MINISTRY OF SCIENCE AND HIGHER EDUCATION
OF THE RUSSIAN FEDERATION
Federal State Budgetary Educational Institution
of Higher Education
“Tambov State University named after G.R. Derzhavin”
Institute of Mathematics, Physics and Information Technologies
Department of Mathematical Modelling and Information Technologies

APPROVED by
Director of the Institute of Mathematics,
Physics and Information Technologies
_____ N.L. Koroleva
"22" September 2021

PROGRAM OF ADMISSIONS TESTING

for master’s course

09.04.03 “Applied Informatics”

profile: Computer Security and Networking

Tambov 2021

1. PURPOSE, OBJECTIVES AND FORMS OF ADMISSIONS TESTING

The main purpose of admissions testing is to test knowledge in the main sections of specialization disciplines, competences and skills of independent work (including research), as well as general cultural and professional competencies acquired in previous training; admissions testing is aimed at applicants (specialists/bachelors), applying for a master's course, in order to choose on a competitive basis the most prepared ones for further training.

Admissions testing for master training programs is done in the form of written examination (a test) in the field of a master training program.

2. REQUIREMENTS FOR KNOWLEDGE AND SKILLS OF APPLICANTS

The enrolment in this educational program is done in accordance with the "Rules for the admission of citizens to the Federal State Budgetary Educational Institution of Higher Education "Tambov State University named after G.R. Derzhavin". The applicant has to submit a state-recognized document of higher education or a certificate of Bachelor's degree.

The main requirements for the knowledge and skills of applicants include personal qualities that will allow applicants to carry out the following types of professional activities: research, organization and management, analytical activities, project work, production and technological activities; applicants should also have well-developed general cultural (universal) and professional (research, organizational and managerial, analytical, design, production and technological) competencies.

In addition, for the successful accomplishment of this master’s educational program, an applicant must have the appropriate competencies in the field of informatics in the volume of the state educational standards for a bachelor’s degree.

3. CONTENT OF THE PROGRAM (SUMMARIES OF THEMES)

Module №1 "Information systems and technologies"

FUNDAMENTALS OF INFORMATION TECHNOLOGIES. The concept of information technology. Objects of information technology. Results of information technology. Means and methods of information technology. General characteristics of technical means of information technology. Life cycle of technical means of information technology.

COMPUTER GRAPHICS. The colour theory and its application in art and design. Basics of raster graphics. Basics of composition and design. Methods for compressing images, audiosignals and videos. Digital image processing and pattern recognition. Image filtering methods. Basic concepts of vector graphics. Fundamentals of fractal graphics.

CALCULATION SYSTEMS. Arithmetic in number systems. Converting integers from decimal to any number system. Converting integers from any number system to decimal. Multiple number systems. Examples.

LOGICAL OPERATIONS ON PROPOSITIONS. Basic equivalences of the algebra of logic. Building a truth table in MS Excel.

MEASUREMENT OF INFORMATION. Probabilistic and alphabetical approaches. The Shannon-Hartley formula. Examples.

MULTIMEDIA TECHNOLOGIES. Sound processing, video processing.

TECHNOLOGY OF PROCESSING NUMERICAL TEXT INFORMATION.

Working with the Microsoft Office package. Editing and preparation of texts, graphs, tables and more complex images. Technologies for processing text documents. Technologies for processing numerical information. Database technologies.

Module №2 "Designing information systems"

ARCHITECTURE OF PERSONAL COMPUTERS. The concept of architecture of a calculation device. Main components and characteristics. Operating system. Definition, structure, main functions. Processes. Definition, basic properties. Process life cycle. Processes. Interaction of processes, methods of synchronization.

CONCEPT AND COMPONENT COMPOSITION OF THE INFORMATION SYSTEM. The life cycle of software. Life cycle models.

DATABASES AND FILE SYSTEMS. DBMS functions. Typical DBMS organization. The "Entity-relationship" method. General concepts of the relational approach to database organization. Basic concepts and terms. Relational database design. SQL language. Functions and main features. The operators Select, Insert, Delete, Update. Client-server architecture.

Module №3 "Operating systems"

OPERATING SYSTEMS. Operating system functions. Basic terms and concepts. OS classification. The structure of files and directories in Linux and Windows. Command interpreter. Physical devices. Loading the system. Processes in Linux and Windows. OS kernel. Kernel loader. File system. Basic set of system utility programs. The procedure for mounting file systems during system boot time. File types. Access rights. File characteristics and file system architecture in Linux and Windows. File layout. Data protection. Sharing files between processes. Realization in Windows and Linux. Memory management. I/O control. The logical and physical organization of the file system. Principles of construction and protection against errors and unauthorized access.

Module №4 "Information Security"

PROTECTION OF COMPUTER SYSTEMS AGAINST DESTRUCTIVE PROGRAMS

Classification of computer viruses. Medium and algorithms of viruses. Trojans. Spyware, software bookmarks. Methods for detecting and removing computer viruses. Prevention of virus infections and reduction of anticipated damage. Antivirus software. Basic rules of protection. Prediction of malware and antivirus software development.

Module №5 "Programming Languages and Programming Methods"

SEARCHING ALGORITHMS. Search in an unordered / ordered sequence. Example.
CONCEPT of PROCESSES AND THREADS IN WINDOWS-APPLICATIONS.
PROGRAMMING. Sequential and binary search, sorting. Example.
PROGRAMMING. Basic sorting methods: selection sort. Example.
PROGRAMMING. Basic sorting methods: exchange sorting. Example.
PROGRAMMING. Basic sorting methods: insertion sort. Example.

OBJECT-ORIENTED APPROACH TO PROGRAMMING AND DESIGN. Paradigms (principles) of object-oriented programming: encapsulation, inheritance, polymorphism. Classes and objects.

Module №6 "Web programming"

UPLOADING WEB-APPLICATIONS TO THE REMOTE SERVER with FTP. Installing and configuring a web application (for example, CMS PhpBB or MOODLE). HTML LANGUAGE. General characteristics of the hypertext markup language HTML. The main tags of the HTML language and their attributes, syntax features. HTML lists. Numbered and bulleted lists. Multilevel lists. Tools for describing tables in HTML. Graphics in HTML: basic graphic file formats. Compression of JPEG, GIF, PNG graphic formats. Using graphics on web pages

STRUCTURE OF THE CLIENT SCRIPT. Java Script language.

Module №7 "Computer networks"

COMPUTER NETWORKS. Internet. Basic communication protocols, addressing system. Choosing a provider and connecting to the network. Data exchange in a local wired network, Ethernet technology. Logical addressing. Wireless technologies and devices, IEEE 802.11 WiFi standard. Wireless LAN components. Setting up an access point. Configuring a wireless client. Technologies of global networks. Network devices. Routers. Switches. Switch working principles. MAC address tables. Switching methods. VLANs. Port security function. Wireless access points. Integrated routers. Router work principles. Routing tables. Routing protocols - RIP, OSPF, EIGRP, BGP. TCP / IP. IP address and subnet mask, default gateway, DNS server. Static and dynamic addresses. DHCP protocol. Classes of IP addresses, network segmentation. MAC addresses. ARP protocol. Interaction of clients and servers. Application layer protocols. HTTP and HTTPS protocols. FTP protocol. SMTP, POP3, IMAP protocols. Domain Name Service. Configuring the Router. Interface management. Setting the IP address and subnet mask. Quality of service (QoS). Packet scheduling within a network device, traffic shaping and traffic control.

4. TEACHING AND LEARNING RESOURCES

Essential literature

1. Attestatsiya ob"ektov informatizatsii i vydelennykh pomeshcheniy [Elektronnyy resurs] [Certification of objects of informatization and allocated premises]. Tambov, Tamb. gos. un-t im. G.R. Derzhavina, 2014. 1 electronic optical disk (CD-ROM).

2. Bazy dannykh: uchebno-metod. kompleks: dlya napravleniya podgotovki 230700 "Prikladnaya informatika" [Databases: study guide for training program 230700 "Applied Informatics"]. Razrabotchiki: A.V. Samokhvalov, N.A. Ryzhova (eds). Tambov, Tamb. gos. un-t im. G.R. Derzhavina, 2014. 1 electronic optical disk (CD-ROM).

3. Klygina E.V. Osnovy algoritmizatsii i programmirovaniya dlya studentov-zaochnikov spetsial'nostey "Matematika", "Fizika" [Fundamentals of Algorithmization and Programming for Part-Time Students of the specialties "Mathematics," "Physics"]. Tambov, TGU imeni G.R. Derzhavina Publ., 2013, 152 p.

4. Kompleksnaya sistema zashchity informatsii ob"ektov informatizatsii. Tambov, Tamb. gos. un-t im. G.R. Derzhavina, In-t matematiki, fiziki i informatiki, 2014. 1 electronic optical disk (CD-ROM).
5. Kopytova N.E., Pronina L.A., Makarova L.N. Tekhnologiya sozdaniya kursovykh i diplomnykh rabot: prakt. Rukovodstvo [Technology for writing term papers and theses: practical study guide]. 4th ed. Tambov, TROO "Biznes-Nauka-Obshchestvo" Publ., 2011, 98 p.
6. Lopatin, D. V. Zashchita ot vredonosnykh programm [Malware protection]. Tambov, Tamb. gos. un-t im. G.R. Derzhavina, 2014. 1 electronic optical disk (CD-ROM).
7. Lopatin, D. V. Zashchita ot vredonosnykh programm [Computer forensics]. Tambov, Tamb. gos. un-t im. G.R. Derzhavina, 2014. 1 electronic optical disk (CD-ROM).
8. Lopatin, D.V. Programmno-apparatnaya zashchita informatsii [Hardware and software information protection]. Tambov, Tamb. gos. un-t im. G.R. Derzhavina, 2014. 1 electronic optical disk (CD-ROM).
9. Lyskova V.Yu. Teoriya i metodika prepodavaniya informatiki [Theory and Methods of Teaching Informatics]. Tambov, TGU imeni G.R. Derzhavina Publ., 2011, 160 p.
10. Metodika obucheniya informatike: UMK po spets. "Pedagogicheskoe obrazovanie (Informatika)" [Methods of teaching informatics: teaching materials pack in training program "Pedagogical Education (Informatics)"]. Sost. V.Yu. Lyskova (ed.). Tambov, Tamb. gos. un-t im. G.R. Derzhavina, Kafedra informatiki i informatsionnykh tekhnologiy, 2014. 1 electronic optical disk (CD-ROM).
11. Pronina L.A., Kopytova N.E. Informatsionnye resursy [Informational resources]. Tambov, TGU imeni G.R. Derzhavina Publ., 2012, 297 p.
12. Sidlyar M.Yu., Konchakov R.B. 3D modelirovanie sredstvami GOOGLE SKETCHUP v prikladnykh i gumanitarnykh issledovaniyakh [3D modeling with GOOGLE SKETCHUP in applied and humanitarian research]. Tambov, TGU imeni G.R. Derzhavina Publ., 2013, 232 p.
13. Web-mastering [Web-mastering]. A.V. Samokhvalov, I.I. Chernykh (eds.). Tambov, Tamb. gos. un-t im. G.R. Derzhavina, 2013. 1 electronic optical disk (CD-ROM).

Further reading

1. Akulov O.A., Medvedev N.V. Informatika [Informatics]. Moscow, Omega-L Publ., 2012, 576 p.
2. Aliev A., Mishchenkova O. Matematicheskoe modelirovanie v tekhnike [Mathematical modeling in engineering]. Izhevsk, Institut komp'yuternykh issledovaniy Publ., 2012, 476 p.
3. Vasin N.N. Osnovy setevykh tekhnologiy na baze kommutatorov i marshrutizatorov [Fundamentals of network technologies based on switches and routers]. Moscow, Internet-Universitet Informatsionnykh Tekhnologiy; BINOM. Laboratoriya znaniy Publ., 2011, 272 p.
4. Virt N. Algoritmy i struktury dannykh. Novaya versiya dlya Oberona [Algorithms and data structures. New version for Oberon]. Moscow, DMK Press Publ., 2010, 272 p.
5. Gavrilova I.V. Razrabotka prilozheniy [Developing applications]. Moscow, FLINTA Publ., 2012, 242 p.
6. Dolgov A.I. Algoritmizatsiya prikladnykh zadach [Algorithmization of applied problems]. Moscow, FLINTA Publ., 2011, 136 p.
7. Zhuravleva T.Yu.Sistemnoe i prikladnoe programmnoe obespechenie System and applied software [System and applied software]. Moscow, Izdatel'stvo Moskovskogo gosudarstvennogo otkrytogo universiteta Publ., 2010, 144 p.

8. Zinkevich V.P. Vychislitel'naya tekhnika i programmirovanie [Computing and programming]. Moscow, Izdatel'stvo Moskovskogo gosudarstvennogo otkrytogo universiteta Publ., 2011, 108 p.
9. Ivanov I.P., Golubkov A.Yu., Skorobogatov S.Yu. Sbornik zadach po kursu «Algoritmy i struktury dannykh» [Collection of problems in "Algorithms and Data Structures"]. Moscow, MGTU im. N.E. Baumana Publ., 2013, 32 p.
10. Ivanova N.Yu., Manyakhina V.G. Sistemnoe i prikladnoe programmnoe obespechenie [System and applied software]. Moscow, MPGU Publ., 2011, 201 p.
11. Informatika: ekspress-podgotovka k internet-testirovaniyu [Informatics: express preparation for Internet testing]. Pod red. O.N. Rubal'skoy (ed.). Moscow, Finansy i statistika Publ., 2010, 240 p.
12. Karasev A.P. Proektirovanie komp'yuternoy seti [Computer network design]. Moscow, Izdatel'stvo Moskovskogo gosudarstvennogo otkrytogo universiteta Publ., 2010, 150 p.
13. Kaufman V.Sh. Yazyki programmirovaniya. Kontseptsii i printsipy [Programming languages. Concepts and principles]. Moscow, DMK Press Publ., 2010, 464 p.
14. Maksimov E.M., Bakhtadze N.N Bazy dannykh v sistemakh upravleniya proizvodstvennymi protsessami [Databases in control systems of production processes]. Moscow, Izdatel'stvo Moskovskogo gosudarstvennogo otkrytogo universiteta Publ., 2011, 160 p.
15. Meyer B. Pochuvstvuy klass [Feel the class]. Moscow, Internet-Universitet Informatsionnykh Tekhnologiy; BINOM, Laboratoriya znaniy Publ., 2011, 776 p.
16. Min'kovich T.V. Model' metodicheskikh sistem obucheniya informatike [Model of methodological systems for teaching informatics]. Moscow, Logos Publ., 2011, 305 p.
17. Nazarov S.V., Shirokov A.I. Sovremennye operatsionnye sistemy [Modern operating systems]. Moscow, Internet-Universitet Informatsionnykh Tekhnologiy; BINOM. Laboratoriya znaniy Publ., 2011. 280 p.
18. Okulov S.M. Osnovy programmirovaniya [Basics of programming]. Moscow, BINOM, Laboratoriya znaniy Pubbl., 2010, 442 p.
19. Okulov S.M. Programmirovanie v algoritmakh [Programming in algorithms]. Moscow, Binom. Laboratoriya znaniy Publ., 2014, 384 p.
20. Patarakin E.D. Sotsial'nye vzaimodeystviya i setevoe obuchenie 2.0 [Social interactions and network learning 2.0]. Moscow, Sovremennye tekhnologii v obrazovanii i kul'ture Publ., 2009, 176 p.
21. Polyakov A.M. Bezopasnost' Oracle glazami auditora: napadenie i zashchita [Oracle Security Through the Eyes of an Auditor: Offense and Defense]. Moscow, DMK Press Publ., 2010, 102 p.
22. Potopakhin V.V. Sovremennoe programmirovanie s nulya! [Modern programming from scratch!]. Moscow, DMK Press Publ., 2010, 242 p.
23. Przhiyalkovskiy V.V. Vvedenie v Oracle SQL [Introduction to Oracle SQL]. Moscow, InternetUniversitet Informatsionnykh Tekhnologiy, BINOM, Laboratoriya znaniy Publ., 2011, 320 p.
24. Smirnova E.V., Proletarskiy A.V., Baskakov I.V., Fedotov R.A. Postroenie kommutiruemykh komp'yuternykh setey [Building switching computer networks]. Moscow, Internet-Universitet Informatsionnykh Tekhnologiy; BINOM. Laboratoriya znaniy Publ., 2011, 368 p.
25. Tumanov V.E. Proektirovanie khranilishch dannykh dlya sistem biznes-analitiki [Designing data warehouses for business intelligence systems]. Moscow, Internet-Universitet Informatsionnykh Tekhnologiy; BINOM. Laboratoriya znaniy Publ., 2010, 616 p.

26. Ul'man L. Osnovy programmirovaniya na PHP [Fundamentals of PHP programming]. Moscow, DMK Press Publ., 2010, 284 p.
27. Sharkov F.I. Interaktivnye elektronnye kommunikatsii (vozniknovenie «Chetvèrtoy volny») [Interactive electronic communications (the emergence of the "Fourth wave")]. Moscow, Dashkov i K Publ., 2012, 260 p.

Appendix

Assessment criteria for the admissions test

The admissions testing (an exam) is carried out in the form of a test (computer-based). The admissions testing is assessed according to a 50-point scale.

The duration of the test is 60 minutes.

The test contains 40 questions:

- 30 questions with one correct answer. The correct answer is worth 1 point.
- 10 questions with two correct answers. The correct is worth 2 points.

Success range: 15-50 points.