Postgraduate Track Program: Computer and Data Science

1. Olympiad Winner's Skill Set

To win the Olympiad, you should have a firm grasp of computer and data science concepts, namely:

- Fundamentals of computer science and discrete mathematics;
- Basic mathematical sections for building information systems;
- Criteria for evaluating algorithms and data structures;
- Information security standards;
- Principles of software creation and verification;
- Programming languages and functional structure of computers;
- Trends and technologies in Computer and Data Science;
- Fundamentals of machine learning, artificial intelligence, and data analysis;
- Principles of operation of computer networks;
- Project management methods in software development.

You should also have a solid command of the following skills:

- Evaluating trends in software development;
- Using information security tools and version control systems;
- Applying algorithms, data structures, and information-theoretic models;
- Working with IDEs, SDKs, and programming tools;
- Developing, testing, and optimizing algorithms;
- Applying machine learning methods and optimizing models;
- Using cryptography to protect data;
- Installing software and administering the OS;
- Configuring network services.

2. List of Eligible Degree Programs

2.1. List of Master's Programs

01.04.01 Applied Mathematics

09.04.01 Information Science and Computer Engineering

09.04.02 Information Systems and Technologies

09.04.03 Applied Computer Science

09.04.04 Software Engineering

11.04.02 Infocommunication Technologies and Communication Systems

2.2. List of Doctoral Programs

1.2.1 Artificial intelligence and Machine Learning

1.2.4 Cybersecurity

2.2.15 Telecommunication Systems, Networks, and Equipment

2.3.1 System Analysis, Management and Information Processing, Statistics

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2.3.2 Computing Systems and Their Elements

2.3.5 Math- and Software for Computer Systems, Complexes, and Computer Networks

3. Program Content

Applied Mathematics
1. O-symbolism.
2. Linear space: definition of space and dimension. Matrix rank. Matrix determinant. Inverse matrix. Eigenvalues and eigenvectors.
3. Modular arithmetic. Fermat's little theorem. Finite fields of deductions: definition of final field, ability to carry out calculations in residue fields. Euclid's algorithm. Linear representation of GCD.
4. Numeral system. Converting numbers from one number system to another.
5. Boolean algebra. Standard Boolean operations: conjunction, disjunction, implication, equivalence, exclusive OR, Schaeffer stroke, Peirce arrow. Construction of formulas for Boolean functions: DNF, CNF, simplification using De Morgan's laws, distributivity rules, absorption.
6. Schemes of functional elements. Complexity and depth: definition, computation for specific circuits. Constructing a circuit for a given Boolean function using the formula.
7. Inductive (recursive) definitions. Inductive proofs by construction.
8. Integer algorithms: working with long numbers. Euclid's algorithm and its use.
9. Determination of probability. Elementary properties: theorem of addition of probabilities, theorem of multiplication of probabilities.
10. Probability distributions: uniform, binomial, geometric, Poisson, normal.
11. Total probability formula.
12. Bayes formula.
13. Basic combinatorial numbers: numbers of placements (permutations), combinations. Solving counting problems.
14. Growth rates of combinatorial numbers: asymptotic estimation of expressions with combinatorial numbers.
15. Generation of combinations and placements.
16. Formula of inclusions and exclusions.
17. Graphs: undirected, oriented, bipartite, complete (cliques). Subgraphs: general definition, generated subgraph, spanning subgraph. Distances in graphs. Breadth-first and depth-first graph traversal.
18. Trees. Minimum spanning tree problem.
19. Planar graphs. Euler's formula for planar graphs.
20. Finite automata: definitions, examples of languages they accept. Nondeterministic finite automata.
21. Regular expressions. Construction of an automaton that accepts a language described by a regular expression. POSIX Extended regular expression writing standard.

Computer Science: Information Systems

1. Concept of "information": general characteristics of collecting, transmitting, processing and accumulating information; information measurement. Units of information measurement. Information and entropy.
2. Concepts of "information system" and "information technology."
3. Hardware and software of information technology.
4. Concept of "system". Systems in technology, economics, wildlife. Types of systems. Control object and control system. Information. Feedback. Object of technical cybernetics and information theory.
5. Modeling as a scientific method of cybernetics. Types of models. Models of technical, biological and socio-economic systems. Concept of "black box." Identification problem. Adequacy of models.
6. Pragmatic, semantic, and syntactic aspects of information.
7. Reliability of an information systems' hardware and software complex.

Computer Science: Artificial Intelligence
1. Machine learning as a branch of artificial intelligence. Definition and basic concepts.
2. Main types of machine learning problems: classification, regression, clustering, search for association rules, anomaly detection.
3. Knowledge discovery process. The main stages of data mining. Data Science.
4. Classification algorithms: Naive Bayes, C4.5, CART, BackProp, SVM, etc.
5. Evaluating the effectiveness of machine learning models. Quality metrics for classification and regression: F1, AUC.
6. Clustering algorithms: hierarchical, k-Means, EM, DBScan, SOM, etc.
7. Algorithms for searching for association rules: Apriori, FP-Growth.
8. Ensemble methods of machine learning: Bagging, Boosting, Stacking. Random Forest algorithm.
9. Deep learning. Definition. Main differences from machine learning.
10. Theory of fuzzy sets and fuzzy logic. Linguistic variable. Fuzzy logical inference. Mamdani algorithm.

Computer Science: Interdisciplinary Applications
1. Decision support systems (DSS).
2. The concept of a data warehouse (DW). Purpose. Architecture.
3. Physical HD. Virtual HD. Data marts (DM).
4. Data transfer. ETL is a process. Data cleaning. HD and analysis.
5. Data storage. Purpose. Architecture.
6. Multidimensional data model. Presentation of data as a multidimensional cube.
7. Basic concepts of information security of objects and subjects of information security. Factors influencing information security.
8. Basic international standards in information security, their purpose, and scope of application.
9. Information security policy, its role in organization management.
10. Information security threats. Approaches to modeling information threats and intruders.

11. Approaches to information risk management. Risk assessment. Measurement scales and criteria.
12. Information security management systems. Objectives of a system and principles of construction.
13. Intrusion prevention and detection systems in computer systems and networks, their purpose, tasks, and principles of construction.
14. Firewalling of computer networks, basic principles, and tasks.
15. Virtual protected (private) networks (VPN), their purpose, principles of construction, solution selection criteria.
16. Models and systems for managing access to information resources.
17. Identification, authentication, and authorization. Authentication and authorization methods.
18. Steganography, its purpose and tasks. Methods for embedding hidden information in executable files.
19. Symmetric encryption systems. Block ciphers, their modes of operation. Modern standards and protocols for symmetric encryption.
20. Public key cryptosystems. Principles of their construction. Modern standards and protocols for public key encryption.
21. Public key infrastructure, certificate authorities, and digital certificates.

Computer Science: Software Engineering
1. Software requirements.
2. Software design.
3. Software life cycle
4. Error and interrupt handling.
5. Software security.
6. Development patterns.
7. User interface design.
8. Software complexity.
9. Standards in software design.
10. Reuse in software development.
11. Executable models.
12. Basic principles of object-oriented programming.
13. Software testing.
14. Software maintenance.
15. Software reengineering.
16. Software configuration management.
17. Software assembly.
18. Product management.
19. Software development management.
20. Software quality management.
21. Risk assessment in software development.
22. Metrics in software development.

23. Prototyping in software development.
24. Modeling of software systems, UML language.

Computer Science: Hardware and Architecture

1. Classification of operating systems.
2. Data structures.
3. Multithreading: basic concepts. Synchronization methods in multithreaded applications.
4. Interaction of processes. Shared memory, synchronization tools. Message queues and other means of data exchange.
5. Parallel data processing on a computer. Basic classes of modern parallel systems.
6. Architecture of modern processors. Multicore and single-threaded architectures.
7. Computer memory: RAM, cache, virtual memory. Operating principles and architecture.
8. Input-output systems: interfaces and devices. Operating principles, standards.
9. GPU architecture and their application in computing. GPU programming.
10. Embedded systems: architecture and application. Examples of microcontrollers and single board computers.
11. Architecture and principles of operation of systems on a chip (SoC).
12. Operating principles and architecture of RAID systems. RAID types and configurations.
13. Technologies and architecture of cloud computing. Virtualization, containerization.
14. Architecture and principles of operation of network data storage (NAS, SAN).
15. Software-Defined Architecture (SDA).
16. Hardware acceleration technologies (FPGA, ASIC).

Telecommunications

1. Principles of structural and functional organization of computer networks. Computer networks with packet switching. TCP/IP protocol stack. Addressing in IP networks.
2. Reference model of open system interconnection (ISO OSI model), its purpose. Data encapsulation. Layers of OSI Reference Model.
3. Basics of wireless networks. Wi-Fi, Bluetooth, NFC technologies.
4. Principles of mobile network operation. 3G, 4G, 5G standards.
5. Fiber-optic communications. Principles of data transmission, optical fiber types.
6. Network protocols and standards. Transport layer protocols (Ethernet, MPLS).
7. Satellite communication technologies. Basics of satellite systems, types of satellites.
8. Network traffic management. QoS (Quality of Service) and bandwidth management.
9. Network virtualization. SDN (Software-Defined Networking) and NFV (Network Functions Virtualization).
10. VoIP technologies (Voice over IP). Protocols and standards, voice quality.
11. Operating principles and architecture of IoT (Internet of Things) networks. Protocols and standards.
12. Fundamentals of cryptography in telecommunications. Methods for encrypting data in networks.
13. Data transmission technologies in industrial networks. Protocols and standards for SCADA systems.

14. Methods for monitoring and diagnosing telecommunication networks. Tools and protocols.
15. Principles of operation of global data networks (Internet backbones). Backbone networks and their architecture.

4.   Recommended References

4.1.   Reading List
Applied Mathematics

Sources in English	Topic
1. Durrett R. Probability: Theory and Examples (Cambridge Series in Statistical and Probabilistic Mathematics Book 49) 5th Edition ISBN: 978-1108473682 https://services.math.duke.edu/~rtd/PTE/PTE5_011119.pdf free access	2, 9, 14, 16
2. Anthony W. Knapp Advanced Algebra https://www.infobooks.org/pdfview/824-advanced-algebra-anthony-w-knapp/ free access	3
3. Mitchel T. Keller, William T. Trotter Applied Combinatorics https://www.infobooks.org/pdfview/17733-applied-combinatorics-mitchel-t-keller-william-t-trotter/ free access	13, 15, 17
4. CSE 1400 Applied Discrete Mathematics Conversions Between Number Systems Department of Computer Sciences College of Engineering https://cs.fit.edu/~wds/classes/adm/Handouts/Conversion.pdf free access	4
5. Mario F. Triola Bayes' Theorem https://staff.washington.edu/tamre/BayesTheorem.pdf free access	12
6. Desh Ranjan Department of Computer Science New Mexico State University Euclid's Algorithm for the Greatest Common Divisor https://www.cs.nmsu.edu/historical-projects/Projects/Euclid2010.pdf free access	8
7. Hopcroft J.E., Motwani R., Ullman J.D. Introduction to Automata Theory, Languages, and Computation (3rd ed.). Pearson, 2013. ISBN 978-1292039053. https://drive.google.com/file/d/13uGXwVcRPps2KmQ-Rb9gmuIO_zLQjeHd/view free access	1, 7, 20, 21
8. Steven Givant, Paul Halmos Introduction to Boolean Algebras e-ISBN: 978-0-387-68436-9	5

https://github.com/manjunath5496/Boolean-Algebra-Books/blob/master/boln(6).pdf free access	
9. INTRODUCTORY MONOGRAPHS IN MATHEMATICS General Editor A. J. MoAKES, M.A https://github.com/manjunath5496/Boolean-Algebra-Books/blob/master/boln(1).pdf free access	6
10. Probability, Statistics and Estimation Short Edition https://www.incertitudes.fr/book.pdf free access	10, 11
11. Heinold B. A Simple Introduction to Graph Theory https://brianheinold.net/graph_theory/graph_theory_book.html free access	17-19

Sources in Russian	Topic
1. Ю.А. Аляев, С. Ф. Тюрин. Дискретная математика и математическая логика. Учебник — М.: Финансы и статистика, 2006. — 368 с. I8BN 5-279-03045-7 https://fileskachat.com/getfile/74321_8f8e23c2233350997e7c69c922661acb Free access	1, 4, 5, 7, 8, 11, 12, 17-23
2. А.А. Ожиганов Теория автоматов. Учебное пособие - Санкт-Петербург: НИУ ИТМО, 2013. - 84 с. https://books.ifmo.ru/file/pdf/1013.pdf Free access	4, 6, 9
3. В.А. Горбатов. Фундаментальные основы дискретной математики. Информационная математика. — М.: Наука. Физматлит, 2000.—544 с.— ISBN 5-02-015238-2. https://www.klex.ru/1o6f Free access	4, 5, 6, 13, 15, 17, 18, 19, 20

Computer Science: Information Systems

Sources in English	Topic
1. Tanenbaum A.S. et al. Computer networks. Prentice-Hall international editions, 1996. 813 p. https://theswissbay.ch/pdf/Gentoomen%20Library/Networking/Prentice%20Hall%20-%20Computer%20Networks%20Tanenbaum%204ed.pdf Free access	1-4, 8, 11 - 15
2. Hopcroft J. E., Motwani R., Ullman J. D. Introduction to automata theory, languages, and computation. 2006	1, 5, 7

https://www-2.dc.uba.ar/staff/becher/Hopcroft-Motwani-Ullman-2001.pdf Free access	
3. Rainer R.K., Prince B., Cegielski C. G. Introduction to Information Systems. John Wiley and Sons Singapore Pte. Limited, 2015. https://humdiana.files.wordpress.com/2018/03/introduction-to-information-system-edisi-5-tahun-2014.pdf Limited access	1, 4, 5, 6, 7, 9, 10, 15

Sources in Russian	Topic
1. Хопкрофт Д.Э., Мотвани Р., Ульман Д. Введение в теорию автоматов, языков и вычислений, 2-е изд.: Пер. с англ. М.: Издательский дом "Вильямс", 2008. https://files.nazaryev.ru/ifmo/third-year/%D0%90%D1%80%D1%85%D0%B8%D0%B2%203/6%20%D1%81%D0%B5%D0%BC%D0%B5%D1%81%D1%82%D1%80/%D0%A2%D0%B5%D0%BE%D1%80%D0%B8%D1%8F%20%D0%B0%D0%B2%D1%82%D0%BE%D0%BC%D0%B0%D1%82%D0%BE%D0%B2/%D0%9B%D0%B8%D1%82%D0%B5%D1%80%D0%B0%D1%82%D1%83%D1%80%D0%B0/%D0%94%D0%B6%D0%BE%D0%BD%20%D0%A5%D0%BE%D0%BF%D0%BA%D1%80%D0%BE%D1%84%D1%82,%20%D0%A0%D0%B0%D0%B4%D0%B6%D0%B8%D0%B2%20%D0%9C%D0%BE%D1%82%D0%B2%D0%B0%D0%BD%D0%B8,%20%D0%94%D0%B6%D0%B5%D1%84%D1%84%D1%80%D0%B8%20%D0%A3%D0%BB%D1%8C%D0%BC%D0%B0%D0%BD%20%D0%92%D0%B2%D0%B5%D0%B4%D0%B5%D0%BD%D0%B8%D0%B5%20%D0%B2%20%D1%82%D0%B5%D0%BE%D1%80%D0%B8%D1%8E%20%D0%B0%D0%B2%D1%82%D0%BE%D0%BC%D0%B0%D1%82%D0%BE%D0%B2,%20%D1%8F%D0%B7%D1%8B%D0%BA%D0%BE%D0%B2%20%D0%B8%20%D0%B2%D1%8B%D1%87%D0%B8%D1%81%D0%BB%D0%B5%D0%BD%D0%B8%D0%B9%20(2008).pdf Free access	1, 2, 3, 5, 9, 10
2. Акимова Е.В. Вычислительная техника. Учебное пособие для СПО Издательство: Лань, 2022 https://lanbook.com/catalog/informatika/vychislitelnaya-tekhnika/ Limited access	1, 3, 6-10
3. Голицына О.Л., Максимов Н. В., Попов И. И. Информационные системы, 2014. 496 с. Голицына О .А. Максимов Н.ij. Попов И.И. ИНФОРМАЦИОННЫЕ 6 СИСТЕМЫ Free access	1, 3, 4, 6 - 9

Sources in Russian	Topic
4. Олифер В.Г, Олифер Н.А. Компьютерные сети. Принципы, технологии, протоколы. Учебник для вузов, 2020 https://disk.yandex.ru/d/K6mNwrr7-RbxnA Free access	1, 2, 5, 11 - 15

Computer Science: Artificial Intelligence

Sources in English	Topic
1. Ian W., Elbe F. Data Mining: Practical Machine Learning Tools and Techniques with Java Implementations. University of Waikato, 2011. ISBN 978-0-123-74856-0 https://www.researchgate.net/publication/30876208_Data_Mining_-_Practical_Machine_Learning_Tools_and_Techniques_with_JAVA_Implementations Limited access	1-8
2. Ian Goodfellow and Yoshua Bengio and Aaron Courville. Deep Learning. MIT Press, 2016. 978-0262-03561-3 https://www.deeplearningbook.org/ Free access	1, 2, 9
3. Mohri M., Rostamizadeh A., Talwalkar A. Foundations of Machine Learning. MIT Press, 2018. ISBN 978-0-262-03940-6 https://cs.nyu.edu/~mohri/mlbook/ Free access	1, 2, 4-6, 8
4. Elmer P. Dadios. Fuzzy Logic - Controls, Concepts, Theories and Applications. InTechOpen, 2012. ISBN 978-953-51-0396-7 https://www.intechopen.com/books/2273 Free access	10
5. Alpaydin E. Introduction to Machine Learning. London: The MIT Press, 2010. ISBN 978-0-262-01243-0 https://kkpatel7.files.wordpress.com/2015/04/alppaydin_machinelearning_2010.pdf Free access	1-8
6. Bishop C.M. Pattern Recognition and Machine Learning, Springer, 2006. ISBN 978-0-387-31073-2 http://users.isr.ist.utl.pt/~wurmd/Livros/school/Bishop%20-%20Pattern%20Recognition%20And%20Machine%20Learning%20-%20Springer%20%202006.pdf Free access	1-6, 8, 9

Sources in Russian	Topic
1. Рассел, Стюарт, Норвиг, Питер. Искусственный интеллект: современный подход, 2-е изд..: Пер. с англ. — М.: Издательский	1-8, 10

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Sources in Russian	Topic
дом "Вильямс", 2006. — 1408 с.: ил. — Парад, тит. англ. ISBN 5-8459-0887-6 (рус.) https://disk.yandex.ru/d/8nwy8H01lnlyPA Free access	
2. Машинное обучение (курс лекций, К.В. Воронцов). http://www.machinelearning.ru/wiki/index.php?title=%D0%9C%D0%B0%D1%88%D0%B8%D0%BD%D0%BD%D0%BE%D0%B5_%D0%BE%D0%B1%D1%83%D1%87%D0%B5%D0%BD%D0%B8%D0%B5_%28%D0%BA%D1%83%D1%80%D1%81_%D0%BB%D0%B5%D0%BA%D1%86%D0%B8%D0%B9%2C_%D0%9A.%D0%92.%D0%92%D0%BE%D1%80%D0%BE%D0%BD%D1%86%D0%BE%D0%B2%29 Free access	1-9
3. Замятин, Н. В. Нечёткая логика и нейронные сети. - Томск: ТУСУР, 2014. https://edu.tusur.ru/publications/7020 Free access	9, 10

Computer Science: Interdisciplinary Applications

Sources in English	Topic
1. Easttom W. Computer Security Fundamentals. 4th Edition. Pearson IT Certification; 4th edition, 2019. 512 p. https://www.oreilly.com/library/view/computer-security-fundamentals/9780135774854/ Free access	1, 2, 6, 7, 10
2. Ferguson N., Schneier B., Kohno T. Cryptography Engineering: Design Principles and Practical Applications 1st Edition, Wiley, 2011. 386 p. https://www.schneier.com/wp-content/uploads/2015/12/fortuna.pdf Free access	11-15
3. Rhodes-Ousley M. Information Security: The Complete Reference, Second Edition 2nd Edition Publisher: McGraw-Hill Education; 2nd edition, 2013. 896 p. https://d.cxcore.net/InfoSec/Information%20Security%20The%20Complete%20Reference,%202nd%20Edition/Information%20Security%20The%20Complete%20Reference,%202nd%20Edition.pdf Free access	1, 2, 4, 7, 9, 10, 11
4. Schultz C. P., Perciaccante B. Kali Linux Cookbook - Second Edition: Effective penetration testing solutions. Packt Publishing; 2nd Revised edition, 2017. 438 p. http://dl.hellodigi.ir/dl.hellodigi.ir/dl/book/Kali%20Linux%20Cookbook%20%28Second%20Edition%29.pdf	6-11

Free access	
5. Eagle C., Nance V. The Ghidra Book: The Definitive Guide. No Starch Press, 2020. 608 p. https://www.amazon.com/Ghidra-Book-Definitive-Guide-ebook/dp/B0852N9Y4Q Limited access	1, 2, 3, 5, 6,

Sources in Russian	Topic
1. Бондарев В. В. Введение в информационную безопасность автоматизированных систем : учеб. пособие – МГТУ им. Н. Э. Баумана. - М. : Изд-во МГТУ им. Н. Э. Баумана, 2016. ISBN 978-5-7038-4414-4. https://www.labirint.ru/books/559227/ Limited access	7-9, 11-15
2. Баранова, Е. К. Информационная безопасность и защита информации : учебное пособие — Москва : РИОР : ИНФРА-М, 2022. ISBN 978-5-369-01761-6 https://znanium.com/catalog/document?id=393765#bib Limited access	1-6, 10
3. Запечников С.В., Милославская Н.Г., Толстой А.И., Ушаков Д.В. Информационная безопасность открытых систем. Том 1. Угрозы, уязвимости, атаки и подходы к защите. М.: Горячая линия-Телеком, 2006. — 536 с.: ил. — ISBN: 5-93517-291-1. https://f.eruditor.link/file/975534/ Limited access	8-16

Computer Science: Software Engineering

Sources in English	Topic
1. ISO/IEC/IEEE 24765:2010 Systems and Software Engineering— Vocabulary, ISO/ IEC/IEEE, 2010. https://www.iso.org/standard/50518.html Free access	1, 2, 5, 6, 8, 11, 12, 15, 17-20
2. Bourque P., Fairley R.E. Guide to the Software Engineering Body of Knowledge (SWEBOK(R)): Version 3.0. IEEE Computer Society https://www.computer.org/education/bodies-of-knowledge/software-engineering Free access	1, 2, 4, 5, 7, 9, 10, 15, 16, 19-23
3. Bass L., Clements P., Kazman R. Software Architecture in Practice, 3rd ed., Addison-Wesley Professional, 2013. https://edisciplinas.usp.br/pluginfile.php/5922722/mod_resource/content/1/2013%20-%20Book%20-%20Bass%20%20Kazman-Software%20Architecture%20in%20Practice%20%281%29.pdf Free access	12, 13, 14, 17, 18, 24

4. Sommerville I. Software Engineering. 9th ed., Addison-Wesley, 2011. https://engineering.futureuniversity.com/BOOKS%20FOR%20IT/Software-Engineering-9th-Edition-by-Ian-Sommerville.pdf Free access	2, 3, 5, 6, 8, 9, 11-14, 17, 18, 24
5. Naik S., Tripathy P. Software Testing and Quality Assurance: Theory and Practice. Wiley-Spektrum, 2008. https://www.softwaretestinggenius.com/download/staqtpsn.pdf Free access	14-23
6. INCOSE, Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities, version 3.2.2, International Council on Systems Engineering, 2012. https://disk.yandex.ru/i/Igmxb-JliYOlBA Limited access	4, 5, 6, 8, 9, 11-16, 19-23

Sources in Russian	Topic
1. Розенберг Д., Скотт К. Применение объектного моделирования с использованием UML и анализ прецедентов.: Пер. с англ. М.: ДМК Пресс, 2002 https://www.litres.ru/book/dug-rozenberg/primenenie-obektnogo-modelirovaniya-s-ispolzovaniem-uml-i-an-22879266/ Limited access	1, 2, 5-10, 12-16, 19-24
2. Э. Гамма Приемы объектно-ориентированного проектирования. Паттерны проектирования / Э. Гамма, Р. Хелм, Р. Джонсон, Д. Влиссидес. – СПб.: Питер, 2009. – 366 с. https://disk.yandex.ru/i/Al6EIgWORrsvjg Free access	1, 3-5, 8, 9, 17, 18
3. Гамма Э., Хелм Р., Джонсон Р., Влиссидес Дж. Приемы объектно-ориентированного проектирования. Паттерны проектирования. — СПб: Питер, 2001. — 368 с.: ил. https://student.dei.uc.pt/~arede/Addison-Wesley.Design.Patterns.Elements.of.Reusable.Object-Oriented.Software.by.GoF.RUS.pdf Free access	1-7, 9, 12, 17-24

Computer Science: Hardware and Architecture

Sources in English	Topic
1. David A. Patterson , John L. Hennessy. Computer Organization and Design RISC-V Edition. Elsevier Science http://home.ustc.edu.cn/~louwenqi/reference_books_tools/Computer%20Organization%20and%20Design%20RISC-V%20edition.pdf free access	1-16

2. Harris D., Harris S. Digital Design and Computer Architecture. Publisher: Morgan Kaufmann,2012, 561 p. https://edisciplinas.usp.br/pluginfile.php/7910542/mod_resource/content/1/Digital%20Design%20and%20Computer%20Architecture.pdf Free access	1-16
3. Tanenbaum A., Austin T. Structured Computer Organization. Publisher: Pearson, 2012, 801 p. https://csc-knu.github.io/sys-prog/books/Andrew%20S.%20Tanenbaum%20-%20Structured%20Computer%20Organization.pdf Free access	1-16

Sources in Russian	Topic
1. Таненбаум Э., Остин Т., Архитектура компьютера. 6-е изд. — СПб.: Питер, 2013. — 816 с.: ил. https://nvkarta.com/project/library/uploads/engineering/computing/(ru)_tanenbaum_arkhytektura_kompyutera.pdf Free access	1-16
2. Сергеев С. Л. Архитектуры вычислительных систем: учебник. — СПб.: БХВ-Петербург, 2010. — 240 с.: ил. — (Учебная литература для вузов) ISBN 978-5-9775-0575-8 https://cdnpdf.com/embed/52710-arhitektury-vychislitelnyh-sistem-20010-s-l-sergeev free access	1-16
3. Харрис Д.М., Харрис С.Л., Цифровая схемотехника и архитектура компьютера — М.: ДМК Пресс, 2018. — 1662 с. https://is.ifmo.ru/books/2016/digital-design-and-computer-architecture-russian-translation_July16_2016.pdf Free access	1-16

Telecommunications

Sources in English	Topic
1. James F. Kurose, Keith W. Ross. Computer Networking. A Top-Down Approach. Seventh edition. Hoboken, New Jersey: Pearson, [2017] https://www.ucg.ac.me/skladiste/blog_44233/objava_64433/fajlovi/Computer%20Networking%20_%20A%20Top%20Down%20Approach,%207th,%20converted.pdf free access	1-15
2. Tanenbaum A.S. et al. Computer networks. Prentice-Hall international editions, 1996. 813 p.	1-15

https://theswissbay.ch/pdf/Gentoomen%20Library/Networking/Prentice%20Hall%20-%20Computer%20Networks%20Tanenbaum%204ed.pdf Free access	
3. Howser G. Computer Networks and the Internet. Publisher: Springer Cham, 2019. 555 p. https://link.springer.com/content/pdf/10.1007/978-3-030-34496-2.pdf Limited access	1-15

Sources in Russian	Topic
1. Эндрю Таненбаум, Ник Фимстер, Дэвид Уэзеролл Компьютерные сети. 6-е изд.. — СПб.: Питер, 2023. 1174с. https://nvkarta.com/project/library/uploads/engineering/computing/(ru)_tanenbaum_kompyuternye_sety.pdf Free access	1-15
2. Олифер В.Г, Олифер Н.А. Компьютерные сети. Принципы, технологии, протоколы. Учебник для вузов, 2010 https://disk.yandex.ru/d/K6mNwrr7-RbxnA Free access	1-15
3. Сергеев А. Н. Основы локальных компьютерных сетей: Учебное пособие. — СПб.: Издательство «Лань», 2016. — 184 с.: ил. — (Учебники для вузов. Специальная литература). https://vk.com/doc7608079_521149619?hash=cfsuu76cII7oosdqcIm5Z55SxlbXVgJNvwuRU8D87wwanddl=7ss5fHTFMKV3idzodses0kGmIBjRvTk2kNeLhSgvZgs Free access	1-15

4.2.   Recommended Online Courses

Applied Mathematics

Online courses in English	Link	Summary
Mathematical Thinking in Computer Science	https://www.coursera.org/learn/what-is-a-proof	This course covers essential discrete mathematics tools, including induction, recursion, logic, and invariants, and applies them to programming problems related to solution existence, optimality, and requirement fulfillment. It involves using a hands-on approach to tackle interactive puzzles that facilitate independent discovery of key concepts.
Combinatorics and Probability	https://www.coursera.org/learn/combinatorics	This online course covers standard combinatorial settings and their applications, focusing on real-life and algorithmic problems, recursive counting techniques, and the basics of probability theory, essential for fields like statistics and machine learning.

Single Variable Calculus	https://www.coursera.org/learn/discrete-calculus	This course covers single-variable calculus with a focus on conceptual understanding and applications, ideal for engineering, physical, and social science students. Key features include early introduction of Taylor series, synthesis of discrete and continuous Calculus, emphasis on concepts over computations, and a clear, unified approach.
Data Science Math Skills	https://www.coursera.org/learn/datasciencemathskills	This course introduces the basic math needed for data science. It covers essential topics without extra complexity, ensuring that participants master the necessary vocabulary, notation, concepts, and algebra rules for data science. Topics include set theory, real number properties, interval notation, summation, Cartesian plane math, graphing functions, instantaneous rate of change, exponents, logarithms, and probability theory, including Bayes' theorem.
Algorithms on Graphs	https://www.coursera.org/learn/algorithms-on-graphs	This course covers graph basics and properties, traversal methods, and practical applications of graph traversal. It includes shortest path algorithms, from basics to advanced methods used in services like Google Maps, with an optional Fast Shortest Routes capstone project. The course concludes with minimum spanning trees, relevant for network planning, clustering, and approximation algorithms.
Online courses in Russian	**Link**	**Summary**
Методы вычислительной математики (Computational Mathematics Methods)	https://openedu.ru/course/spbstu/NUMMETH/?session=spring_2024	The course is devoted to the fundamental principles of computational methods and the practice of numerical solution of applied problems in various fields. The goal of the course is to develop fundamental knowledge about the mathematical foundations of numerical methods and sustainable skills in applying basic methods of computational mathematics to solve real engineering problems.
Дискретная математика (Discrete Mathematics)	https://openedu.ru/course/mephi/mephi_dism/?session=spring_2024	This course provides an introduction to discrete mathematics topics relevant to semantic information processing, offering a foundation for studying artificial intelligence. It teaches students how to create semantic mappings, establish data dependencies, and perform semantic operations on both intensional and extensional knowledge units. The course lays the groundwork for advanced studies in discrete mathematics, computational models, AI, and database modeling.
Дискретная математика:	https://openedu.ru/course/	The course starts with a brief introduction to combinatorics, a fundamental topic in data analysis and computer science.

| | hse/discrete_math/?session=2022 | It then applies combinatorial principles to discrete probability, laying a foundation for more advanced study in future courses. Finally, the course explores graphs, a common combinatorial structure in data analysis, and concludes with building a simple recommendation system based on random walks in graphs. |
| подсчеты, графы, случайные блуждания (Discrete Mathematics: Counting, Graphs, Random Walks) | | |

Computer Science: Information Systems

Online courses in English	Link	Summary
Information Systems	https://www.coursera.org/specializations/information-systems	This series of courses offers a comprehensive introduction to Information Systems Management. It begins with an exploration of how Information Systems align with business strategies and includes an economic analysis of these systems. The second course focuses on modeling information systems to prepare for development, while the third reviews the capabilities of enterprise systems and the managerial aspects of their selection and implementation. The fourth course covers IT infrastructure choices and associated trade-offs, with an emphasis on change management. Applied Learning Projects allow participants to address business problems by conceptualizing IT solutions, defining system specifications, and evaluating or developing solutions.
Introduction to Computer Science and Programming	https://www.coursera.org/specializations/introduction-computer-science-programming	This series of courses covers basic computing principles and mathematical foundations crucial for computer science. It explains how computers work, helps develop introductory programming skills for interactive and graphical applications, and presents numerical mathematics tools for problem-solving and modeling.
How to Code: Simple Data	https://www.edx.org/course/how-to-code-simple-data	Aiming to enhance a student's ability to program effectively in any language, this course teaches a systematic programming method without focusing on a specific language. It covers core design methods related to numbers, strings, images, and lists. The course addresses the development of program requirements, creation of consistently structured programs, and integration of testing into the programming process, culminating in the design of a simple interactive game.

Online courses in Russian	Link	Summary
Проектирование информационных систем (Information system design)	https://intuit.ru/studies/courses/2195/55/info	The course focuses on modern methods of designing information systems (IS) in economics, with an emphasis on using CASE tools. It covers the composition and structure of various economic information systems, technologies and design methods, stages and features of design, as well as methods for modeling information processes. The course's scientific foundation includes system analysis and modeling, enabling solutions to problems related to functionality, adaptability, data design, and interfaces. The practical component includes assignments on developing and analyzing models of economic objects, along with a case assignment on IS design.
Корпоративные информационные системы (Corporate Information Systems)	https://openedu.ru/course/hse/CORPIS/?session=2022	This course covers the purpose, functions, and standards of information systems, using examples such as MS Dynamics Ax, 1C, and SAP ERP. It explores the structure of IT infrastructure, management processes, and relevant standards. Additionally, the course addresses hardware and software classification, as well as IT service management.
Информационные технологии и сервисы (Information Technology and Services)	https://openedu.ru/course/urfu/ITS/?session=spring_2024	The course covers fundamental topics in computer system architecture, digital data storage, and processing. It aims to provide basic knowledge and practical skills in information services, modern operating systems, and network principles, as well as an understanding of AI and smart technologies. Additionally, it helps develop practical skills in selecting computer components and applying IT concepts in professional work.

Computer Science: Artificial Intelligence

online courses in English	Link	Summary
Deep Learning in Computer Vision	https://learnonline.hse.ru/course/view.php?id=6148	Deep learning has significantly advanced computer vision, enabling everyday applications like face recognition, photo stylization, and machine vision in self-driving cars. This course introduces students to the basics of computer vision and modern deep learning models, covering image and video recognition, object detection, motion estimation, and more. The course project focuses on building a face recognition and manipulation system, illustrating the internal mechanics of this widely recognized technology.

Supervised Machine Learning: Regression and Classification	https://www.coursera.org/learn/machine-learning	In the first course of this series, students build and train machine learning models in Python using libraries like NumPy and scikit-learn, focusing on linear and logistic regression for prediction and classification tasks. This beginner-friendly program offers a comprehensive introduction to machine learning and AI. Covering both supervised and unsupervised learning, as well as best practices from Silicon Valley, this three-course series provides the foundational knowledge and practical skills needed to tackle real-world AI challenges and build a career in machine learning.
Deep Learning	https://www.coursera.org/specializations/deep-learning	The Deep Learning series is a foundational program designed to equip participants with the skills and knowledge necessary to advance in AI technology. The program covers building and training neural network architectures, including Convolutional Neural Networks, Recurrent Neural Networks, and Transformers, and applying techniques such as Dropout and BatchNorm. Using Python and TensorFlow, students work on real-world applications such as speech recognition, chatbots, and image analysis, and receive career advice from experts. The course culminates in mastering deep learning concepts, optimizing neural networks, and applying advanced techniques to solve complex problems.
Data Science	https://www.edx.org/professional-certificate/harvardx-data-science	The HarvardX Data Science program equips you with essential skills and knowledge for real-world data analysis challenges. Covering probability, inference, regression, and machine learning, the program teaches R programming, data wrangling with dplyr, visualization with ggplot2, and tools like Unix/Linux and GitHub. Using motivating case studies—such as trends in world health, US crime rates, and election forecasting—students learn to apply data analysis techniques in the R software environment, integrating statistical concepts with practical problem-solving.
Introduction to Machine Learning with Pytorch	https://www.udacity.com/course/intro-to-machine-learning-nanodegree--nd229	This program teaches machine learning concepts with a focus on supervised and unsupervised learning. Spanning three courses, it covers linear and logistic regression, decision trees, Naive Bayes, support vector machines, neural networks, and clustering. Participants apply these techniques to real-world problems, such as identifying potential charity donors and clustering customers, using Python and PyTorch, with lessons on model evaluation and tuning.

Machine Learning Course	https://online.stanford.edu/courses/cs229-machine-learning	This course offers a comprehensive introduction to machine learning and statistical pattern recognition, covering both supervised and unsupervised learning, learning theory, and reinforcement learning. It explores applications such as robotic control, data mining, and autonomous navigation, helping to acquire skills in designing and developing algorithms. The course focuses on creating computer systems that improve with experience and simulating human thinking.
Data Analysis Essentials	https://www.edx.org/course/data-analysis-essentials	This online course teaches fundamental data analysis skills essential for business success. It covers collecting, presenting, describing, and making inferences from data. Designed for beginners, the course includes regular activities to build confidence and proficiency in data analysis.
Data Processing and Analysis with Excel	https://www.edx.org/course/data-processing-and-analysis-with-excel	This course focuses on data organization and cleaning in Microsoft Excel, including identifying outliers, changing data types, and developing a data analysis plan. It addresses advanced Excel functions like pivot tables and vlookup, creating various chart types, and applying techniques such as descriptive statistics. The course covers Excel add-ins and tools for transforming data into actionable insights, with all activities demonstrated using Windows OS and Microsoft Excel 2016.
Machine Learning Specialization	https://www.coursera.org/specializations/machine-learning-introduction	This foundational program introduces the basics of machine learning and the development of real-world AI applications. The three-course series covers supervised learning (including linear and logistic regression, neural networks, and decision trees), unsupervised learning (such as clustering and recommender systems), and best practices in AI. Participants master machine learning models using Python and TensorFlow, apply best practices, and build models for various tasks, including deep reinforcement learning and recommender systems.
A Beginner's course on Fuzzy Logic and it's Application	https://www.udemy.com/course/fuzzylogic/	This course introduces beginners to fuzzy logic and soft computing, focusing on handling uncertainty and imprecision in problem-solving. It covers the basics of fuzzy set theory and its application to real-world problems involving vagueness. Designed as a foundation for researchers in science and engineering, this course equips participants with the tools to implement fuzzy logic effectively.

online courses in Russian	Link	Summary
Основы искусственного интеллекта (Fundamentals of AI)	https://opene du.ru/course/ msu/IINTEL LIGENCE/?s ession=summ er_2024	This course explores cutting-edge applications of artificial intelligence (AI) across various fields, focusing on methods for analyzing large data sets and solving complex research problems. Topics include big data analytics, machine learning techniques, and data representation. The course will clarify key terms, capabilities, limitations, and real-world applications of AI technologies.
Основы машинного обучения (Fundamentals of Machine Learning)	https://opene du.ru/course/ hse/INTRML /?session=20 22	This online course covers the basics of data analysis and machine learning. It focuses on data preprocessing, visualization, and core machine learning methods (linear, metric, decision trees, and their combinations), as well as model evaluation.
Машинное обучение и анализ данных (Machine learning and data analysis)	https://opene du.ru/course/ ITMOUniver sity/MLDAT AN/?session =self_2024	This course explores modern approaches to statistical data processing and machine learning model building. It aims to highlight key tasks and methods in machine learning, demonstrating that many of these tasks are common in everyday life.

Computer Science: Interdisciplinary Applications

online courses in English	Link	Summary
Cryptography	https://opene du.ru/course/ nsu/CRYPT O/?session=y ear_2024_apr _dec	This course delves into cryptography, covering essential mathematics behind ciphers and their resistance to attacks. Key topics include the development of cryptography in Russia and the Soviet Union, Boolean functions and S-boxes, cryptanalysis methods, and specialized cryptographic functions like bent functions and APN-functions. Additionally, the course explores the role of AI and ML in enhancing cryptographic techniques.
Introduction to Cybersecurity and Risk Management	https://www. coursera.org/ specialization s/information -security	This case-based program explores cybersecurity through security governance and risk management. It focuses on creating security strategies aligned with company goals, applying risk assessment techniques, and implementing effective security education programs. Participants complete case studies involving real-world cybersecurity threats like IoT vulnerabilities, ransomware, and social engineering, applying concepts and tools from the course to practical scenarios.

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IBM Cybersecurity Analyst Professional Certificate	https://www.coursera.org/professional-certificates/ibm-cybersecurity-analyst	This course covers network security, endpoint protection, incident response, threat intelligence, penetration testing, and vulnerability assessment. Participants gain hands-on experience through real-world projects and virtual labs, using tools like Wireshark and IBM QRadar.
IT Security: Defense against the digital dark arts	https://www.coursera.org/learn/it-security	This course covers fundamental IT security concepts and tools, including threats, attacks, and data encryption. It focuses on authentication, authorization, and accounting systems, as well as network security solutions and how to create a multi-layered security architecture.
Information Systems Auditing, Controls and Assurance	https://www.coursera.org/learn/information-systems-audit	This course explores risks associated with information systems and looks at how to mitigate these risks through proper IS controls. It covers IS audit procedures, their application throughout the Systems Development Life Cycle (SDLC), and formal IS Management practices like Change Management Controls.
Data, Security, and Privacy	https://www.coursera.org/learn/data-security-privacy	This course offers hands-on experience with productivity tools and foundational knowledge in system design and development, integrating hardware, software, and Internet concepts. It covers data security, data privacy, and methods to enhance productivity and efficiency. Additionally, students explore technology career paths and industry certifications.
Online courses in Russian	**Link**	**Summary**
Информационная безопасность (Information security)	https://openedu.ru/course/ITMOUniversity/INFSEC/?session=self_2024	This course focuses on secure programming, aiming to teach students the full cycle of secure software development. It provides foundational knowledge and skills needed to understand secure programming principles, choose appropriate tools and technologies, and assess information security risks.
Защита информации (Information protection)	https://openedu.ru/course/hse/DATPRO/?session=2022	This course introduces the basics of information security, including key concepts, principles, and protective measures. It teaches modeling security threats, developing security policies, and assessing IT security.
Введение в современную криптографию (Introduction to	https://openedu.ru/course/mephi/mephi_011_crypto/	This course covers key applied aspects of modern cryptography, focusing on methods for information protection. Students will learn fundamental cryptographic primitives, apply symmetric and asymmetric algorithms,

Modern Cryptography)	?session=spring_2024	and master techniques for addressing current security challenges.

Computer Science: Software Engineering

online courses in English	Link	Summary
Software Development Lifecycle	https://www.coursera.org/specializations/software-development-lifecycle	This course aims to develop skills in building secure software using SDLC methodologies, analyzing and improving a team's SDLC approach, and comparing different methodologies based on various constraints. Applied projects involve fictional case studies where participants make decisions on methodologies, practices, and processes, including creating story maps and value stream maps.
IBM DevOps and Software Engineering Professional Certificate	https://www.coursera.org/professional-certificates/devops-and-software-engineering	This course offers hands-on experience with Python, Linux shell scripting, GitHub projects, Docker, Kubernetes, CI/CD, and cloud technologies.
IBM Full Stack Software Developer Professional	https://www.coursera.org/professional-certificates/ibm-full-stack-cloud-developer	This program covers full stack development, cloud native technologies, and generative AI tools, equipping participants to build, deploy, test, and manage applications using technologies like Node.js, React, Docker, Kubernetes, and more.
Software Engineering Specialization	https://www.coursera.org/specializations/software-engineering	The series of courses delves into software engineering methodologies, tools, and techniques for planning, designing, implementing, testing, and maintaining large-scale software systems. It combines theoretical knowledge with practical examples and real-life case studies, requiring basic object-oriented programming skills. Through hands-on projects, participants apply these techniques in realistic development environments to deepen their understanding of software engineering.
Software Design and Architecture Specialization	https://www.coursera.org/specializations/software-design-architecture	This series of courses cover the design principles, patterns, and architectures needed to create flexible and reusable software systems.

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Online courses in Russian	Link	Summary
Язык программирования C++. Часть 1. Процедурное программирование (C++ Programming Language. Part 1. Procedural Programming)	https://openedu.ru/course/mephi/mephi_pro/	The course provides knowledge of procedural programming in the C/C++ languages, which serves as a basis for further study of popular "C-like" programming languages, such as Python, Java, C#, JavaScript, and PHP. It also deepens participants' understanding of C++, a long-standing staple in the programming world.
Введение в системную инженерию (Introduction to Systems Engineering)	https://openedu.ru/course/mephi/mephi_vsi/?session=spring_2023	This course provides knowledge on balancing organizational and engineering methods for managing the lifecycle of complex technical systems, using international standards and IT tools. It covers project management, systems engineering principles (such as requirements management and system architecture), and related engineering disciplines. Students will gain competencies in managing complex technical projects and system life cycles.
Практики системной инженерии (Systems Engineering Practices)	https://openedu.ru/course/urfu/SYSTENG/?session=spring_2024	The course centers on universal systems engineering practices aimed at minimizing project risks and uncertainties related to problem definition and engineering decisions. Topics include team organization, stakeholder needs analysis, requirements development, functional modeling, and system architecture, all utilizing industry-standard software.

Computer Science: Hardware and Architecture

Online courses in English	Link	Summary
Digital design with FPGAs	https://openedu.ru/course/spbstu/DDFPGAS/	This course covers the basics of digital design, VHDL programming, and the Vivado IDE, along with implementing digital signal processing (DSP) algorithms. Students will gain theoretical knowledge and practical skills in FPGA programming, including combinatorial and sequential logic, high-speed and low-area development techniques, and best coding practices.
Computer Architecture	https://www.coursera.org/learn/comparch	This course provides an introduction to the fundamental concepts of computer architecture, focusing on the design and organization of computer systems. It focuses on instruction set architecture, processor design, memory hierarchy, and input/output systems. The course covers both

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		theoretical aspects and practical applications, using real-world examples to illustrate how computer architecture impacts system performance.
Introduction to Hardware and Operating Systems	ttps://www.coursera.org/learn/introduction-to-hardware-and-operating-systems	This course covers essential hardware and operating system knowledge. It addresses computer components, interfaces, and peripherals, as well as IT tasks like workstation setup and troubleshooting. The course includes interactive exercises and hands-on labs, culminating in a final project where participants can showcase their skills.
Computer and Peripheral Hardware	https://www.coursera.org/learn/illinois-tech-computer-and-peripheral-hardware	This course centers on computer hardware components and peripherals, including cables, memory, storage devices, motherboards, CPUs, and multifunction devices. It equips participants with the skills needed to identify and install various hardware components, configure essential system parts, and understand electronic principles related to power supplies and device settings.
Online courses in Russian	**Link**	**Summary**
Архитектура ЭВМ (Computer Architecture)	https://openedu.ru/course/spbu/EVM/?session=spring_2021	The course provides knowledge on computer architecture, optimization of software products, and designing custom computer systems. It covers key operating system concepts, their historical development, and methods for accelerating and innovating computer structures. The course familiarizes participants with the architecture, instruction set, and advantages of components specific to the Samson HLL computer, while complying with international standards.
Разработка встраиваемых приложений и архитектура микроконтроллеров (Development of Embedded Applications and Microcontroller Architecture)	https://openedu.ru/course/mephi/mephi_rvpam/	This introduces the basics of embedded systems and programming techniques. It covers low-level programming for microcontrollers, focusing on efficient, readable, and portable methods, using STM32 as an example, with principles applicable to other ARM microcontrollers. The course also includes guidelines for code formatting, version control, and teamwork.
Встроенные системы	https://openedu.ru/course/	The course focuses on the design and functionality of embedded systems, aiming to provide students with

(Embedded systems)	ITMOUniversity/EMBSYS/?session=self_2024	foundational knowledge and relevant skills. It covers the principles of embedded systems, selection of development tools and technologies, and methods for assessing their effectiveness in various applications. The course employs remote prototyping systems, creative assignments, and problem-based learning.

Telecommunications

Online courses in English	Link	Summary
Fundamentals of Network Communication	https://www.coursera.org/learn/fundamentals-network-communications	This course explores the evolution of networks and the foundational concepts of layered architecture. It covers network protocols, digital communication fundamentals, and error control techniques such as parity checks and polynomial codes.
TCP/IP and Advanced Topics	https://www.coursera.org/learn/tcp-ip-advanced?specialization=computer-communications	This course provides an in-depth study of TCP/IP protocols, focusing on how IP facilitates communication across networks and the hierarchical structure of IP addresses for Internet scalability. It covers details on address prefixes, masks, TCP's three-way handshake, flow control, and congestion control, and introduces advanced topics such as Multicast, SDN, and security.
Computer Communications Specialization	https://www.coursera.org/specializations/computer-communications	This program focuses on essential network architecture concepts and their impact on cybersecurity, while also developing skills in network protocol design and exploring various network design alternatives. The applied learning project involves assessments that build a foundation in network architectures, protocol design, and TCP/IP programming.
Online courses in Russian	**Link**	**Summary**
Компьютерные сети (Computer Networks)	https://openedu.ru/course/mephi/mephi_cn/	The course offers fundamental knowledge in constructing computer networks and understanding typical protocols, while also developing skills in working with network equipment and software to create secure networks. It covers basic technologies, the processes of generating and transmitting signals and data, and the characteristics of various network protocols and technologies. This knowledge can be applied to select equipment and justify

		the implementation of technologies in the design of information systems.
Беспроводные телекоммуника ционные системы (Wireless Communication Systems)	https://opene du.ru/course/ urfu/TELEC OM/?session =spring_202 4	The course covers the fundamentals of wireless communication, including channel models, radio transmitters and receivers, as well as modulation and signal manipulation. It develops skills in designing and analyzing electronic systems and constructing spectral representation models of discrete signals. Additionally, it enhances abilities in designing and studying electronic devices and systems.
Сетевое и системное администриров ание. Базовый курс. (Fundamentals of Network and System Administration)	https://stepik. org/course/10 5044/promo? search=4733 825676	The course focuses on Cisco networking equipment, covering network fundamentals such as the OSI model layers, network topologies, protocol architecture, and security requirements. It develops skills in designing, configuring, and troubleshooting local area networks (LANs), understanding network documentation, and using various diagnostic and monitoring tools.