**APPROVED**

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|  | **Vice-Rector for Research Activities, Professor**  **Zhusupov B.S. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **«\_\_\_\_»\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_2018y.** |

**THE PROGRAM OF INTRODUCTORY EXAMINATIONS IN THE MASTER**

**SPECIALTY 6M074800 “PHARMACEUTICAL PRODUCTION TECHNOLOGY”**

**(YEAR, BIENNIAL DIRECTION)**

**FOR 2018 - 2019 ACADEMIC YEAR**

**Almaty 2018y.**

The program was discussed and approved at the meeting of the department "Technologies of medicines and engineering disciplines" protocol

No. \_\_\_, from "\_\_\_" \_\_\_\_\_\_\_\_ 2018y.

Head of the department

'Technology of medicines and engineering disciplines »

Doctor of pharmaceutical sciences, professor \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Ustenova G.O.

The program was approved at a meeting of the Committee of Educational Programs of Postgraduate and Further Education,

Protocol No. \_\_\_\_, from "\_\_\_\_" \_\_\_\_\_\_\_\_\_\_ 2018

Chairman of the CEP \_\_\_\_\_\_\_\_\_\_\_\_ Nurmakhanova Zh.M.

The program was approved at the meeting of the academic Council of KazNMU

Protocol no.\_\_\_\_, from "\_\_\_"\_\_\_\_\_\_\_\_\_\_\_\_2018 y.

Chairman, Professor \_\_\_\_\_\_\_\_\_\_\_\_\_Bayldinova K. Zh.

**Introduction**

The program covers general issues of industrial production, basic concepts and theoretical bases of discipline, state regulation of production of medicines and quality control, modern requirements for the production of medicines, technology of medicines, including the main provisions and requirements of good practices, problems and achievements.

Chemistry and technology of synthetic substances as the main subject in a number of special disciplines, determines the specificity of pharmaceutical analysis of medicines, their determining value in medical practice.

The program is developed taking into account the existing normative documentation for medicinal plant raw materials included in the State Register of Medicines authorized for using in medical practice and industrial production in Kazakhstan

**Purpose of the entrance examination:**

To evaluate the complex of competences (knowledge, skills, etc.) acquired by the undergraduate students in the process of training on the basic educational programs of the disciplines "Industrial technology of medicines", "Chemistry and Technology of Natural Substances", "Chemistry and Technology of Synthetic Substances" a certain type of professional activity.

**The tasks of the entrance examination:**

­­­­­­­­­–То know about the achievements of pharmaceutical science and practice; the concept of pharmaceutical development at the modern stage;

* To know about the main regulatory documents related to the production, quality control, distribution, storage and use of medicines domestic and international standards (GMP, GLP, GPP), pharmacopoeia, guidelines and instructions approved by the Ministry of Healthcare of the Republic of Kazakhstan;
* To know the rules for ensuring aseptic conditions for the manufacture of medicines;
* To know the general principles of selecting and evaluating the quality and operation of process equipment (filtration plants, grinding apparatus and machines, sifting plants, sterilization units and apparatus, etc.);
* To know the basics of environmental safety of production and use of medicines, safety technology, labor protection regulations;
* to know about the algorithm of development, testing and registration of medicines, the methodology of optimization of existing medicines based on modern technologies and biopharmaceutical research in accordance with the international system of requirements and standards, and to have a holistic view of the problems of the modern pharmaceutical industry.

**Form of carrying outentrance exams: The second stage of entrance exams (the 1st stage of entrance exams is testing according to the English language) consist of two periods:**

1. Testing in specialized subjects

2. Interviews

The interview will be conducted in the form of an essay defense (Appendix 1).

**Contents of the disciplines for the entrance examination in the specialty of 6M074800 - "Pharmaceutical Production Technology"**

**"Industrial technology of medicines"**is one of the main disciplines that determines the content of practical activity of pharmaceutical process engineers, whose main tasks are: to study the theoretical bases for the manufacture of medicines of industrial production, applying the principles of organization of the technological process and compliance with the sanitary regime in accordance with international standards and standards; the development of new medicines in rational dosage forms and the improvement of existing prescriptions and technological schemes for obtaining on the basis of biopharmaceutical research using modern equipment for their production, etc.

At the current stage, the issues of creating long-acting and direct-acting dosage forms with controlled release of medicinal substances are topical; development of new types of packaging; search for new excipients, improve the quality control of dosage forms; conducting biopharmaceutical research using "in vivo" and "in vitro" methods.

**“Chemistry and technology of synthetic substances”** - applied science, based on general chemical and physical laws and engaged in research of structure, chemical properties, the relationship of chemical structure with pharmacological activity and the development of the production of medicinal substances.

A special place in a new group of medicinal substances is occupied by various derivatives of aromatic and heterocyclic compounds. The importance of these compounds in medical practice for the treatment and prevention of various diseases is invaluably increasing, which is explained by the significant superiority over the known analogous groups of compounds. The effectiveness of their action is in direct connection with their chemical structure. Possibilities of various chemical methods of analysis for drugs of aromatic and heterocyclic series are dictated by the peculiarities of the chemical behavior of these compounds. Especially this concerns the analysis not only of the physiologically active part of the molecule, which determines the chemical structure, but also of the individual functional groups that make up the structure of the compound.

**The list of questions of the discipline "Industrial technology of medicines"**

1. Pharmaceutical technology as a science. The modern theoretical concept of pharmaceutical technology: the unity of patterns of the effects of pharmaceutical factors in the process of creating medicinal, preventive, rehabilitation and diagnostic means.
2. Structure of pharmaceutical technology as a discipline, its sections: medicines and auxiliary substances, basic processes and apparatuses of pharmaceutical technology, technology of medicinal forms, machines and equipment for pharmaceutical manufacturing, Medicines.
3. Excipients. Ways of obtaining, processing. Qualityrationing.
4. Medicinal products. Classifications by pharmaco-therapeutic groups, by chemical structure, depending on the origin: medicinal substances of chemical synthesis, from native raw materials (vegetable, animal origin and minerals), biotechnological synthesis.
5. Rationing the quality of dosage forms, substances. Rationing of pharmacopeia production and quality of medicine and dosage forms. Features of the State Pharmacopoeia of the latest edition. International Pharmacopoeia.
6. Chemical-pharmaceutical manufacturing enterprise. The structure of pharmaceutical enterprises, the plant principle of the organization for production of medicines.
7. The technological process and its components. Stages and operations of the technological process. Continuous and periodic process. Production flow. General concepts: raw materials, ingredients, semi-finished product, finished product, by-product, production waste.
8. Types of the main processes of pharmaceutical technology on various grounds: mechanical, hydro-mechanical, thermal, mass exchange, etc. Role and interrelation of typical processes of pharmaceutical technology.7
9. General concepts of machines and apparatus. Basicconceptsoftransfermechanisms.
10. The law of equilibrium. Thermodynamic equilibrium. Direction and driving force of processes.
11. Powders as a dosage form. Definition. Characteristic. Requirements for powders. Classification of powders. Stages of technology of powders. Basic rules for mixing powder ingredients and their justification. Evaluation of the quality of powders. Storage. Directions for improving powders.
12. Medical solutions. Classification of solutions. Modern nomenclature of solutions and prospects for its expansion in the factory.
13. Preparation of solutions in various ways at chemical-pharmaceutical enterprises. Dissolutionas a diffusion-kineticprocess.
14. Basic provisions and requirements of the instruction "Good Manufacturing Practice (GMP)". Production (industrial) regulations as the main technological document.
15. Thermal processes in pharmaceutical production. Heat exchanging devices of periodic and continuous action. Vacuum evaporation. Apparatuses and their operating principle. Adverse events during evaporation and ways to eliminate them.
16. Drying various materials in pharmaceutical production. Factors determining the drying process.Methods of drying. Dryers.
17. Extraction. The main technological factors affecting the completeness and speed of extraction. Ways of intensification of mass transfer. Extractionmethods.
18. Recuperation and rectification of ethyl alcohol. Basics of rectification. The device and the principle of operation of rectification plants. Obtaining and using alcohol-rectificate and absolute alcohol.
19. Tinctures. Classification. Getting tinctures. Nomenclature of tinctures. Cleaningoftinctures. Standardizationoftinctures. Storage.
20. Extracts. Definition. Classification according to the consistency and the extractant used. Generalcharacteristics.
21. Liquid extracts. Ways of obtaining. Cleaning. Standardization. Storage. Nomenclature of liquid extracts.
22. Thick and dry extracts. Standardization. Storage. Nomenclature of thick extracts. Oily extracts. Polyextracts. Prospects for the development of production of extracts.
23. Maximum purified phyto-preparations. Methods of extracting plant material. Extractants. Methods for purifying primary extracts from co-products. Standardization.
24. Individual phyto-preparations. Obtaining individual phytopreparations. Methods for isolation, purification and separation. Standardization. Storage.
25. Preparations from animal raw materials. Features of animal raw materials. Classificationoforganopreparations. Obtainingofpreparations. Standardization.
26. Enzyme preparations. Classification. Obtaining of enzyme preparations. Methods of immobilization and standardization. Packaging. Storage. Definition.
27. Tablets. Characteristic. Types and nomenclature of tablets. Theoreticalbasesoftableting.
28. The main groups of excipients used in the production of tablets. Stages of the technological process for obtaining tablets. Pressing. Tablet machines.
29. Coating the tablets. Tablets of prolonged action. Multilayer tablets. Evaluation of the quality of tablets. Themodernnomenclatureoftablets.
30. Triturational tablets. Features of technology.
31. Ways of improvement, development prospects, packaging of tablets. Types of packages. Automatic machines for dosing and packaging of tablets. Storage.
32. Granules, spinsules, dragees. The technological process of obtaining granules. Qualitycontrol.
33. Medical capsules and microcapsules. Types of medical capsules. Assortment, properties of auxiliary substances used in the production of gelatin capsules. Methods of production for medical capsules. Standardization of medicines in capsules. Packaging. Storage.
34. Microencapsulationofmedicinalpreparation.
35. Production of suspensions and emulsions in the factory. Equipment. Standardization. Storage.
36. Ointments and pastes. Features of technology of dermatological, rectal and vaginal ointments. Equipment. Modern methods for assessing the stability and effectiveness of ointments. Storageofointmentsandpastes.
37. Industrial production of suppositories . Characteristics of the basics. Technological equipment for the production and packaging of suppositories. Methods of preparing suppositories in the factory. Standardization. Storage. Prospects for the development of rectal dosage forms.
38. Injection solutions for ampoules. Industrial production for ampoules. Preparation in aseptic conditions. Requirements for dosage forms of injections.
39. Solvents for injectable dosage forms.
40. Manufacture of ampoules and vials. Preparation of injection solutions in the factory.
41. Способыстерилизацииинъекционныхрастворов.
42. Evaluation of the quality for finished products.
43. Labeling of ampoules. Packaging. Automatic machines for packing ampoules.
44. Features of technology of eye medicinal forms of factory production. Ophthalmic ointments. Eye medicinal films. Kinds and prospects of packages of medicinal forms for eyes. Packagingforsingleuse, tube-dropper.
45. Biopharmacy as one of the main theoretical directions of medicine technology. Terms of biopharmacy . The rate of release of medicinal substances from dosage forms. Therapeutic inadequacy of medicines. Statistical processing of experimental results.
46. Biological availability of dosage forms. Methods of determination. Pharmaceutical factors affecting the bioavailability of medicines.
47. Basic concepts for the pharmacokinetics of medicinal preparations.
48. Veterinary preparations. Definition. Classification. Features and rules for the preparation of raw materials for veterinary medicines. Rules for storage and standardization of raw materials.
49. Classification of age-related dosage forms. Requirements for them. Requirements for excipients. Requirements, packaging and registration of age-related dosage forms. The problem of creating children's and geriatric medicinal forms and medicines.
50. Achievements of pharmaceutical technology in the creation of new dosage forms. Therapeutic systems.

**The list of questions of the discipline "Chemistry and Technology of Synthetic Substances"**

1. Modern stages of the development of chemical technology.
2. Classificationofmedicinalsubstances
3. Sourcesofreceivingpharmaceuticalmedicines
4. Production of iodine. Purification of iodine-raw. What parameters made the classification of dosage forms?
5. What parameters a classification is made of medicinal forms produced on?
6. What normative documentation is used in the analysis of medicinal substances of industrial production?
7. Describe of drugs from a number of aliphatic hydrocarbons.
8. How doesinfluences the introduction of halogen atoms on the biological properties of hydrocarbons?
9. How do changethe properties in the series methylene chloride-dichloromethane-chloroform-carbon tetrachloride change?
10. Provide schemes of synthesis of the chloroform and theiodoform. Explainwhy do they have different application in medicine?
11. Bring structural formulas over and name the substances used as anesthesia.
12. Methods of production of synthetic medicinal substances.
13. Classification of medicinal forms and feature of their analysis.
14. Normative documents regulating the quality of medicines in the Republic of Kazakhstan.
15. What chemical and pharmaceutical preparations are got from salicylic acid?
16. Bring structural formulas over and describe their application domains.
17. Bring a chart over of synthesis of acetophene and indicate fields of her application domain.
18. What kind of sideproducts do appear at the synthesis of acetophene?
19. Bring a basic technological scheme for the production of acetylsalicylic acid.
20. What medicines from a number of aliphatic hydrocarbons it is used in medicine?
21. How doesinfluences the introduction of halogen atoms on the biological properties of hydrocarbons?
22. How do changethe properties in the series methylene chloride-dichloromethane-chloroform-carbon tetrachloride change?
23. Provide schemes of synthesis of the chloroform and theiodoform. Explainwhy do they have different application in medicine?
24. Bring structural formulas and tell the substances used as anesthesia.
25. Make a scheme for the synthesis of urotropine, characterize its properties and fields of application.Make a scheme for the synthesis of chloral hydrate and tell its applications in medical practice.
26. Methods of receiving synthetic caffeine. Production of caffeine from 8 methylcaffeine.
27. Characterize medicines on the basis of n-aminobenzole acid. Write their structural formulas and characterize features of action on an organism. In structure of anesthetics show anestezioforny groups
28. Provide schemes of synthesis of benzocaine.Write their comparative characteristic.Characterize features of an industrial method of receiving benzocaine.
29. Provide schemes of synthesis of novocaine. Write their comparative characteristic.
30. Characterize features of an industrial way of receiving novocaine. Draw the scheme of purification of novocaineindependently.
31. Provide schemes of synthesis of a dikain, lidocaine, atrimekain. Characterize features of their action in comparison with novocaine.
32. Characterize chemical-pharmaceutical medicines on the basis of a furan. Provide the scheme of synthesis and describe stages of production of Furacilin.
33. Technological stages of production of potassium of iodide. Safety measures and protection of the equipment.
34. Chloroform. Obtainingof chloroform from alcohol and calcium hypochlorite. Production of medical chloroform and chloroform for anesthesia.
35. Chemistry and technology of chemical and pharmaceutical preparations.
36. The scheme of production of bromine. Safety precautions when working with bromine. Productionofsodiumbromide.
37. Technology ofproduction of barium sulfate. Advantages of the hydrochloric acid and chlorocalcium process for obtaining barium sulfate. Chemical control. Pharmacopeic requirements for the degree of dispersion of barium sulfate.
38. The technology of production ofiodoform.
39. The methods of chemical transformations used in technology of receiving organic compounds.
40. Raw material for the production of mineral salts. Mineral substances and their role are in an organism.Сырьедляпроизводстваминеральныхсолей. Минеральные вещества и их роль в организме.
41. Obtaining the hloralgidrat on reaction of chlorination of ethyl alcohol. Scheme of synthesis, hardware registration of production of the hloralgidrat (chlorination).
42. Bicyclic terpenes: camphor, bromkamfor, sulfocamphor acid, sulphocamphocaine. Methods of quality control.
43. Sources and methods for the preparation of vitamins of group K. Preparation of phytoquinonein the way condensation of 2-methyl-1,4-naphthohydroquinone with phytol (Fisher's method).
44. Studying the mechanism Kolbe-Schmidtin the development of new methods for the synthesis of salicylic acid.
45. Receiving of technical hexamethylenetetramine in the industry for liquid-phase and gas-phase methods. Receiving of pharmacopeia preparation, purification methods.
46. Studying the mechanism Kolbe-Schmidtin the development of new methods for the synthesis of salicylic acid.
47. Chemical structure of retinol acetate. Sourcesofreceiving
48. Industrial way of receiving pyridoxine hydrochloride.
49. Characteristic of four stages of obtaining white streptocide, requirement to conditions of carrying out synthesis, safety measures.
50. General concepts about condensation processes

**Recommended literatures**

1.В.И. Чуешов, Е.В. Гладух, И.В. Сайко. Технология лекарств промышленного производства. Ч. 1. –Винница: Нова книга, 2014. -696 с.

2.В.И. Чуешов, Е.В. Гладух, И.В. Сайко. Технология лекарств промышленного производства. Ч. 2. –Винница: Новакнига, 2014. -664 с.

3.Aultons Pharmaceutics The Design and Manufacture of Medicines -Michael E. AultonBPharm PhD FAAPS 717c

4.Фармацевтическая технология: руководство к лабораторным занятиям. / Быков В.А., Демина Н.Б., Скатков С.А., Анурова М.Н./ – М.: ГЭОТАР – Медиа, 2009.- 304 с.

5.Арзамасцев А.П. Фармацевтическая химия: учебное пособие, 3-е изд., испр. – М.: ГЭОТАР-Медиа, 2008. – 640 с.

6. Беликов В.Г. Фармацевтическая химия: учебное пособие, 2-е изд. – М.: МЕДпресс-информ, 2008. – 616 с.

7.Руководство к лабораторным занятиям по фармацевтической химии: Э.Н. Аксенова, О.П. Андрианова, А.П. Арзамасцев и др. – М.: Медицина, 2001. – 384 с.

8.Государственная фармакопея Республики Казахстан: первое издание. – Астана: Изд. дом «Жибекжолы», 2008. – 592 с.

9.Указ Президента РК от 29 ноября 2010 года № 1113 «Государственная программа развития здравоохранения Республики Казахстан «СаламаттыЌазаќстан» на 2011 – 2015 годы».

10.Программа развития фармацевтической промышленности Республики Казахстан на 2010-2014 годы. Астана, 2010.

11.Лекарственное сырье растительного и животного происхождения. Фармакогнозия / Под.ред. Г.П. Яковлева. – СПб.: СпецЛит, 2006. – 845 с.: ил.

**Additional:**

1.Государственная Фармакопея Республики Казахстан. – том 1 – Алматы. – Издательский дом: «Жибекжолы».– 2008.– 592 с.

2.Государственная Фармакопея Республики Казахстан.– том 2. – Алматы.– Издательский дом: «Жибекжолы».– 2009. – 792 с.

4. Машковский М.Д. Лекарственные средства. – 15-е изд., перераб., испр. и доп. – М.: РИА “Новая волна”: Издатель Умеренков, 2008. – 1206 с.: ил.

5. Практикум по фармакогнозии: Учеб.пособие для студ. Вузов / В.Н. Ковалев, Н.В. Попова, В.С. Кисличенко и др.: Под общ. ред. В.Н. Ковалева. – Харьков: Изд-во НФаУ: Золотые страницы: МТК – книга, 2004. – 512 с.: 615 ил.: 24 с. вкл.

6. Руководство к практическим занятиям по фармакогнозии: Анализ фасованной продукции: учеб.пособие / под ред. И.А. Самылиной. – М. ООО “Медицинское информационное агентство”, 2008. – 288 с.: ил.

7. Технология лекарств, под редакцией А.И. Тихонова, Харьков, «Оригинал» - 2006 г

8.Б.А. Сағындықова. Дәрілердіңөндірістіктехнологиясы. - Шымкент, 2008. - 346 б.

9.Б.А. Сағындықова. Дәрілердіңөндірістіктехнологиясы. -Алматы, 2011. - 346 б.

10. Р.Д. Ділбарханов, У.М. Датхаев, М.Е. Амантаева. Жақпамайлар. Алматы, 2005.– 123 б.

Appendix 1

ESSAY-PORTFOLIO

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(Full nameof the Applicant)

**Section 1. Justification for the choice of AsfendiyarovKazNMU University, for studying in a master's:**what attracts AsfendiyarovKazNMU, compared with other universities; what scientific, educational, clinical, and public achievements of the university were of the greatest interest; the planned scientific and public activities in the university - in what direction or what kind of scientific research is planned to be conducted in the master's (up to 1 page of text).

**Section 2. Explanation of the choice of the master's program in the specialty:** why this specialty and program was chosen, how the chosen program is related to the present or future professional activity. This section describes the reasons and features of choosing a profession, describes the future image and reveals your own strategies for achieving career success (up to 1 page of text).

**Section 3.Applicant'sachievements:**

publications in scientific journals and proceedings; participation in conferences and exhibitions; scientific grants; scientific diplomas and awards; the average score for the diploma of higher education, the other (the volume of the text if necessary).

Applicant's signature:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

signature full name