properties of building materials and their operational requirements;
- environment control measures and transport and planning structure of the city.

The winner is expected to demonstrate a solid command of the following skills:

- presenting the natural structure of urban design objects;
- determining building types and understanding the main structural elements of architectural space, as well as the basics of architectural form-making;
- using cartography and topography tools;
- introducing the design of urban objects and spaces that meet the needs of modern society.

2. List of degree programs covered by the subject area

2.1 List of bachelor’s degree programs

07.03.04 Urban planning
08.03.01 Construction
38.03.10 Housing and Utility Infrastructure

3. Content

Field of science 1. Civil engineering and construction

Mathematics

1. Numbers and calculus.

Physics

1. Construction thermal engineering.
2. Computer science
3. Digital literacy.
4. Social science
5. Individual in society.
6. Legal regulation of public relations in Russia.

Field of science 2. Mechanics

Mathematics

1. Equations and inequalities.
2. Physics
3. Dynamics; statics; oscillations and waves.
4. Computer science
5. Algorithms and programming.

Field of science 3. Urban studies

Mathematics
1. Functions and graphs.
2. Physics
3. Physics and methods of academic inquiry.
4. Computer science
5. Theoretical foundations of computer science.

Field of science 4: Road construction
Mathematics
1. Geometry.

Physics
1. Mechanics.

Computer science
1. Geoinformation literacy.
2. Social science
3. Economic life of society.

Field of science 5: Construction technology
Mathematics
1. Probability and statistics.
2. Physics
3. Molecular physics and thermodynamics.
4. Computer Science
5. Information technology.
6. Social Science
7. Architecture as an art form.

4. Preparation materials
4.1.Recommended reading

Field of science 1. Civil engineering and construction

Reading list in English
1. Levenspiel, Oct. Understanding engineering thermo. Corvallis, OR : Distributed by OSU Bookstore, 2000.—URL: https://archive.org/details/understandingeng0000leve/page/n7/mode/2up
2. Lynn, M. Elementary algebra. Houston, Texas : OpenStax College, Rice University, 2017.—URL: https://archive.org/details/ElementaryAlgebra_201904/page/n3/mode/2up
3. The Architects' Handbook / Edited by Quentin Pickard Riba.—Blackwell Science Ltd., 2002.—URL: https://archive.org/details/architectureinfrancetaschen/Architects%27%20Handbook.pdf (free access).
4. Thomas, D. Architecture and the Urban Environment: a vision for the new age. - Oxford ; Boston, MA : Architectural Press, 2002.—URL: https://archive.org/details/architectureinfrancetaschen/Architecture%20and%20the%20Urban%20Environment%20A%20Vision%20for%20the%20New%20Age.pdf

5. Wischhusen, M. Intermediate information and communication technology : compulsory units.—Oxford: Heinemann Educational, 2000.—URL: https://archive.org/details/intermediateinfo0000wisc

Field of science 2. Mechanics

Reading list in English
1. Orland P. Math for Programmers.—Manning. Shelter Island, 2019.— URL: https://oceanofpdf.com/authors/paul-orland/pdf-epub-math-for-programmers-download/
2. Ginzburg V. L., Levin L. M., Rabinovich M. S. Molecular Physics, Thermodynamics, Atomic and Nuclear Physics: Problems in Undergraduate Physics.—Pergamon Press Ltd., 2013.—URL: https://www.google.ru/books/edition/Molecular_Physics_Thermodynamics_Atomic/NzQvBQAAQBAJ?hl=ru&gbpv=1 (free access).
3. Graham F. C. Computational Grids: Generations, Adaptation & Solution Strategies (Series in Computational and Physical Processes in Mechanics).—CRC Press, 1997.—URL: https://books.google.ru/books?id=0w4iXh4FXKYC&printsec=frontcover&hl=ru#v=onepage&q&f=false

Field of science 3: Urban studies

Reading list in English
Harata, N. Fundamentals of “Transportation-Oriented Urban Planning”. In: Horita, M., Koizumi, H. (eds) Innovations in Collaborative Urban Regeneration. C SUR-UT Series: Library for Sustainable Urban Regeneration, vol 6. Springer, Tokyo. 2014. https://doi.org/10.1007/978-4-431-99264-6_3
Jacopo Parravicini, The Foundations of Experimental Physics: Unraveling the Premises of Physical and Scientific Knowledge // Department of Physics and Astronomy University of Florence Sesto Fiorentino (Firenze), Italy, 2024.—URL: https://ru.z-lib.fm/book/28999580/afd715/the-foundations-of-experimental-physics-unraveling-the-premises-of-physical-and-scientific-knowledg.html?dsource=recommend
Jacobs J. The Death and Life of Great American Cities (Modern Library): 50th Anniversary Edition Hardcover—13 Sept. 2011.—URL: https://oceanofpdf.com/authors/jane-jacobs/pdf-epub-the-death-and-life-of-great-american-cities-download-66471486402/ (free access).
Planning and urban design standards / American Planning Association.— 1st ed.—Hoboken, N.J. : John Wiley & Sons, 2006.—URL: https://www.just.edu.jo/~arabed/assets/files/UP-702-PlanningandUrbanDesignStandards.pdf
Yoshiwara K. Modeling, Functions, and Graphs // Department of Mathematics Los Angeles Pierce College.—URL: https://yoshiwaramath.org/mfg/colophon-1.html

Field of science 4: Road construction

Reading list in English
Swenson L. Pythagorean Theorem: History, Applications, and Proofs.—flexbook.—URL: https://www.dropbox.com/scl/fi/r718xioudbuugv985jxyo/Geometry-Pythagorean-Theorem-with-Solutions.pdf?rlkey=otpyucpbzr7fwi32rbzov6rof&e=1&dl=0
Hutchinson, B. G. Principles of urban transport systems planning Washington, Scripta Book Co. 1974.—https://www.civil.iitb.ac.in/~dhingra/ce751/hutchinson.pdf
Shapiro Joel A. Classical Mechanics.—2010.—URL:

https://www.physics.rutgers.edu/~shapiro/507/book.pdf
DeJong M. Information Literacy for Science and Engineering Students.—Bloomsbury Libraries Unlimited.—2024.—URL: https://www.bloomsbury.com/us/information-literacy-for-science-and-engineering-students-9781440878763/ (free access).
Smelser Neil J. The Sociology of Economic Life.—Quid Pro Books, 2013.—URL: https://books.google.ru/books/about/The_Sociology_of_Economic_Life.html?id=EoGbKUblWikC&redir_esc=y

Field of science 5: Construction technology

Reading list in English
Wasserman L. All of Statistics: A Concise Course in Statistical Inference.—Pittsburgh, Pennsylvania, 2003.—URL: https://egrcc.github.io/docs/math/all-of-statistics.pdf
Sinha S. K., Dey T.K. Molecular Physics: Kinetic Theory and Thermodynamics.—Alpha Science International Limited, 2006.—URL: https://books.google.ru/books/about/Molecular_Physics.html?id=mv_iPQAACAAJ&redir_esc=y
Blankenbaker, E. Keith. Construction and building technology / by E. Keith Blankenbaker—1st. - The Goodheart-Willcox Company, Inc., 2013.—URL: https://www.g-wonlinetextbooks.com/construction-building-technology-2013/2
Ingold T. Making Anthropology, Archaeology, Art and Architecture.—Routledge. 2013.—URL: http://ndl.ethernet.edu.et/bitstream/123456789/8315/1/179.pdf

4.2.Recommended online courses

Field of science 1. Civil engineering and construction

Online courses in English	**Link**	**Course description**
City Design	https://stepik.org/course/43/promo?search=4777805584	This course provides a foundational understanding of urban systems.
Historic Monuments in the World	URL: https://stepik.org/course/181095/promo?search=5050198854	This quiz invites its takers to explore the remarkable creations of nature and humanity, including architectural masterpieces.
Discovering expressions, equations and functions	URL:https://www.mathplanet.com/education/algebra-1/discovering-expressions-equations-and-functions/expressions-and-variables	This course introduces mathematical fundamentals with a focus on expressions, equations, and functions.

Field of science 2. Mechanics

Online courses in English	**Link**	**Course description**

Introduction to middleschool physics	URL: https://www.khanacademy.org/science/ms-physics/x1baed5db7c1bb50b:movement-and-forces/x1baed5db7c1bb50b:representing-motion/v/introduction-to-middle-school-physics	This course provides students with a basic understanding of the physical laws that govern the world, covering topics such as forces and motion, energy, and waves.
Mostly Physics	URL: https://www.youtube.com/@mostlyphysics	This course offers a series of videos for participants seeking to gain a grasp of general physics.
Physics 1 Course—Algebra Based—Unit 1 Displacement, Velocity, Vectors & Scalars	URL: https://www.mathtutordvd.com/public/Physics-1-Course-Unit-1Displacement-Velocity-Vectors-Scalars.cfm	This course covers vectors, motion, force, energy, and work, focusing on example-based instruction to help students effectively develop practical skills.

Field of science 3. Urban studies

Online courses in English	**Link**	**Course description**
Modeling Urban Ecosystems	URL:https://stepik.org/course/172614	This course aims to improve understanding of the properties, processes, functions, and services of urban ecosystems. It reviews existing approaches to ecological modeling for their applicability to urban ecosystems. The theory and practice of statistical, GIS, and process modeling are presented through case studies of ecological processes and risks, such as air and soil pollution or climate change. The course provides a deeper understanding of the interactions between urban inhabitants and the environment and offers appropriate tools for analyzing and modeling these interactions and their consequences.
Geography of Russia (Online School by European Gymnasium)	URL: https://stepik.org/course/82658/promo?search=4777815738	This course aims to develop a thorough understanding of the concepts related to Russia's federal structure and its geographical and natural features.

Fundamentals of Earth Remote Sensing and Geographic Information Systems	https://stepik.org/course/170081/promo	This course focuses on studying methods of mapping and data analysis.

Field of science 4: Road construction

Online courses in English	**Link**	**Course description**
Structural Dynamics	URL: https://stepik.org/course/172763	This course introduces fundamental principles of urban system structure.
Civil 3D Mastery: Comprehensive Guide from Basics to Advance	URL:https://stepik.org/course/200974/promo?search=5050071018	This course helps participants become familiar with the principles of working in Civil 3D and begin using its basic tools and features to address common design tasks.
Heat engineering	URL: https://openedu.ru/course/urfu/TEPL/?ysclid=m09rrkeoyd220361634	This course covers the fundamentals of technical thermodynamics and the theory of heat transfer and heat exchange.

Field of science 5: Construction technology

Online courses in English	**Link**	**Course description**
Urban planning	URL: https://stepik.org/course/172614	This course introduces methods employed in urban planning.
Green city and sustainable urban landscapes design	URL: https://mgsu.ru/universityabout/Struktura/Institути/IDPO/68865/	This course covers methods related to green cities and the design of sustainable urban landscapes.
Construction vocabulary booster	URL: https://learn.mgsu.ru/course/view.php?id=5239	The course is aimed at enhancing participants' construction vocabulary.