

Program: Urbanism & Civil Engineering

This document outlines the scope of themes, which may be included in the Olympiad tests. The themes are grouped by areas and are followed by the list of recommended references in the Russian and English languages.

Olympiad winner's skill set by Subject

The winner of the Olympiad in the field of "Urbanism and civil engineering" must have the following skills.

Analytical activity

1. Analysis of mechanical systems. Analysis of stresses, strains, forces and displacements of building structures
2. Analysis of design solutions
3. Analysis of the structure and properties of building materials
4. Analysis of urban planning solutions

Project-oriented activity

1. Implementation of a simplified design scheme and analytical dependencies of the element operation. Selection of optimal sizes and shapes of cross sections of rods
2. Implementation of quality control of building materials. Performing verification calculations of structures
3. Development of solutions for territorial development

Research activities

1. Calculation of rigidity, strength and stability of structural elements, buildings and structures (tension-compression, torsion, shear, bending, combined loading).
2. the identification and evaluation of diverse building materials to ensure appropriate material selection and precise mix design for construction projects.
3. Comprehensive study of the processes, problems and trends of territorial development.

Content

Section 1. Strength of materials

1. Types of loading
2. Stress. Normal stress. Shear stress
3. Strain
4. Mechanical properties of materials. The stress-strain diagram. Stress-strain behavior of structural material. Hook's law. Modulus of elasticity. Strength
5. Tension and compression. Statically determinate and indeterminate axially loaded systems
6. State of stress
7. Geometric properties of an area. Centroid of an area. Moment of inertia for an area. Polar moment of inertia
8. Torsion. Torsional stress
9. Bending. Shear and moment diagram. The flexure formula
10. Combined loading

Section 2. Civil engineering materials

1. Fundamental of building materials. Structures of materials.
2. Physical properties. Density, apparent density, bulk density. Specific gravity. Porosity.
3. Thermal properties. Temperature. Specific heat. Thermal conductivity and heat capacity.
4. Cement. Composition. Properties.
5. Concrete. Types of concrete. Components of concrete. Aggregates for concrete. Testing. Mechanical properties.
6. Concrete mix design. The design of the mix proportion of concrete.
7. Wall materials. Bricks. Blocks. Plates.
8. Steel. Steel for different applications. Testing. Mechanical properties.
9. Wood. Structures of wood. Testing. Mechanical properties.
10. Heat-insulating materials.

Section 3. Structural mechanics

1. Statistically determinate and statically indeterminate rod systems.
2. Geometrically unstable and geometrically stable rod systems.
3. Structural analysis of statically determinate multispans hinged beams.
4. Structural analysis of statically determinate frames with closed boundary shape.
5. Structural analysis of statically determinate trusses.
6. Calculation of displacements in statically determinate frames and beams.
7. Calculation basis of statically indeterminate rod systems by force method.
8. Calculation basis of statically indeterminate rod systems by the displacement method.

Section 4. Building structures

Reinforced concrete structures

1. Mechanical properties of materials for reinforced concrete.
2. Limit state design.
3. Design of reinforced concrete structures according to the Ultimate Limit State (ULS).
4. Analysis of normal (cross) sections.
5. Analysis of inclined (diagonal) sections.
6. Reinforced concrete beams and slabs. Balanced-, Over-Reinforced, and Under-Reinforced Beams.
7. Design of reinforced concrete structures according to Serviceability Limit State (SLS)
8. Prestressed concrete.

Steel structures

9. Materials for structures and connections.
10. Design characteristics of structures and connections.
11. Effective length and ultimate flexibility of steel structure elements.
12. Analysis of elements of steel structures under central tension and compression.
13. Analysis of elements of steel structures in bending.

Section 5. Urbanism

1. The history of the urban development spaces. The main schools and theories of urban studies.
2. Models of modern cities. Problems and trends in the development of the urban environment.
3. The social environment of the city.

4. Urban transport.
5. Green spaces in the urban environment.
6. Digitalization processes in modern urbanism.

Recommended literature

Section 1. Strength of materials

Sources in English	Topic
<p>1. Beer F.P., Johnston E. R., DeWolf J.T., Mazurek D.F. Mechanics of Materials. McGraw Hill, 2019, 896 p.</p> <p>https://www.amazon.com/Mechanics-Materials-Ferdinand-P-Beer/dp/1260113272</p> <p>Limited access</p>	<ol style="list-style-type: none"> 1. Types of loading. 2. Stress. Normal stress. Shear stress. 3. Strain. 4. Mechanical properties of materials. The stress-strain diagram. Stress-strain behavior of structural material. Hook's law. Modulus of elasticity. Strength. 5. Tension and compression. Statically determinate and indeterminate axially loaded systems. 6. State of stress. 7. Geometric properties of an area. Centroid of an area. Moment of inertia for an area. Polar moment of inertia. 8. Torsion. Torsional stress. 9. Bending. Shear and moment diagram. The flexure formula. 10. Combined loading.
<p>2. Case J., Chilver L., ROSS C. Strength of Materials and Structures, Fourth Edition, Butterworth-Heinemann. 1999. 706 p.</p> <p>https://www.sciencedirect.com/book/9780340719206/strength-of-materials-and-structures</p> <p>Limited access</p>	<ol style="list-style-type: none"> 1. Types of loading. 2. Stress. Normal stress. Shear stress. 3. Strain. 4. Mechanical properties of materials. The stress-strain diagram. Stress-strain behavior of structural material. Hook's law. Modulus of elasticity. Strength. 5. Tension and compression. Statically determinate and indeterminate axially loaded systems. 6. State of stress. 7. Geometric properties of an area. Centroid of an area. Moment of inertia for an area. Polar moment of inertia. 8. Torsion. Torsional stress. 9. Bending. Shear and moment diagram. The flexure formula.

<p>3. Hibbeler R.C. Mechanics of Materials, 10th Global Edition. Pearson, 2018. 896 p.</p> <p>https://www.internshipslive.com/2022/01/mechanics-of-materials-10th-edition-pdf.html</p> <p>Limited access</p>	<p>10. Combined loading.</p> <ol style="list-style-type: none"> 1. Types of loading. 2. Stress. Normal stress. Shear stress. 3. Strain. 4. Mechanical properties of materials. The stress-strain diagram. Stress-strain behavior of structural material. Hook's law. Modulus of elasticity. Strength. 5. Tension and compression. Statically determinate and indeterminate axially loaded systems. 6. State of stress. 7. Geometric properties of an area. Centroid of an area. Moment of inertia for an area. Polar moment of inertia. 8. Torsion. Torsional stress. 9. Bending. Shear and moment diagram. The flexure formula. 10. Combined loading.
<p>4. Hučko B., Jančo R. Introduction to Mechanics of Materials: Part I, Bookboon, 2013, 160 p.</p> <p>https://bookboon.com/en/introduction-to-mechanics-of-materials-part-i-ebook</p> <p>Free access</p>	<ol style="list-style-type: none"> 1. Types of loading. 2. Stress. Normal stress. Shear stress. 3. Strain. 4. Mechanical properties of materials. The stress-strain diagram. Stress-strain behavior of structural material. Hook's law. Modulus of elasticity. Strength. 5. Tension and compression. Statically determinate and indeterminate axially loaded systems. 6. State of stress. 7. Geometric properties of an area. Centroid of an area. Moment of inertia for an area. Polar moment of inertia. 8. Torsion. Torsional stress.
<p>5. Hučko B., Jančo R. Introduction to Mechanics of Materials: Part II, Bookboon, 2013, 234 p.</p> <p>https://bookboon.com/en/introduction-to-mechanics-of-materials-part-ii-ebook</p> <p>Free access</p>	<ol style="list-style-type: none"> 9. Bending. Shear and moment diagram. The flexure formula.
<p>6. Potter M.C. Schaum's Outline of Strength of Materials, 7th Edition, 2019, 304 p.</p>	<ol style="list-style-type: none"> 1. Types of loading. 2. Stress. Normal stress. Shear stress.

<p>https://www.accessengineeringlibrary.com/content/book/9781260456547/</p> <p>Limited access</p>	<p>3. Strain.</p> <p>4. Mechanical properties of materials. The stress-strain diagram. Stress-strain behavior of structural material. Hook's law. Modulus of elasticity. Strength.</p> <p>5. Tension and compression. Statically determinate and indeterminate axially loaded systems.</p> <p>6. State of stress.</p> <p>7. Geometric properties of an area. Centroid of an area. Moment of inertia for an area. Polar moment of inertia.</p> <p>8. Torsion. Torsional stress.</p> <p>9. Bending. Shear and moment diagram. The flexure formula.</p> <p>10. Combined loading.</p>
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Sources in Russian	Topic
<p>1. Миролюбов И.Н. и др. Сопротивление материалов: Пособие по решению задач. – 9-е изд., испр. – СПб.: Издательство «Лань», 2022. – 512 с.</p> <p>https://e.lanbook.com/book/211427</p> <p>Free access</p>	<p>1. Types of loading.</p> <p>2. Stress. Normal stress. Shear stress.</p> <p>3. Strain.</p> <p>4. Mechanical properties of materials. The stress-strain diagram. Stress-strain behavior of structural material. Hook's law. Modulus of elasticity. Strength.</p> <p>5. Tension and compression. Statically determinate and indeterminate axially loaded systems.</p> <p>6. State of stress.</p> <p>7. Geometric properties of an area. Centroid of an area. Moment of inertia for an area. Polar moment of inertia.</p> <p>8. Torsion. Torsional stress.</p> <p>9. Bending. Shear and moment diagram. The flexure formula.</p> <p>10. Combined loading.</p>
<p>2. Павлов П.А., Паршин Л.К., Мельников Б.Е., Шерстнев В.А. Сопротивление материалов: учебник. 5-е изд. Санкт-Петербург: Лань, 2022. 556 с.</p> <p>https://e.lanbook.com/book/206420</p> <p>Limited access</p>	<p>1. Types of loading.</p> <p>2. Stress. Normal stress. Shear stress.</p> <p>3. Strain.</p> <p>4. Mechanical properties of materials. The stress-strain diagram. Stress-strain behavior of structural material. Hook's law. Modulus of elasticity. Strength.</p>

	<p>5. Tension and compression. Statically determinate and indeterminate axially loaded systems.</p> <p>6. State of stress.</p> <p>7. Geometric properties of an area. Centroid of an area. Moment of inertia for an area. Polar moment of inertia.</p> <p>8. Torsion. Torsional stress.</p> <p>9. Bending. Shear and moment diagram. The flexure formula.</p> <p>10. Combined loading.</p>
<p>3. Павлов П.А., Паршин Л.К., Мельников Б.Е., Шерстнев В.А. Сборник задач по сопротивлению материалов: учебное пособие, 5-е изд. Санкт-Петербург: Лань, 2022. 432 с.</p> <p>https://e.lanbook.com/book/209822</p> <p>Limited access</p>	<p>1. Types of loading.</p> <p>2. Stress. Normal stress. Shear stress.</p> <p>3. Strain.</p> <p>4. Mechanical properties of materials. The stress-strain diagram. Stress-strain behavior of structural material. Hook's law. Modulus of elasticity. Strength.</p> <p>5. Tension and compression. Statically determinate and indeterminate axially loaded systems.</p> <p>6. State of stress.</p> <p>7. Geometric properties of an area. Centroid of an area. Moment of inertia for an area. Polar moment of inertia.</p> <p>8. Torsion. Torsional stress.</p> <p>9. Bending. Shear and moment diagram. The flexure formula.</p> <p>10. Combined loading.</p>
<p>4. Феодосьев В.И. Сопротивление материалов: Учебник для студ-ов высш.техн.учеб.зав. 10-е изд. М.: Изд-во МГТУ им. Н.Э. Баумана, 1999. – 592 с.</p> <p>https://pnu.edu.ru/media/filer_public/2013/04/10/2-12_fedosev_sopromat_1999.pdf</p> <p>Free access</p>	<p>1. Types of loading.</p> <p>2. Stress. Normal stress. Shear stress.</p> <p>3. Strain.</p> <p>4. Mechanical properties of materials. The stress-strain diagram. Stress-strain behavior of structural material. Hook's law. Modulus of elasticity. Strength.</p> <p>5. Tension and compression. Statically determinate and indeterminate axially loaded systems.</p> <p>6. State of stress.</p> <p>7. Geometric properties of an area. Centroid of an area. Moment of inertia for an area. Polar moment of inertia.</p> <p>8. Torsion. Torsional stress.</p>

	<p>9. Bending. Shear and moment diagram. The flexure formula.</p> <p>10. Combined loading.</p>
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Section 2. Civil engineering materials

Sources in English	Topic
<p>1. Claisse P. Civil Engineering Materials. Butterworth-Heinemann, 2016. 496 p.</p> <p>https://www.sciencedirect.com/book/9780081002759/civil-engineering-materials</p> <p>Limited access</p>	<p>1. Fundamental of building materials. Structures of materials.</p> <p>2. Physical properties. Density, apparent density, bulk density. Specific gravity. Porosity.</p> <p>3. Thermal properties. Temperature. Specific heat. Thermal conductivity and heat capacity.</p> <p>4. Cement. Composition. Properties.</p> <p>5. Concrete. Types of concrete. Components of concrete. Aggregates for concrete. Testing. Mechanical properties.</p> <p>6. Concrete mix design. The design of the mix proportion of concrete.</p> <p>7. Wall materials. Bricks. Blocks. Plates.</p> <p>8. Steel. Steel for different applications. Testing. Mechanical properties.</p> <p>9. Wood. Structures of wood. Testing. Mechanical properties.</p> <p>10. Heat-insulating materials.</p>
<p>2. Meng Gong, Engineered Wood Products for Construction. IntechOpen, 2022. 358 p.</p> <p>https://www.intechopen.com/books/10584</p> <p>Free access</p>	<p>1. Fundamental of building materials. Structures of materials.</p> <p>9. Wood. Structures of wood. Testing. Mechanical properties.</p>
<p>3. Samui P., Kim D., Lyer N.R., Chaudhary S. New Materials in Civil Engineering, Butterworth-Heinemann, 2020. 1043 p.</p> <p>https://www.sciencedirect.com/book/9780128189610/new-materials-in-civil-engineering</p> <p>Limited access</p>	<p>1. Fundamental of building materials. Structures of materials.</p> <p>2. Physical properties. Density, apparent density, bulk density. Specific gravity. Porosity.</p> <p>3. Thermal properties. Temperature. Specific heat. Thermal conductivity and heat capacity.</p> <p>4. Cement. Composition. Properties.</p> <p>5. Concrete. Types of concrete. Components of concrete. Aggregates for concrete. Testing. Mechanical properties.</p> <p>6. Concrete mix design. The design of the mix proportion of concrete.</p> <p>7. Wall materials. Bricks. Blocks. Plates.</p>

	<p>8. Steel. Steel for different applications. Testing. Mechanical properties.</p> <p>9. Wood. Structures of wood. Testing. Mechanical properties.</p> <p>10. Heat-insulating materials.</p>
<p>4. Yuan Q., Liu Z., Zheng K., Ma C. Civil Engineering Materials: From Theory to Practice. Woodhead Publishing, 2021. 389 p.</p> <p>https://www.sciencedirect.com/book/9780128228654/civil-engineering-materials</p> <p>Limited access</p>	<p>1. Fundamental of building materials. Structures of materials.</p> <p>2. Physical properties. Density, apparent density, bulk density. Specific gravity. Porosity.</p> <p>3. Thermal properties. Temperature. Specific heat. Thermal conductivity and heat capacity.</p> <p>4. Cement. Composition. Properties.</p> <p>5. Concrete. Types of concrete. Components of concrete. Aggregates for concrete. Testing. Mechanical properties.</p> <p>6. Concrete mix design. The design of the mix proportion of concrete.</p> <p>7. Wall materials. Bricks. Blocks. Plates.</p> <p>8. Steel. Steel for different applications. Testing. Mechanical properties.</p> <p>9. Wood. Structures of wood. Testing. Mechanical properties.</p> <p>10. Heat-insulating materials.</p>
<p>5. Zhang H. Building Materials in Civil Engineering. Woodhead Publishing, 2011. 440 p.</p> <p>https://www.sciencedirect.com/book/9781845699550/building-materials-in-civil-engineering</p> <p>Limited access</p>	<p>1. Fundamental of building materials. Structures of materials.</p> <p>2. Physical properties. Density, apparent density, bulk density. Specific gravity. Porosity.</p> <p>3. Thermal properties. Temperature. Specific heat. Thermal conductivity and heat capacity.</p> <p>4. Cement. Composition. Properties.</p> <p>5. Concrete. Types of concrete. Components of concrete. Aggregates for concrete. Testing. Mechanical properties.</p> <p>6. Concrete mix design. The design of the mix proportion of concrete.</p> <p>7. Wall materials. Bricks. Blocks. Plates.</p> <p>8. Steel. Steel for different applications. Testing. Mechanical properties.</p> <p>9. Wood. Structures of wood. Testing. Mechanical properties.</p> <p>10. Heat-insulating materials.</p>

Sources in Russian	Topic
<p>1. Барабанщиков Ю.Г. Строительные материалы и изделия. 5-е изд. М.: Издательский центр «Академия», 2014. – 416 с.</p> <p>http://bask-rb.ru/wp-content/uploads/2020/09/Строительные-материалы-и-изделия.pdf</p> <p>Free access</p>	<ol style="list-style-type: none"> 1. Fundamental of building materials. Structures of materials. 2. Physical properties. Density, apparent density, bulk density. Specific gravity. Porosity. 3. Thermal properties. Temperature. Specific heat. Thermal conductivity and heat capacity. 4. Cement. Composition. Properties. 5. Concrete. Types of concrete. Components of concrete. Aggregates for concrete. Testing. Mechanical properties. 6. Concrete mix design. The design of the mix proportion of concrete. 7. Wall materials. Bricks. Blocks. Plates. 8. Steel. Steel for different applications. Testing. Mechanical properties. 9. Wood. Structures of wood. Testing. Mechanical properties. 10. Heat-insulating materials.
<p>2. Мещеряков Ю.Г., Фёдоров С.В. Строительные материалы: учебник для студентов ВПО, обучающихся по направлению 270800 «Строительство» / Ю. Г. Мещеряков, С. В. Фёдоров; НОУ ДПО «ЦИПК». – СПб, 2013. – 400 с.: ил. ISBN 978-5-85855-122-5</p> <p>https://lib.intuit.kg/wp-content/uploads/2020/06/%D0%AE_%D0%93_%D0%9C%D0%B5%D1%89%D0%B5%D1%80%D1%8F%D0%BA%D0%BE%D0%B2-%D0%A1_%D0%92_%D0%A4%D1%91%D0%B4%D0%BE%D1%80%D0%BE%D0%B2_%D0%A1%D1%82%D1%80%D0%BE%D0%B8%D1%82%D0%B5%D0%BB%D1%8C_%D0%BD%D1%8B%D0%B5-%D0%BC%D0%B0%D1%82%D0%B5%D1%80%D0%B8%D0%B0%D0%BB%D1%8B-%D0%B8-%D0%B8%D0%B7%D0%B4%D0%B5%D0%BB%D0%B8%D1%8F-2013-1.pdf</p> <p>Free access</p>	<ol style="list-style-type: none"> 1. Fundamental of building materials. Structures of materials. 2. Physical properties. Density, apparent density, bulk density. Specific gravity. Porosity. 3. Thermal properties. Temperature. Specific heat. Thermal conductivity and heat capacity. 4. Cement. Composition. Properties. 5. Concrete. Types of concrete. Components of concrete. Aggregates for concrete. Testing. Mechanical properties. 6. Concrete mix design. The design of the mix proportion of concrete. 7. Wall materials. Bricks. Blocks. Plates. 8. Steel. Steel for different applications. Testing. Mechanical properties. 9. Wood. Structures of wood. Testing. Mechanical properties. 10. Heat-insulating materials.

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<p>3. Попов К.Н., Каддо М.Б. Строительные материалы и изделия. М.: Высш. шк. 2001. 367 с.</p> <p>https://www.studmed.ru/view/popov-kn-kaddo-mb-stroitelnye-materialy-i-izdeliya_279f0e12e1e.html</p> <p>Free access</p>	<ol style="list-style-type: none"> 1. Fundamental of building materials. Structures of materials. 2. Physical properties. Density, apparent density, bulk density. Specific gravity. Porosity. 3. Thermal properties. Temperature. Specific heat. Thermal conductivity and heat capacity. 4. Cement. Composition. Properties. 5. Concrete. Types of concrete. Components of concrete. Aggregates for concrete. Testing. Mechanical properties. 6. Concrete mix design. The design of the mix proportion of concrete. 7. Wall materials. Bricks. Blocks. Plates. 8. Steel. Steel for different applications. Testing. Mechanical properties. 9. Wood. Structures of wood. Testing. Mechanical properties. 10. Heat-insulating materials.
<p>4. Строительные материалы и изделия: учеб. пособие / В.С. Руднов [и др.] ; под общ. ред. доц., канд. техн. наук И.К. Доманской.— Екатеринбург: Изд-во Урал. ун-та, 2018.— 203 с. ISBN 978-5-7996-2352-4</p> <p>https://elar.urfu.ru/bitstream/10995/58610/1/978-5-7996-2352-4_2018.pdf</p> <p>Free access</p>	<ol style="list-style-type: none"> 1. Fundamental of building materials. Structures of materials. 2. Physical properties. Density, apparent density, bulk density. Specific gravity. Porosity. 3. Thermal properties. Temperature. Specific heat. Thermal conductivity and heat capacity. 4. Cement. Composition. Properties. 5. Concrete. Types of concrete. Components of concrete. Aggregates for concrete. Testing. Mechanical properties. 6. Concrete mix design. The design of the mix proportion of concrete. 7. Wall materials. Bricks. Blocks. Plates. 8. Steel. Steel for different applications. Testing. Mechanical properties. 9. Wood. Structures of wood. Testing. Mechanical properties. 10. Heat-insulating materials.

Section 3. Structural mechanics

Sources in English	Topic
<p>1. Ghali A., Neville A.M. Structural Analysis. A Unified Classical and Matrix Approach (7th edition): Taylor & Francis Group, 2017. 934 p.</p>	<ol style="list-style-type: none"> 1. Statistically determinate and statically indeterminate rod systems.

<p>https://www.taylorfrancis.com/books/mono/10.1201/b22004/structural-analysis-amin-ghali-neville-brown</p> <p>Limited access</p>	<ol style="list-style-type: none"> 2. Geometrically unstable and geometrically stable rod systems. 3. Structural analysis of statically determinate multispan hinged beams. 4. Structural analysis of statically determinate frames with closed boundary shape. 5. Structural analysis of statically determinate trusses. 6. Calculation of displacements in statically determinate frames and beams. 7. Calculation basis of statically indeterminate rod systems by force method. 8. Calculation basis of statically indeterminate rod systems by the displacement method.
<p>2. Karnovsky I.A., Lebed O. Advanced methods of Structural Analysis. Strength, Stability, Vibration. Second Edition: Springer, 2021. 795 p.</p> <p>https://books.google.ru/books?id=b1YkEAAAQBAJ&printsec=frontcover&hl=ru#v=onepage&q&f=false</p> <p>Limited access</p>	<ol style="list-style-type: none"> 1. Statically determinate and statically indeterminate rod systems. 2. Geometrically unstable and geometrically stable rod systems. 3. Structural analysis of statically determinate multispan hinged beams. 4. Structural analysis of statically determinate frames with closed boundary shape. 5. Structural analysis of statically determinate trusses. 6. Calculation of displacements in statically determinate frames and beams. 7. Calculation basis of statically indeterminate rod systems by force method. 8. Calculation basis of statically indeterminate rod systems by the displacement method.
<p>3. Leet K.M., Uang C.M., Gilbert A.M. Fundamentals of Structural Analysis: McGraw-Hill (fifth Version), McGraw-Hill Education, 2018. 801 p.</p> <p>https://freepdfbook.com/fundamentals-of-structural-analysis-pdf-free/</p> <p>Free access</p>	<ol style="list-style-type: none"> 1. Statically determinate and statically indeterminate rod systems. 2. Geometrically unstable and geometrically stable rod systems. 3. Structural analysis of statically determinate multispan hinged beams. 4. Structural analysis of statically determinate frames with closed boundary shape. 5. Structural analysis of statically determinate trusses. 6. Calculation of displacements in statically determinate frames and beams. 7. Calculation basis of statically indeterminate rod systems by force method.

	8. Calculation basis of statically indeterminate rod systems by the displacement method.
<p>4. Pataik S.N., Hopkins D.A. Strength of Materials. A Unified Theory: Elsevier, 2004. 750 p.,</p> <p>http://nzdr.ru/data/media/biblio/kolxoz/E/EM/Pataik%20S.N.,%20Hopkins%20D.A.%20Strength%20of%20Materials..%20A%20Unified%20Theory%20(Elsevier,%202004)(ISBN%20978074024774s)_EM_.pdf</p> <p>Free access</p>	<p>1. Statistically determinate and statically indeterminate rod systems.</p> <p>2. Geometrically unstable and geometrically stable rod systems.</p> <p>3. Structural analysis of statically determinate multispan hinged beams.</p> <p>4. Structural analysis of statically determinate frames with closed boundary shape.</p> <p>5. Structural analysis of statically determinate trusses.</p> <p>6. Calculation of displacements in statically determinate frames and beams.</p> <p>7. Calculation basis of statically indeterminate rod systems by force method.</p> <p>8. Calculation basis of statically indeterminate rod systems by the displacement method.</p>

Sources in Russian	Topic
<p>1. Баженов В.А., Перельмутер А.В., Шишов О.В. Строительная механика. Компьютерные технологии и моделирование. К.: ПАТ «ВИПОЛ», 2014. 912с.</p> <p>https://www.livelib.ru/book/1001320566-stroitel'naya-mehanika-kompyuternye-tehnologii-i-modelirovanie-uchebnik-anatolij-perelmuter</p> <p>Limited access</p>	<p>1. Statistically determinate and statically indeterminate rod systems.</p> <p>2. Geometrically unstable and geometrically stable rod systems.</p> <p>3. Structural analysis of statically determinate multispan hinged beams.</p> <p>4. Structural analysis of statically determinate frames with closed boundary shape.</p> <p>5. Structural analysis of statically determinate trusses.</p> <p>6. Calculation of displacements in statically determinate frames and beams.</p> <p>7. Calculation basis of statically indeterminate rod systems by force method.</p> <p>8. Calculation basis of statically indeterminate rod systems by the displacement method.</p>
<p>2. Дарков А.В., Шапошников Н.Н. Строительная механика. СПб: Издательство «Лань», 2010. 656 с.</p> <p>https://e.lanbook.com/book/212861</p> <p>Free access</p>	<p>1. Statistically determinate and statically indeterminate rod systems.</p> <p>2. Geometrically unstable and geometrically stable rod systems.</p> <p>3. Structural analysis of statically determinate multispan hinged beams.</p> <p>4. Structural analysis of statically determinate frames with closed boundary shape.</p>

	<p>5. Structural analysis of statically determinate trusses.</p> <p>6. Calculation of displacements in statically determinate frames and beams.</p> <p>7. Calculation basis of statically indeterminate rod systems by force method.</p> <p>8. Calculation basis of statically indeterminate rod systems by the displacement method.</p>
<p>3. Ржаницын А.Р. Строительная механика: учеб.пособие для вузов. М.: Высшая школа, 1982. 400с.</p> <p>https://studizba.com/files/show/pdf/16227-1-rzhanicy-n-a-r--stroitel-naya-mehanika.html</p> <p>Free access</p>	<p>1. Statically determinate and statically indeterminate rod systems.</p> <p>2. Geometrically unstable and geometrically stable rod systems.</p> <p>3. Structural analysis of statically determinate multispan hinged beams.</p> <p>4. Structural analysis of statically determinate frames with closed boundary shape.</p> <p>5. Structural analysis of statically determinate trusses.</p> <p>6. Calculation of displacements in statically determinate frames and beams.</p> <p>7. Calculation basis of statically indeterminate rod systems by force method.</p> <p>8. Calculation basis of statically indeterminate rod systems by the displacement method.</p>
<p>4. Яровая А.В. Строительная механика. Статика стержневых систем. Учебное пособие: М-во образования респ.беларусь, Белорус.гос.ун-т трансп., 2013. 447с.</p> <p>http://elib.bsut.by/handle/123456789/1324?show=full</p> <p>Free access</p>	<p>1. Statically determinate and statically indeterminate rod systems.</p> <p>2. Geometrically unstable and geometrically stable rod systems.</p> <p>3. Structural analysis of statically determinate multispan hinged beams.</p> <p>4. Structural analysis of statically determinate frames with closed boundary shape.</p> <p>5. Structural analysis of statically determinate trusses.</p> <p>6. Calculation of displacements in statically determinate frames and beams.</p> <p>7. Calculation basis of statically indeterminate rod systems by force method.</p> <p>8. Calculation basis of statically indeterminate rod systems by the displacement method.</p>

Section 4. Building structures

Sources in English	Topic
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<p>1. Lingyu Zhou, Liping Wang, Liqiang Jiang. Design of Steel Structures. Materials, Connections, and Components 1st Edition - August 12, 2022.</p> <p>https://shop.elsevier.com/books/design-of-steel-structures/zhou/978-0-323-91682-0</p> <p>Limited access</p>	<p>9. Materials for structures and connections 10. Design characteristics of structures and connections 11. Effective length and ultimate flexibility of steel structure elements 12. Analysis of elements of steel structures under central tension and compression 13. Analysis of elements of steel structures in bending</p>
<p>2. Wight James K. Reinforced concrete: mechanics and design. Boston: Pearson, 2016. ISBN 978-1-292-10601-4.</p> <p>https://search.ebscohost.com/login.aspx?direct=true&db=edsvle&AN=edsvle.AH31546071&lang=ru&site=eds-live</p> <p>Limited access</p>	<p>1. Mechanical properties of materials for reinforced concrete 2. Limit state design 3. Design of reinforced concrete structures according to the Ultimate Limit State (ULS) 4. Analysis of normal (cross) sections 5. Analysis of inclined (diagonal) sections 6. Reinforced concrete beams and slabs. Balanced-, Over-Reinforced, and Under-Reinforced Beams 7. Design of reinforced concrete structures according to Serviceability Limit State (SLS) 8. Prestressed concrete</p>
<p>3. Yining D., Xiliang N. Reinforced Concrete: Basic Theory and Standards. Press and Springer Nature Singapore Pte Ltd. 2023.</p> <p>https://doi.org/10.1007/978-981-19-2920-5</p> <p>Free access</p>	<p>1. Mechanical properties of materials for reinforced concrete 2. Limit state design 3. Design of reinforced concrete structures according to the Ultimate Limit State (ULS) 4. Analysis of normal (cross) sections 5. Analysis of inclined (diagonal) sections 6. Reinforced concrete beams and slabs. Balanced-, Over-Reinforced, and Under-Reinforced Beams 7. Design of reinforced concrete structures according to Serviceability Limit State (SLS) 8. Prestressed concrete</p>

Sources in Russian	Topic
<p>1. Бондаренко В.М. Примеры расчета железобетонных и каменных конструкций: учебное пособие для студентов высших учебных заведений, обучающихся по специальности «Промышленное и гражданское строительство» направления подготовки дипломированных специалистов «Строительство» / В.М. Бондаренко, А.И. Судницын, В.Г. Назаренко; [под редакцией В.М. Бондаренко]. — Москва: Директмедиа: Дистрибьюшн, 2021.</p> <p>http://elib.spbstu.ru/dl/2/ek21-27.pdf</p>	<p>1. Mechanical properties of materials for reinforced concrete 2. Limit state design 3. Design of reinforced concrete structures according to the Ultimate Limit State (ULS) 4. Analysis of normal (cross) sections 5. Analysis of inclined (diagonal) sections 6. Reinforced concrete beams and slabs. Balanced-, Over-Reinforced, and Under-Reinforced Beams 7. Design of reinforced concrete structures according to Serviceability Limit State (SLS) 8. Prestressed concrete</p>

Limited access	
<p>2. Кузнецов, В. С. Железобетонные и каменные конструкции: учебник / В.С. Кузнецов. — Москва: АСВ, 2022. — 360 с.</p> <p>https://elib.spbstu.ru/doc/info?url=https%3A%2F%2Fwww.studentlibrary.ru%2Fbook%2FISBN9785432303257.html</p>	<p>1. Mechanical properties of materials for reinforced concrete</p> <p>2. Limit state design</p> <p>3. Design of reinforced concrete structures according to the Ultimate Limit State (ULS)</p> <p>4. Analysis of normal (cross) sections</p>
Free access	
<p>3. Проектирование металлических конструкций: учебник для вузов. Ч. 1. Металлические конструкции. Материалы и основы проектирования / [С. М. Тихонов, В. Н. Алехин, З. В. Беляева [и др.]; под общей редакцией А. Р. Туснина; [Ассоциация развития стального строительства]. — [Москва]: Перо, 2020.</p> <p>http://elib.spbstu.ru/dl/2/z21-4.pdf</p>	<p>9. Materials for structures and connections</p> <p>10. Design characteristics of structures and connections</p> <p>11. Effective length and ultimate flexibility of steel structure elements</p> <p>12. Analysis of elements of steel structures under central tension and compression</p> <p>13. Analysis of elements of steel structures in bending</p>
Limited access	
<p>4. Проектирование металлических конструкций: учебник для вузов. Ч. 2. Металлические конструкции. Специальный курс / [А. Р. Туснин, В. А. Рыбаков, Т. В. Назмеева [и др.]; под общей редакцией А. Р. Туснина; [Ассоциация развития стального строительства]. — [Москва]: Перо, 2020.</p> <p>http://elib.spbstu.ru/dl/2/z21-5.pdf</p>	<p>9. Materials for structures and connections</p> <p>10. Design characteristics of structures and connections</p> <p>11. Effective length and ultimate flexibility of steel structure elements</p> <p>12. Analysis of elements of steel structures under central tension and compression</p> <p>13. Analysis of elements of steel structures in bending</p>
Limited access	
<p>5. СП 16.13330.2017 Стальные конструкции. Актуализированная редакция СНиП II-23-81* (с Поправками, с Изменениями N 1, 2, 3, 4). Официальное издание. М.: Стандартинформ, 2017.</p> <p>https://docs.cntd.ru/document/456069588?section=text</p>	<p>9. Materials for structures and connections</p> <p>10. Design characteristics of structures and connections</p> <p>11. Effective length and ultimate flexibility of steel structure elements</p> <p>12. Analysis of elements of steel structures under central tension and compression</p> <p>13. Analysis of elements of steel structures in bending</p>
Free access	
<p>6. СП 63.13330.2018 Бетонные и железобетонные конструкции. Основные положения. СНиП 52-01-2003 (с Изменениями № 1, 2). Официальное издание. М.: Стандартинформ, 2019 г.</p>	<p>1. Mechanical properties of materials for reinforced concrete</p> <p>2. Limit state design</p> <p>3. Design of reinforced concrete structures according to the Ultimate Limit State (ULS)</p>

<p>https://docs.cntd.ru/document/554403082?section=text</p> <p>Free access</p>	<p>4. Analysis of normal (cross) sections 5. Analysis of inclined (diagonal) sections 6. Reinforced concrete beams and slabs. Balanced-, Over-Reinforced, and Under-Reinforced Beams 7. Design of reinforced concrete structures according to Serviceability Limit State (SLS) 8. Prestressed concrete</p>
<p>7. Страхов Д.А. Железобетонные и каменные конструкции: учебное пособие. Ч. 1. Прочность, трещиностойкость и перемещения стержневых железобетонных элементов / Д.А. Страхов, В. А. Соколов; Санкт-Петербургский государственный политехнический университет. — Санкт-Петербург: Изд-во Политехн. ун-та, 2011.</p> <p>http://elib.spbstu.ru/dl/2/si20-606.pdf</p> <p>Limited access</p>	<p>1. Mechanical properties of materials for reinforced concrete 2. Limit state design 3. Design of reinforced concrete structures according to the Ultimate Limit State (ULS) 4. Analysis of normal (cross) sections 5. Analysis of inclined (diagonal) sections 6. Reinforced concrete beams and slabs. Balanced-, Over-Reinforced, and Under-Reinforced Beams 7. Design of reinforced concrete structures according to Serviceability Limit State (SLS) 8. Prestressed concrete</p>

Section 5. Urbanism

Sources in English	Topic
<p>1. Colin Ellard. Places of the Heart: The Psychogeography of Everyday Life. Kindle Edition. 257 p.</p> <p>https://www.amazon.com/Places-Heart-Psychogeography-Everyday-Life-ebook/dp/B011H510K0</p> <p>Limited access</p>	<p>2. Models of modern cities. Problems and trends in the development of the urban environment 3. The social environment of the city 5. Green spaces in the urban environment</p>
<p>2. Encyclopedia of Urban Studies 1st Edition, Kindle Edition</p> <p>https://www.amazon.com/Encyclopedia-Urban-Studies-Earl-Hutchison-ebook/dp/B00YFRCST0</p> <p>Limited access</p>	<p>2. Models of modern cities. Problems and trends in the development of the urban environment 3. The social environment of the city 4. Urban transport</p>
<p>3. History of Urban Planning and Design. Cognella Academic Publishing. 2012. 358 p.</p> <p>https://www.amazon.com/History-Planning-Design-Rabinowitz-Bussell/dp/1621310523</p> <p>Limited access</p>	<p>1. The history of the urban development spaces. The main schools and theories of urban studies</p>

<p>4. Rob Kitchin. The Data Revolution: Big Data, Open Data, Data Infrastructures and Their Consequences 1st Edition. SAGE Publications Ltd. 2014. 240 p.</p> <p>https://se.moevm.info/lib/exe/fetch.php/courses:smart data:the data revolution big data open data data infrastructures and their consequences by rob kitchin z-lib.org .pdf</p> <p>Free access</p>	6.Digitalization processes in modern urbanism
<p>5. Vukan Vuchic. Transportation for Livable Cities. Routledge; 1st edition. 378 p.</p> <p>https://www.amazon.com/Transportation-Livable-Cities-Vukan-Vuchic/dp/0882851616</p> <p>Limited access</p>	4. Urban transport
<p>6. William J Mitchell ME++ – The Cyborg Self and the Networked City. Massachusetts Institute of Technology. 2003 269 p.</p> <p>https://satanovakomunita.cz/wp-content/uploads/2020/06/William-J.-Mitchell-Me_-The-Cyborg-Self-and-the-Networked-City-The-MIT-Press-2004.pdf</p> <p>Free access</p>	6.Digitalization processes in modern urbanism

Sources in Russian	Topic
<p>1. Глазычев В.Л. Урбанистика 1-е изд., стер. - Москва: Европа: КДУ, 2008. 326 с.</p> <p>http://www.glazychev.ru/books/urbanistika/Glaziychev_Urbanistika.pdf</p> <p>Free access</p>	<p>1. The history of the urban development spaces. The main schools and theories of urban studies</p> <p>2. Models of modern cities. Problems and trends in the development of the urban environment</p>
<p>2. Микроурбанизм. Город в деталях / Сб. статей; под отв. редакцией О. Бредниковой, О. Запорожец. М.: Новое литературное обозрение, 2014. 352 с.: ил. (Серия studia urbanica)</p> <p>https://www.hse.ru/data/2015/03/21/1323410336/%D0%9C%D0%B8%D0%BA%D1%80%D0%BE%D1%83%D1%80%D0%B1%D0%B0%D0%BD%D0%B8%D0%B7%D0%BC.pdf</p> <p>Free access</p>	<p>2. Models of modern cities. Problems and trends in the development of the urban environment</p> <p>3. The social environment of the city</p>

<p>3. Митягин С.Д. Территориальное планирование, градостроительное зонирование и планировка территории: учебное пособие / С. Д. Митягин. — Санкт-Петербург: Лань, 2022. — 200 с. — ISBN 978-5-8114-4050-4. — Текст: электронный // Лань: электронно-библиотечная система.</p> <p>https://e.lanbook.com/book/206957</p> <p>Free access</p>	<p>2. Models of modern cities. Problems and trends in the development of the urban environment</p>
<p>4. Основы градостроительства: Учебное пособие / Г.А. Малоян. — Москва: Издательство Ассоциации строительных вузов, 2004. — 120 с., ил. — ISBN 5-93093-283-2 https://tehne.com/node/4183</p> <p>Free access</p>	<p>2. Models of modern cities. Problems and trends in the development of the urban environment</p> <p>4. Urban transport</p> <p>5. Green spaces in the urban environment</p>
<p>5. Перькова М.В. Пространственное развитие белгородской региональной системы расселения и ее элементов. БГТУ им. В.Г. Шухова, 2016. 250 с.</p> <p>https://elibrary.ru/item.asp?id=36737182</p> <p>Limited access</p>	<p>2. Models of modern cities. Problems and trends in the development of the urban environment</p> <p>4. Urban transport</p> <p>5. Green spaces in the urban environment</p>
<p>6. Попов Е.В. Умные города: монография. Москва: Издательство Юрайт, 2023. 346 с. ISBN 978-5-534-13732-3. — Текст: электронный // Образовательная платформа Юрайт [сайт].</p> <p>https://urait.ru/viewer/umnye-goroda-519740#page/34</p> <p>Limited access</p>	<p>6. Digitalization processes in modern urbanism</p>
<p>7. Рой О.М. Основы градостроительства и территориального планирования: учебник и практикум для вузов / О. М. Рой. — 2-е изд., испр. и доп. — Москва: Издательство Юрайт, 2019. — 249 с. — (Высшее образование). — Текст : непосредственный. ISBN 978-5-534-11611-3</p> <p>https://azon.market/image/catalog/v_1/product/pdf/373/3725825.pdf</p> <p>Free access</p>	<p>2. Models of modern cities. Problems and trends in the development of the urban environment</p>

Recommended online courses

Section 1. Strength of materials

1. Video Lectures by Dr. Atta ur Rehman Shah, Ph.D. Mechanical Engineering (FreeVideoLectures)
<https://sites.google.com/view/atta85/video-lectures>
2. Strength of Materials (FreeVideoLectures)
<https://freevideolectures.com/course/96/strength-of-materials>
3. Strength of Materials (FreeVideoLectures)
<https://freevideolectures.com/course/2361/strength-of-materials>
4. Mechanics of Materials I: Fundamentals of Stress & Strain and Axial Loading (Coursera)
<https://www.coursera.org/learn/mechanics-1>
5. Mechanics of Materials III: Beam Bending (Coursera)
<https://www.coursera.org/learn/beam-bending>
6. Mechanics of Materials IV: Deflections, Buckling, Combined Loading & Failure Theories (Coursera)
<https://www.coursera.org/learn/materials-structures>
7. Сопротивление материалов (Openedu)
https://openedu.ru/course/misis/MATSTR/?session=spring_2023
8. Сопротивление материалов. Часть 1. Основные положения, растяжение-сжатие прямолинейных стержней, кручение прямолинейных стержней, простой изгиб, сложный изгиб (Openedu)
https://openedu.ru/course/mephi/mephi_sm1/
9. Сопротивление материалов. Часть 2. Теория напряжений, теория предельных состояний, устойчивость, толстостенные трубы, осесимметричные пластины (Openedu)
https://openedu.ru/course/mephi/mephi_sm2/

Section 2. Civil engineering materials

1. Materials behavior (Coursera)
<https://www.coursera.org/learn/material-behavior>
2. Material processing (Coursera)
<https://www.coursera.org/learn/material-science-engineering>
3. Design of Steel-Concrete Composite Structures (EDX)
<https://www.edx.org/course/design-of-steel-concrete-composite-structures>
4. Sustainable building with timber (EDX)
<https://www.edx.org/course/building-with-timber/>
5. Основы расчета строительных конструкций (Openedu)
https://openedu.ru/course/spbstu/BASBUILD/?session=spring_2023

Section 3. Structural mechanics

1. Fundamentals of Structural Analysis (Udemy)
https://www.udemy.com/course/statics-for-engineering-undergrads/?utm_medium=website&utm_source=archdaily.com
2. Mechanics of Materials I: Fundamentals of Stress & Strain and Axial Loading (Coursera)
https://www.coursera.org/learn/mechanics-1?irclid=xOxWoo2vUxyPwMXUVWY2ITICUkFwX0RdHxVyQw0&irgwc=1&utm_medium=partners&utm_source=impact&utm_campaign=3400355&utm_content=b2c
3. Applications of theoretical mechanics (Coursera)

https://www.coursera.org/learn/engineering-mechanics-statics-2?irclickid=xOxWoo2vUxyPwMXUVWY2ITICUkFwX21RHxVvQw0&irgwc=1&utm_medium=partners&utm_source=impact&utm_campaign=3400355&utm_content=b2c#about

4. Engineering of Structures: Compression (Coursera)
<https://www.coursera.org/learn/engineering-of-structures-compression#about>
5. Engineering of Structures: Tension and Compression
<https://www.coursera.org/learn/engineering-of-structures-tension-and-compression#outcomes>
6. Engineering of Structures: Shear and Bending (Coursera)
<https://www.coursera.org/learn/engineering-of-structures-shear-and-bending#about>

Section 4. Building structures

1. Purdue University: Fundamentals of Prestressed Concrete (EDX)
https://www.edx.org/course/fundamentals-of-prestressed-concrete/?index=product&queryID=300976fdb04278e643e3931d3340dd95&position=1&results_level=first-level-results&term=Concrete&objectID=course-c5c761af-6422-4525-aafd-067fba41e43d&campaign=Fundamentals+of+Prestressed+Concrete&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch
2. Purdue University: Design of Steel-Concrete Composite Structures (EDX)
https://www.edx.org/course/design-of-steel-concrete-composite-structures?source=aw&awc=6798_1609089823_3e479685e1ad2e0a90b69f81eb8b15c4&utm_source=aw&utm_medium=affiliate_partner&utm_content=text-link&utm_term=301045_https%3A%2F%2Fwww.class-central.com%2F
3. Purdue University: Steel Beam and Plate Girder Design (EDX)
https://www.edx.org/course/steel-beam-and-plate-girder-design?source=aw&awc=6798_1609090130_1608fb92147fc5c1f7eeb3e7a6d1b5f9&utm_source=aw&utm_medium=affiliate_partner&utm_content=text-link&utm_term=301045_https%3A%2F%2Fwww.class-central.com%2F
4. Fundamentals of Structural Analysis (Udemy)
https://www.udemy.com/course/statics-for-engineering-undergrads/?utm_medium=website&utm_source=archdaily.com
5. Основы расчета строительных конструкций (Openedu)
<https://openedu.ru/course/spbstu/BASBUILD/>

Section 5. Urbanism

1. Shaping Urban Futures (Coursera)
<https://www.coursera.org/learn/shaping-urban-futures>
2. Regional Planning: Basic Concepts and Its Contextualization (Udemy)
<https://www.udemy.com/course/regional-planning/>
3. City Planning from Ancient Times to Today (Udemy)
<https://www.udemy.com/course/city-planning/>
4. An Introduction to Urban Planning and Design (Udemy)
<https://www.udemy.com/course/an-introduction-to-urban-planning-and-design/>
5. Learn Urban Planning Concepts (Udemy)
<https://www.udemy.com/course/urban-planning-concepts/>