# MINISTRY OF SCIENCE AND HIGHER EDUCATION

# OF THE RUSSIAN FEDERATION

# Federal State Budgetary Educational

# Institution of Higher Education

# “Astrakhan State University”

# (Astrakhan State University)

# APPROVED

# by Academic Council

# of FSBEI HE Astrakhan State University

# on October 28, 2021

# (Protocol No. 3)

**PROGRAMME**

**OF IN-HOUSE ENTRANCE EXAMINATION**

**in DIGITAL MEDICINE SYSTEMS AND TECHNOLOGIES**

**conducted by Astrakhan State University**

**for master program**

**12.04.04 BIOENGINEERING SYSTEMS AND TECHNOLOGIES**

**Specialty\field of study – DIGITAL MEDICINE SYSTEMS AND TECHNOLOGIES**

**in 2022**

ASTRAKHAN – 2021

**1. PURPOSE OF THE ENTRANCE EXAMINATION.**

To determine the applicant’s level of proficiency for ASU Master's degree program in Biotechnical Systems and Technologies.

**2. SPECIFIC FEATURES OF THE ENTRANCE EXAMINATION:**

Entrance tests (examinations) are held in the form of an interview in an open meeting of the examination commission, the composition of which is approved by the order of the Rector of the University.

At the entrance examination applicants get examination tickets which are drawn (pulled) at random from the set of offered tickets. The applicant has the right to prepare an answer for at least 30 minutes. During the preparation the student is allowed to use only the program of entrance examination for the given direction of preparation, which contains a brief description of the main sections of the discipline. The applicant can make necessary notes on each question of the examination ticket only on the interview sheets issued by the technical secretary of the examination commission (the sheets are stamped by the Admissions Committee).

During the entrance examination applicants are not allowed to use Internet resources, mobile phones and other means of computer technology, textbooks and notes. Leaving the classroom during the examination allowed only in exceptional cases, and only with the consent of members of the examination commission for no more than 10 minutes, handing their tickets and notes to members of the Commission in advance.

The oral examination (interview) involves the student's presentation to the examination commission of no more than 20 minutes on the questions formulated in the ticket. During the presentation and after its completion on all the questions of the examination ticket, the applicant may be asked clarifying and additional questions within the program of the entrance test by the members of the examination commission.

For the discussion and final evaluation of answers the examination commission holds a closed meeting, after hearing responses from all applicants present at the exam, determining the final grade of 100 points system adopted at ASU (see p. 6). In case the members of the examination commission have different opinions, the decision is made by a simple majority vote. In the event of a tie vote, the chairman shall have the casting vote.

During the oral examination and at the closed meeting of the examination commission the secretary keeps a record. The results of the interview shall be noted in the record for each examinee. The records shall be completed by the secretary of the examination commission and signed by the members of the commission. The results of the interview shall be announced on the day of the interview.

# 3. TEXTBOOKS AND STUDY GUIDES RECOMMENDED FOR EXAM PREPARATION:

(All the materials are available at [www.elibrary.ru](http://www.elibrary.ru) for registered users. The registration procedure is free).

1. Aleev R.J., Molodorich M.I. Teoriya veroyatnostey i matematicheskaya statistika [Probability Theory and Mathematical Statistics]. Textbook / Ministry of Education and Science of the Russian Federation, South Ural State University, Faculty of Computational Mathematics and Informatics. Chelyabinsk, 2015.
2. Alfyorov O.A. Upravleniye proyektami [Project Management]. study and methodology complex. Kaliningrad, 2012.
3. Berestneva O.G., Sharopin K.A., Yumasheva A.L., Abdulkina N.G., Stepanenko N.P., Gerget O.M. Metody matematicheskogo modelirovaniya v zadachakh otsenki sostoyaniya organizma cheloveka [Mathematical modeling methods in human body condition assessment tasks]. Study guide / Moscow region, Noginsk, 2016.
4. Vaseva E.S. Predmetno-oriyentirovannyye ekonomicheskiye informatsionnyye sistemy (section “Informatsionnyye sistemy upravleniya personalom”) [Subject-oriented economic information systems (section “Information systems of personnel management”).]. Textbook / Nizhny Tagil, 2017.
5. Veetsman V.M. Avtomatizirovannaya razrabotka korporativnykh informatsionnykh system [Automated development of corporate information systems]. Study guide / Responsible for the issue T.E. Ovsyannikova, Design Y.A. Stepanov, Computer layout R.D. Rumyantseva, Corrector, technical editor L.V. Shtamagina. Yaroslavl, 2003. Series Mathematics and Informatics 6.
6. Vladzimirsky A.V. Telemeditsina [Telemedicine]: Curatio sine tempora et distantia. Moscow, 2016.
7. Vysotskaya N.V. Prinyatiye i realizatsiya upravlencheskogo resheniya [Adoption and implementation of management decisions]. Nizhny Novgorod, 2019.
8. Goncharov S.F., Shilkin I.P., Bystrov M.V. Primeneniye distantsionnykh telemeditsinskikh tekhnologiy v deyatelnosti lechebnykh meditsinskikh organizatsiy i polevykh gospitaley sluzhby meditsiny katastrof [Application of remote telemedicine technologies in the activities of medical medical organizations and field hospitals of disaster medicine service]. Study guide for doctors / Moscow, 2016. Ser. Library of the All-Russian Disaster Medicine Service
9. Graetskaya O.V., Chusova Y.S. Informatsionnyye tekhnologii podderzhki prinyatiya resheniy [Information technologies for decision support]. Rostov-on-Don, 2019.
10. Dorrer G.A. Metody i sistemy prinyatiya resheniy [Methods and systems of decision-making]. Siberian Federal University, Institute of Space and Information Technologies. Krasnoyarsk, 2016.
11. Esipov M.A., Kostin G.A., Kurlov V.V. Vychislitelnyye sistemy. seti i telekommunikatsii [Computer systems, networks and telecommunications]. Textbook / Saint Petersburg, 2011.
12. Eremin M.Y., Afonichev D.N., Mazukha N.A. Elektrotekhnika. elektronika i elektroprivod [Electrical Engineering, Electronics and Electric Drive]. Study guide. FSBEI HE Voronezh State Agrarian University. Voronezh, 2018.
13. Zolin P.P., Lebedev V.M., Konvai V.D., Patyukov A.G., Patyukov K.A., Atavina O.V., Stepanova I.P., Vysokogorskiy V.E., Korpacheva O.V., Tyulko Z.S., Golovanova O.A., Troshina E.N. Matematicheskoye modelirovaniye biologicheskikh protsessov [Mathematical modelling of biological processes]. Omsk, 2010.
14. Ionov A.C., Belousova G.A. Ekonomicheskiye instrumenty upravleniya proyektami [Economic instruments of project management]. Stavropol, 2020.
15. Kamayev V.A. Kognitivnoye modelirovaniye sotsialno-ekonomicheskikh sistem [Cognitive modelling of social and economic systems] - Volgograd: IGNL Volgograd State Technical University, 2012.- 136p.
16. Korablev V.N., Melnikova N.A. Ekonomika zdravookhraneniya [Economics of Healthcare System]. Study guide for students / Khabarovsk, 2009.
17. Korablev V.N. Otsenka rezultativnosti i effektivnosti sistemy zdravookhraneniya i meditsinskikh organizatsiy [Evaluation of effectiveness and efficiency of the healthcare system and medical organizations]. Monograph / Khabarovsk, 2015.
18. Korobkova O.K. Ekonomika i upravleniye meditsinskimi uslugami na osnove informatsionnykh i telekommunikatsionnykh tekhnologiy [Economics and management of medical services based on information and telecommunication technologies]. Monograph / Khabarovsk State University of Economics and Law. Khabarovsk, 2015.
19. Kotenko P.K., Shevtsov V.I. Organizatsiya zdravookhraneniya i obshchestvennoye zdorovye [Healthcare System and Public Health Management]. Self-teaching guide - Saint Petersburg, 2019. Volume 1.
20. Kotenko P.K., Shevtsov V.I. Organizatsiya zdravookhraneniya i obshchestvennoye zdorovye [Healthcare System and Public Health Management]. Self-teaching guide - Saint Petersburg, 2019. Volume 2.
21. Kotenko P.K., Shevtsov V.I. Organizatsiya zdravookhraneniya i obshchestvennoye zdorovye [Healthcare System and Public Health Management]. Self-teaching guide -Saint Petersburg, 2019. Volume 3.
22. Kotenko P.K., Shevtsov V.I. Organizatsiya zdravookhraneniya i obshchestvennoye zdorovye [Healthcare System and Public Health Management]. Self-teaching guide - St. Petersburg, 2020. Volume 4.
23. Kramarenko T.A., Lukyanenko T.V. Metodiki i modeli proyektirovaniya i razrabotki informatsionnykh sistem [Methods and models of design and development of information systems]. - Krasnodar, 2018.
24. Kudrina V.G., Andreeva T.V., Goncharova O.V., Lipatova E.L. Testovyye zadaniya po meditsinskoy statistike i informatike [Test tasks in medical statistics and informatics]. Moscow, 2010. (4th edition, revised and enlarged)
25. Kumratova A.M., Popova E.V., Bidzhiev A.Z. Ekonomiko-matematicheskoye modelirovaniye riska v zadachakh upravleniya resursami zdravookhraneniya [Economic and mathematical modelling of risk in healthcare resources task management]. - Kuban State Agrarian University. Krasnodar, 2014.
26. Liberman I.V., Polupan K.L., Koryagin S.I., Klachek P.M. Osnovy iskusstvennogo intellekta [Fundamentals of artificial intelligence]. Kaliningrad, 2018.
27. Lukyanov B.V., Lukyanov P.B. Matematicheskiye i instrumentalnyye metody podderzhki prinyatiya resheniy [Mathematical and instrumental methods of decision support]. Study guide / Moscow, 2016.
28. Paraskevov A.V., Loiko V.I. Mikroprotsessory [Microprocessors]. Textbook. Krasnodar, 2018.
29. Perepelitsa V.A., Popova E.V. Matematicheskoye modelirovaniye ekonomicheskikh i sotsialno-ekologicheskikh riskov [Mathematical modelling of economic, social and environmental risks]. Rostov-on-Don, 2001.
30. Pukha G.P. Sistemy podderzhki prinyatiya resheniya [Decision support systems]. Saint Petersburg, 2018.
31. Rizaev I.S., Rakhal Ya. Intellektual’nyj analiz dannyh dlja podderzhki prinjatija reshenij [Intelligent Data Analysis for Decision-Making Support]. Kazan, 2011. Ser. Modern Applied Mathematics and Informatics.
32. Sivyakov B.K., Sivyakov D.B. Elektrotechnika. [Electrotechnics]. Textbook for students on non-electric training areas under bachelor and master programs in intramural and extramural studies / Yuri Gagarin State Technical University of Saratov. Saratov, 2018.
33. Sukhodolov A.P., Marenko V.A. Sistemnyj analiz, modelirovanie, matematicheskoe modelirovanie [Systemic Analysis, Modeling, Mathematic Modeling]. – Irkutsk, 2018.
34. Usov S.V., Tochilin I.P., Zhdanov A.V., Voznesenskaya A.A. Razrabotka sistem avtomatizacii i informacionnye tekhnologii, sokrashchajushchije sroki sozdanija i osvoenija novyh medicinskih izdelij [Automatization Systems Development and Informational Technologies That Reduce a Term for Development and Implementation of New Medical Devices]. Vladimir State University. Moscow, 2019.
35. Fedotov A.A., Akulov S.A., Kalakutsky L.I. Sistemy elektrostimuljacii organov i tkanej [Organs and Tissues Electrostimulation Systems]. Electronic textbook / Samara, 2012.
36. Fedotov A.A., Akulov S.A. Izmeritel’nye preobrazovateli biomedicinskih signalov sistem klinicheskogo monitoringa [Measuring Converters of Biomedical Signals in Biofeedback Systems]. – Moscow, 2013.
37. Fedotov A.A., Akulov S.A. Matematicheskoe modelirovanie i analiz pogreshnostej izmeritel’nyh preobrazovatelej biomedicinskih signalov [Mathematic Modeling and Error Analysis of Biomedical Signals Measuring Converters]. Moscow, 2013.
38. Fomenkov S.A. Teoreticheskije osnovy modelirovanija sistem [Theoretical Basis for Systems Modeling]: a textbook. / S.A. Fomenko, D.M. Korobkin, V.A. Kamaev; VSTU. – Volgograd, 2016. – 160 p.
39. Chernetsky V.O. Primenenie mikrokontrollerov v sistemah upravlenija [Microcontrollers Application in Control Systems]. Textbook / Ministry of Education and Science of the Russian Federation, South Ural State University, Automatic Control Systems Chair. Chelyabinsk, 2016.
40. Shpolyanskaya I.Yu. Informacionnye sistemy v jekonomike: proektirovanie I ispol’zovanije [Information Systems in Economics: Development and Application]. Textbook. – Rostov-on-Don, 2011.
41. Yarotskaya E.V. Jekonomiko-matematicheskije metody i modelirovanie [Economical and Mathematical Methods and Modeling]. Krasnodar, 2017.

# 4. THE LIST OF QUESTIONS:

1. The concept of “Healthcare System”.
2. The main types of healthcare institutions in Russia.
3. The content of the concept “Management” with regard to healthcare systems in Russia.
4. The concept of healthcare system crisis management.
5. The main areas of “queuing theory” methods application to provide healthcare institutions efficiency.
6. Application of “project management” methods when planning and implementing “projects” and “programs” in Russian healthcare system.
7. Software and hardware applied to support “project management” in healthcare.
8. Economic basis of healthcare system in Russia.
9. The main objectives and application fields of information telecommunication technologies with regard to human resources management in healthcare institutions.
10. The concept of “Biotechnology” and common types of such technologies.
11. The concept of “Information Telecommunication Technologies” and these technologies application fields in healthcare system of Russia.
12. The main objectives and application fields of telemedical technologies.
13. The concept of “Personal Medical Information”.
14. The concept of “Model”. The main types of models applied to management processes analysis and realization in healthcare.
15. The most important categories of medical equipment.
16. The concept of “Bioengineering System”, the most important categories of such systems.
17. The concept of “Statistical Data Processing”.
18. The main application fields of software that implements artificial intelligence methods.
19. The concept of “Systems of Decision-Making Support”.
20. Principles of informational and logical development of informational systems and systems of decision-making support.
21. Data types and structure. File structures.
22. Software types and components.
23. Modern approaches and methods of applied programming.
24. Operational systems purpose and functions.
25. Operational systems modular structure and portability.
26. Operational systems processes and the mechanisms of their management.
27. Memory management in operational systems, memory protection, virtual memory implementation mechanism.
28. Design concepts, electrical protection and access security in operational systems.
29. Modern software development tools.
30. DBMS as informational systems development tool.
31. Databases. DB architecture (data presentation layers). DB basic properties.
32. CASE-tools classification and characteristics. Tools for computer-aided design of databases structures.
33. A relational model: basic concepts. Relations fundamental properties. Integrity of entities and references.
34. Data protection in DB. Security provision.
35. Databases and data storages: key concepts of the field.
36. “Entity-Relationship” model. ER-diagram and its visualization.
37. The concept of “Local Area Network”, description of such networks topology.
38. The concept of “Global Networks”. Structure and principles of the Internet global telecommunication network functioning.
39. The concept of a website. The main types of information posted on websites of healthcare institutions and authorities.
40. The concept “algorithm”. The methods of algorithms visualization for analyzing operations process logic through diagrams and flowcharts.

# THE MAIN CRITERIA FOR ASSESSING THE ANSWERS OF ENTRANTS APPLYING TO MASTER PROGRAMS.

* 1. Knowledge of conceptual constructs under a master program, forms and methods of this knowledge presentation.
  2. Skills at giving reasonable answers, identifying cause-effect relations and presenting them convincingly.
  3. Skills at analyzing and systematizing actual information on the questions an entrant is to answer; at delivering this information logically.
  4. Skills at applying theoretical information (knowledge) in practice; the level of an entrant’s comprehensive knowledge.

# THE RELATION BETWEEN THE ENTRANTS’ ANSWERS ASSESSMENT CRITERIA AND THE LEVEL OF THEIR KNOWLEDGE.

|  |  |
| --- | --- |
| **Knowledge levels and sublevels** | **Scores** |
| Examination questions have been covered at high level. | 90- |
| The answer has revealed knowledge of conceptual constructs, forms and methods of their presentation, skills at giving reasonable answers. | 100 |
| An entrant has demonstrated the following skills: |  |
| to identify cause-effect relations between the objects and the processes; to analyze and systematize actual information on the examination questions; to deliver information logically; to apply actual information that is known to an entrant in practice. |  |
| All the additional questions have been answered fully. |  |
| All the key issues of the examination questions and additional questions have been explained. |  |
| The examination questions have been answered fully; an entrant has shown systematic character and coherence when delivering information; all the key issues of the examination questions have been explained. | 80-  89 |
| However an entrant has had difficulties in delivering information logically and applying theoretical information practically. |  |
| Not all the additional questions have been fully answered. |  |
| The examination questions have not been covered fully. Not all the key issues of the examination questions have been explained. | 70- |
| Not all the key issues of the examination questions have been explained. | 79 |
| The logical sequence of information on the examination questions has been broken. An entrant has made major mistakes when answering additional questions and has not demonstrated skills at debating and reasoning his/her opinion. |  |
| The examination questions have not been covered fully, the basic theoretical points have been delivered non-systemically and incoherently. | Up to  69 |
| Most of the examination questions key issues have not been explained or the given explanation has been wrong. |
| An entrant has not demonstrated skills at debating and reasoning his/her opinion. |
| Additional questions have not been answered. |
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