**PRIVATE HIGHER EDUCATIONAL INSTITUTION**
**"INTERNATIONAL ACADEMY OF ECOLOGY AND MEDICINE"**
**Department of internal medicine with a course in psychiatry and narcology**

# WORKING PROGRAM EDUCATIONAL DISCIPLINE

## " Radiation medicine "

**LEVEL OF HIGHER EDUCATION** Second (master's) level
**DEGREE OF HIGHER EDUCATION** Master
**FIELD OF KNOWLEDGE** 22 Health care
**SPECIALTY** 222 Medicine

Reviewed and approved
at the meeting of the Academic Council
Protocol No. 1, dated August 01, 2020

**Kyiv 2020**

Work program in the discipline " **Radiation Medicine** " for the training of students of the second (master's) higher education level of higher education in specialty 222 Medicine.

**Description of the academic discipline:**

| Name of indicators | Characteristics of the academic discipline | |
|---|---|---|
| | Full-time education | |
| Total number: Credits - 1.5 Hours - 45 Content subdivisions -1 | Mandatory | |
| | A year of training | 5 |
| | Semester | IX-X |
| | Lectures | 5 hours |
| | Practical | 15 hours |
| | Independent work | 25 hours |
| | Including individual tasks | 0 |
| | Final control form | Diff . test |

**1. The purpose and tasks of the educational discipline**

**Purpose:** formation of a complex of knowledge, abilities and skills in radiation medicine in students, such as: to determine etiological, pathogenetic factors and clinical manifestations, to diagnose acute radiation damage and provide emergency aid to victims, to determine the management tactics of victims who have been exposed to ionizing radiation, to determine etiological and pathogenetic factors of chronic radiation damage to people, to determine the tactics of treating victims, to use methods of determining the effect of small doses of radiation on the human body, and to determine means of prevention, treatment and minimization of the harmful effects of radiation.

**Task:**

1 To form the responsibility of the student as a future specialist for the level of his training, its improvement during his studies and professional activity;

2. To make the student a participant in the process of providing medical care to the patient at all stages of the patient's treatment with the possession of professional practical skills.
3. In order to implement the aforementioned, it is necessary to provide the student with a detailed plan of his work at the first lesson of the discipline and ensure the organization of its implementation.

**The process of studying the discipline is aimed at forming elements of the following competencies :**

IR - The ability to solve complex tasks and problems in a certain field of professional activity or in the learning process, which involves conducting research and/or implementing innovations and is characterized by the complexity and uncertainty of conditions and requirements.
ZK1- Ability to abstract thinking, analysis and synthesis.
ZK2 - Ability to know and understand the subject area and professional activity.
ZKZ - Ability to communicate in the state language.

ZK6 - Ability to work in a team.
ZK8 - Ability to evaluate and ensure the quality of the work performed.
ZK9 - The ability to act on the basis of ethical considerations, socially, responsibly and consciously.
ZK10 - Ability to be critical and self-critical.
SK1 - Skills of communication and clinical examination of the patient during diagnosis and treatment.
SK2- Ability to determine the necessary list of clinical laboratory and instrumental studies and evaluate their results during diagnosis and treatment.
SCZ - Ability to establish a preliminary and clinical diagnosis.
SK5 - Ability to diagnose emergency conditions
SK12 - The ability to determine the management tactics of persons subject to dispensary supervision. SK14 - Ability to keep medical documentation.
SK15 - The ability to plan, conduct and analyze activities related to the organization and integration of providing medical care to the population.

**Expected learning outcomes. As a result of studying the academic discipline, the student must :**
**Know:** the clinic, diagnostics, and methods of treatment of radiation sickness, measures to prevent radiation overload of a person.
**Be able:**
- Collect data on the patient's complaints, medical history, and life history to determine radiation damage to various organs and systems of the body.
- Evaluate information regarding the diagnosis using a standard procedure, based on the results of laboratory and instrumental studies to determine radiation damage to various organs and systems of the body. Determine the list of necessary clinical, laboratory and instrumental studies and evaluate their results.
- Identify the leading clinical symptom or syndrome and, on the basis of dosimetry data, the results of laboratory studies and clinical signs, diagnose radiation damage (degree of severity, period of clinical course, etc. ) .
- Establish a preliminary diagnosis, carry out differential diagnosis and determine the clinical diagnosis of the disease.
- Plan and sort the victims according to the severity of the injury, choose the means and place of evacuation.
- Plan and carry out prevention of radiation damage.
- Determine tactics and provide emergency medical care to victims of ionizing radiation

**Master the skills:**
- Communications and clinical examination of the patient.
- Keep medical records.

## CONTENT OF THE EDUCATIONAL DISCIPLINE

**Topic 1. The subject of radiation medicine, its connection with other medical disciplines. The history of the development of radiation medicine.**
Natural radiation background, its components and changes. Artificial sources of ionizing radiation and their use in the national economy. Wilhelm Konrad Röntgen's discovery of x - ray , Henri Becquerel's discovery of the natural radioactivity of uranium, Marie Skladovska-Curie and Pierre Curie's discovery of the radioactive properties of polonium and radium .

**Topic 2. Nature, types and properties of radiation. Dosimetry of ionizing radiation.**
Nature, types and properties of radiation. Dosimetry of ionizing radiation. The principle of construction of dosimeters, radiometers, their types. Assessment of the degree of radionuclide contamination of the environment, soil, water, and food products.
Principles of construction of dosimeters, radiometers, their types. Assessment of the degree of radionuclide contamination of the environment, soil, water, and food products. Permissible levels of ionizing radiation ( IB ). Regulation depending on the categories of the population (Category A (specialists), Category B (staff), Category B the entire population). IB Control Levels . Radiation dose regulations. Units of radioactivity and radiation doses. Exposure dose. Absorbed dose. Equivalent dose. Effective dose. Types of devices for measuring dose and radioactivity.

**Topic 3. Biological effect of ionizing radiation.** Dependence of the biological effect on the nature of the action of ionizing radiation, the volume of exposure, the radiosensitivity of body tissues. The concept of the risk of impact of ionizing radiation on the human body. Radiation syndromes. Mutations and chromosomal aberrations. Nuclear radiosensitivity, DNA cleavage.

**Topic 4. Diagnostic and prognostic value of hematological, biochemical, cytogenetic and other research methods for evaluating pathological changes in human organs and systems after exposure to ionizing radiation.**
Impact of ionizing radiation on various organs and systems of the body: brain, heart, lungs, mucous membranes, digestive system, endocrine system. Primary physico -chemical reactions body and various tissues to the influence of ionizing radiation. "Critical organs" ( Bergenier - Tribondo theory ).

**Topic 5. Types of radiation damage.**
Acute radiation sickness, which arose as a result of external irradiation. Etiology, pathogenesis, diagnosis, clinic, treatment, consequences of acute radiation sickness, medical and social examination. Acute local radiation damage. Peculiarities of the clinic, diagnosis and treatment of persons who have undergone combined radiation. Analysis of the most characteristic disease histories of persons who suffered acute radiation sickness and local radiation injuries. Curation of patients who have suffered acute radiation sickness or have internal diseases, the development of which is related to the influence of the radiation factor. Clinical examination of patients and writing of medical history.

**Topic 6. Chronic radiation sickness.**
Etiology, pathogenesis, diagnosis, clinic, treatment. Degrees of severity of chronic radiation sickness: mild, medium, severe. Annual radiation dose: 0.7 - 1 Gy ; clinical and laboratory characteristics of various degrees of severity of chronic radiation sickness.

**Topic 7. Distant consequences of ionizing radiation.**
Stochastic and non-stochastic effects of radiation. Genetic, teratogenic and somatic consequences of human exposure. The effect of small doses of ionizing radiation on the human body. Radiation damage: intestinal syndrome, oropharyngeal , pulmonitis , radiation cataract, thyroid gland, CNS damage, skin damage.

**Topic 8. Toxicology of the main radionuclides.**
Peculiarities of the clinic, diagnostics and treatment and preventive measures in the case of radionuclides entering the human body. Effects of internal human irradiation. Alpha and beta radiation as a result of entering the body by inhalation, through the digestive tract. Gamma and beta radiation due to penetration through the digestive tract and onto the skin. The higher the specific ionization, the greater the biological efficiency.

**Topic 9. Medical and psychological aspects of large-scale accidents at nuclear plants.**
Equipment and operation of special medical facilities to provide assistance to persons exposed

to ionizing radiation. Model of the accident at the Chornobyl NPP. Demographic indicators after the accident at the Chernobyl nuclear power plant. National register of Ukraine of victims of the Chernobyl disaster: purpose, structure, purpose, tasks.

**Topic 10. Examination of personnel working with sources of ionizing radiation.** Groups of persons of primary dispensary registration, categories and levels of observation. Equipment and operation of special medical facilities to provide assistance to persons exposed to ionizing radiation. The national program for liquidation of the consequences of the accident at the Chernobyl nuclear power plant: the formation of social-ecological, legal and medical norms for the provision of assistance to victims, according to dispensary registration groups.

**The structure of the academic discipline**

| Names of modules, submodules and topics | Number of hours | | | |
|---|---|---|---|---|
| | Total | Lectuers | Practice – no classes | SRS |
| 1 | 2 | 3 | 4 | 5 |
| Topic 1. The subject of radiation medicine, its connection with other medical disciplines. The history of the development of radiation medicine. Natural radiation background and its components. Artificial sources of ionizing radiation. | 6.0 | 2.0 | 2.0 | 2.0 |
| Topic 2. Nature, types and properties of radiation. Dosimetry of ionizing radiation. | 4.0 | | 2.0 | 2.0 |
| Topic 3. Biological effect of ionizing radiation. | 4.0 | | 2.0 | 2.0 |
| Topic 4. Diagnostic and prognostic value of hematological, biochemical, cytogenetic and other research methods for assessing pathological changes in human organs and systems after exposure ionizing radiation. | 2.0 | | | 2.0 |
| Topic 5. Types of radiation damage. Impact of ionizing radiation on the body. Acute and chronic effects of exposure. | 8.0 | 2.0 | 2.0 | 4.0 |
| Topic 6. Chronic radiation sickness. | 4.0 | | 2.0 | 2.0 |
| Topic 7. Distant consequences of ionizing radiation. | 5.0 | | 2.0 | 4.0 |
| Topic 8. Toxicology of the main radionuclides. | 2.0 | | | 2.0 |
| Topic 9. Medical, social, ecological and psychological aspects of large-scale accidents at nuclear plants. Medical consequences of a large-scale nuclear accident (accident at the Chernobyl nuclear power plant). | 6.0 | 1.0 | 1.0 | 4.0 |

| | | | | |
|---|---|---|---|---|
| Topic 10. Medical examination of personnel working with ionizing radiation. | 1.0 | | | 1.0 |
| **Final control of mastering the discipline.** | 2.0 | | 2.0 | |
| **Hours in general:** | 45.0 | 5.0 | 15.0 | 25.0 |

Topics of lectures

| No | Topic |
|---|---|
| 1 | Introductory lecture. The history of the development of radiation medicine. |
| 2 | Impact of ionizing radiation on the body. Acute and chronic effects of exposure. |
| 3 | Medical consequences of a large-scale nuclear accident (accident at the Chernobyl nuclear power plant). |

Topics of practical classes

| No | Topic |
|---|---|
| 1 | The subject of radiation medicine, its connection with other medical disciplines. The history of the development of radiation medicine. Natural radiation background and its components. Artificial sources of ionizing radiation. |
| 2 | Nature, types and properties of radiation. Dosimetry of ionizing radiation. The principle of construction of dosimeters, radiometers, their types. Assessment of the degree of radionuclide contamination of the environment, soil, water, and food products. |
| 3 | Biological effect of ionizing radiation. Radiosensitivity of various body tissues. |
| 4 | Acute radiation sickness. Etiology, pathogenesis, clinic, diagnosis, treatment, consequences, medical and social examination. Acute local radiation damage. Peculiarities of the clinic, diagnosis and treatment of persons who have undergone combined radiation. Analysis of the most characteristic disease histories of persons who suffered acute radiation sickness and local radiation injuries. Curation of patients who have suffered acute radiation sickness or have internal diseases, the development of which is related to the influence of the radiation factor. |
| 5 | Chronic radiation sickness. Etiology, pathogenesis, diagnosis, clinic, treatment. |
| 6 | Distant effects of ionizing radiation. Stochastic and non-stochastic effects of radiation. The effect of small doses of ionizing radiation on the human body. |

| | |
|---|---|
| 7 | Medical, social, ecological and psychological aspects of large-scale accidents at nuclear plants (according to the model of the accident at the Chernobyl NPP). National register of Ukraine of victims of the Chernobyl disaster: goal. Structure, purpose, tasks. Equipment and work special medical institutions to provide assistance to persons exposed to ionizing radiation. |
| 8 | Final control of mastering the discipline. |

Topics of SRS

| No | Topic |
|---|---|
| 1 | The subject of radiation medicine, its connection with other medical disciplines. The history of the development of radiation medicine. Natural radiation background and its components. Artificial sources of ionizing radiation. |
| 2 | Nature, types and properties of radiation. Dosimetry of ionizing radiation. The principle of construction of dosimeters, radiometers, their types. Assessment of the degree of radionuclide contamination of the environment, soil, water, and food products. |
| 3 | Biological effect of ionizing radiation. Radiosensitivity of various body tissues. |
| 4 | Diagnostic and prognostic value of hematological, biochemical, cytogenetic and other research methods for evaluating pathological changes in human organs and systems after exposure to ionizing radiation. Clinical consequences of the impact of ionizing radiation on human organs and systems. |
| 5 | Acute radiation sickness. Etiology, pathogenesis, clinic, diagnosis, treatment, consequences, medical and social examination. Acute local radiation damage. Peculiarities of the clinic, diagnosis and treatment of persons who have undergone combined radiation. Analysis of the most characteristic disease histories of persons who suffered acute radiation sickness and local radiation injuries. Curation of patients who have suffered acute radiation sickness or have internal diseases, the development of which is related to the influence of the radiation factor. |
| 6 | Chronic radiation sickness. Etiology, pathogenesis, diagnosis, clinic, treatment. |
| 7 | Distant effects of ionizing radiation. Stochastic and non-stochastic effects of radiation. The effect of small doses of ionizing radiation on the human body. |

| | |
|---|---|
| 8 | Toxicology of the main radionuclides. Effects of internal human irradiation. |
| 9 | Medical, social, ecological and psychological aspects of large-scale accidents at nuclear plants (according to the model of the accident at the Chernobyl NPP). National register of Ukraine of victims of the Chernobyl disaster: goal. Structure, purpose, tasks. Equipment and operation of special medical facilities to provide assistance to persons exposed to ionizing radiation. |
| 10 | Dispensation of personnel who work with persons of primary dispensary registration, categories and levels of observation. |

## Teaching methods

**Practical classes:** conversation, consideration of presentations on the topics of practical classes, solving clinical situational problems, analysis of the most characteristic histories of diseases of persons who have undergone acute radiation sickness and local radiation injuries. Curation of patients who have suffered acute radiation sickness or have internal diseases, the development of which is related to the influence of the radiation factor.

**Independent work:** independent work with the textbook, independent solution of clinical tasks.

## 9. Control methods and criteria for evaluating learning outcomes

**Current control:** oral survey, testing, assessment of performance of practical skills, solution of situational clinical tasks, assessment of activity in class.
**Final control:** diff . assessment, testing.

***The structure of the current evaluation in the practical lesson*** **:**

1. Evaluation of theoretical knowledge on the subject of the lesson: methods: survey, solving a situational clinical problem; maximum score - 5, minimum score - 3, unsatisfactory score - 2.
2. Evaluation of practical skills and manipulations on the topic of the lesson: methods: evaluation of the correctness of the implementation of practical skills, maximum score - 5, minimum score - 3, unsatisfactory score - 2;
3. Evaluation of work with a patient on the subject of the lesson: methods: assessment of: a) communication skills of communicating with the patient and his parents, b) the correctness of prescribing and evaluating laboratory and instrumental studies, c) compliance with the differential diagnosis algorithm, d) substantiation of the clinical diagnosis, e) drawing up a treatment plan maximum score - 5, minimum score - 3, unsatisfactory score - 2;

**Current assessment criteria for practical training:**

| | |
|---|---|
| "5" | The student has a fluent command of the material, takes an active part in discussing and solving a situational clinical problem, confidently demonstrates practical skills during the examination of a sick child and the interpretation of clinical, laboratory and instrumental research data, expresses his opinion on the topic of the lesson, demonstrates clinical thinking. |
| "4" | The student has a good command of the material, participates in the discussion and solution of a situational clinical problem, demonstrates practical skills during the examination of a sick child and the interpretation of clinical, laboratory and instrumental research data with some errors, expresses his opinion on the topic of the lesson, demonstrates clinical thinking. |
| "3" | The student does not have sufficient knowledge of the material, is unsure of participating in the discussion and solution of a situational clinical problem, demonstrates practical skills during the examination of a sick child and the interpretation of clinical, laboratory and instrumental research data with significant errors. |
| "2" | The student does not master the material, does not take part in the discussion and solution of the situational clinical problem, does not demonstrate practical skills during the examination of a sick child and the interpretation of clinical, laboratory and instrumental research data. |

**A student is admitted to the final control of learning a discipline ( different credit ) on the condition that he meets the requirements of the educational program and if he received at least 3.00 points for the current educational activity, has no missed lectures and practical classes, and successfully completed an essay on the topics of independent works of students (SRS).**

**The structure of the final control of mastering the discipline**

| The content of the evaluated activity | Number |
|---|---|
| **Independent description of three cases of radiation damage (for example: acute and chronic radiation sickness).** | **3** |
| **Answer to 2 (two) theoretical questions.** | **2** |

**Criteria for evaluating the learning outcomes of education seekers in the exam:**

| | |
|---|---|
| "5" | It is issued to a student who worked systematically during the semester, showed during the diff . versatile and in-depth knowledge of the program material, able to successfully perform the tasks provided for by the program, mastered the content of the main and additional literature, realized the interrelationship of individual sections of the discipline, their importance for the future profession, showed creative abilities in understanding and using the educational program material, demonstrated the ability to independently update and replenish knowledge; level of competence - high (creative); |
| "4" | It is awarded to a student who has demonstrated complete knowledge of the curriculum material, successfully completes the tasks provided for by the program, has mastered the basic literature recommended by the program, has shown a sufficient level of knowledge in the discipline and is capable of their independent updating and renewal in the course of further education and professional activity; the level of competence is sufficient ( constructive and variable); |
| "3" | It is awarded to a student who has demonstrated knowledge of the basic curriculum material to the extent necessary for further education and subsequent work in the profession, copes with the tasks provided for in the program, made some mistakes in the answers to the differential assessment and when completing the exam tasks, but possesses the necessary knowledge to overcome mistakes made under the guidance of a scientific and pedagogical worker; level of competence - average (reproductive); |
| "2" | It is issued to a student who has not demonstrated sufficient knowledge of the main curriculum material, has made fundamental mistakes in completing the tasks provided for by the program, cannot use the knowledge in further studies without the help of a teacher, has not managed to master the skills of independent work; the level of competence is low ( receptive -productive). |

A student who has systematically worked during the academic year and has an average score of 4.75 or higher receives 5.00 points without a test during the diff . offset About the possibility and conditions of obtaining a diff . the teacher informs all students of the group "automatically" of the score at the first lesson.

**10. Distribution of points received by students of higher education**

The grade for the discipline consists of 50.0% of the grade for the current academic performance and 50.0% of the grade for the exam.

**The average score for the discipline is translated into a national score and converted into points on a multi-point scale.**

Table of conversion of a traditional assessment into a multi-point assessment:

| National assessment for discipline | The sum of points for the discipline |
|---|---|
| **"5"** | **180-200** |
| **"4"** | **150 -179** |
| **"3"** | **120-149** |

Conversion of traditional grades from disciplines and totals on the ECTS scale

| Evaluation on the ECTS scale | Statistical indicator |
|---|---|
| A | The best 10% of students |
| B | The next 25% of students |
| C | The next 30% are students |

| | |
|---|---|
| D | The next 25% of students |
| E | The next 10% of students |

**List of questions to the diff . offset**

1. X-ray research methods.
2. Nature and properties of ionizing radiation (alpha, beta, gamma, neutrons, X-rays).
3. Nature and properties of ionizing radiation (alpha, beta, gamma, neutrons, X-rays).
4. The concept of dose, dose power. Exposure, absorbed, equivalent, effective dose equivalent. Units of the International System (SI).
5. Dose determination methods. Types of dosimeters.
6. Radioactivity (concept; units, types of radioactive decay).
7. Methods of determining radioactivity.
8. PUCUS algoritms including FAST
9. Natural and artificial sources of radiation, their contribution to the formation of the total dose of exposure to the population.
10. 9. Basic provisions of the Radiation Safety Norms (NRBU-2005/ D - 2017, OSPU-2015). IO. The radiation situation after the accident at the Chornobyl NPP.
11. Tasks and structure of special medical institutions for providing medical care to persons exposed to excessive ionizing radiation.
12. Preventive measures during environmental contamination with radioactive substances.
13. Determination and assessment of the degree of radionuclide contamination of water and food products.
14. Modern understanding of the main mechanisms of biological action of ionizing radiation.
15. The role of free radicals in cell damage due to ionizing radiation.
16. Pathogenesis of radiation damage to tissues.
17. Radiosensitivity of various body tissues.
18. The importance of hematological ( hematomorphological ) research methods for detecting pathological changes in human organs and systems after exposure to ionizing radiation.
19. The principle of the cytogenetic method and its importance for detecting pathological changes in human organs and systems after exposure to ionizing radiation.
20. 20.3 teaching of biochemical, biophysical and other research methods to detect pathological changes in human organs and systems after exposure to ionizing radiation.
21. Effect of ionizing radiation on hematopoietic organs.
22. Effect of ionizing radiation on digestive organs.
23. Impact of ionizing radiation on the cardiovascular system.
24. Impact of ionizing radiation on the pulmonary system.
25. Impact of ionizing radiation on the central nervous system.
26. Impact of ionizing radiation on the endocrine system.
27. Methods and value of physical dosimetry for assessing the degree of human damage in nuclear accidents.
28. Clinical and biological criteria for the diagnosis of acute radiation sickness.
29. Pathogenesis of EPH.
30. General and clinical classification of radiation lesions.

31. Clinical signs of the primary reaction period of GPC.
32. Clinical signs of the hidden (latent) period of GPH.
33. Clinical signs of the period of exacerbation of the disease.
34. Principles of GPC diagnosis and sorting at the stages of medical evacuation.
35. Treatment of GPH depending on the period of the disease and the experience of treating victims of the accident at the Chernobyl nuclear power plant.
36. The principles of medical and psychosocial rehabilitation of persons who have undergone GPH.
37. Classification, clinic, treatment of chronic radiation sickness.
38. Classification, diagnosis and clinic of radiation burns .
39. Treatment of radiation burns depending on the degree of severity and period of the clinical course and the experience of treatment of persons injured in the accident at the Chernobyl NPP.
40. Prevention of radiation damage.
41. Biological effects of small doses of ionizing radiation.
42. Somatic consequences of radiation exposure.
43. Teratogenic consequences of radiation exposure.
44. Genetic consequences of radiation exposure.
45. Stochastic and non-stochastic effects of radiation.
46. Organization of medical aid in case of radiation accidents.
47. Ways of radionuclides entering the body.
48. Distribution of incorporated radionuclides in the body.
49. Effective half- life . Determination of the half-life and effective half-life of a radionuclide.
50. ZO. Radiotoxicology CS 137 . Immediate help when it enters the body.
51. 51 Radiotoxicology Sr. 90 . Immediate help when it enters the body.
52. Radiotoxicology I 131 . Immediate help when it enters the body.
53. Methods of determining the presence of radionuclides in the body.
54. The main directions in the treatment of internal contamination of the body with radionuclides.
55. Preventive and therapeutic measures for the incorporation of I 131 (single prophylaxis).
56. Dispensation of staff of nuclear plants.
57. Medical examination of the population exposed to ionizing radiation as a result of a radiation accident.
58. Categories and levels of observation.
59. Medical consequences of large-scale accidents in nuclear production.
60. Social protection of people exposed to accidental exposure and psychological aspects of nuclear accidents.
61. The purpose and tasks of the National Register of Ukraine of persons affected by the Chernobyl disaster.

**Methodological support:**

Work program of the academic discipline
Syllabus of the academic discipline
Textbooks:

I. Ovcharenko O. P., Lazar A. P., Matyushko R. P. Fundamentals of radiation medicine. - Odesa, Odessa Medical University, 2017. - 208 p.
2. Bebeshko V. E., Kovalenko O. M., Bily D. O. Acute radiation syndrome and its consequences. Ternopil: TDMU, 2015. - 424 p.
3. Radiation medicine: textbook / D.A. Bazika , E.V. Kulinich , M.I. Pylypenko; under the editorship E. Pylypenka -K.: VSV "Medicine", 2018 - 232 p.
4. V. A. Vizir , O. V. Demidenko , V. V. Shkolovyi Radiation injuries: educational and methodological manual for practical classes in internal medicine (military therapy) for students of the 5th year of medical faculties / V.A. Vizier , O.V. Demidenko , V.V. School boy . - Zaporizhzhia: ZDMU, 2019. - 63 p.
5. Protection against chemical and radiation damage factors: training . help _ for universities / O. E. Levchenko [and others]. - K., 2015. - 404 p.

**Recommended literature**

Main:


1. Kovalsky O. V. Radiology. Radiation therapy. X-ray diagnostics: tutorial . for studies _ higher _ honey. teach _ app . IV level of accreditation / O.V. Kovalskyi, D.S. Mechev , V.P. Danylevich - 2nd edition. - Vinnytsia: New Book, 2017. - 512 p. Radiology (radiodiagnosis and radiation therapy). Kyiv, Book plus, pp. 201-743.
2. Halmuradov , B. D. Medicine of emergency situations: Textbook / B. D. Khalmuradov , P.B. Volyanskyi . - K.: Center for Educational Literature, 2018.
3. Radiology (radiodiagnosis and radiation therapy). Test tasks. Part 3. Kyiv, Book plus. 2015. - 248 p.
4. Radiology (radiodiagnosis and radiation therapy): Textbook for students . stomata _ faculty _ higher _ teach _ institution of education of the IV year of accreditation . / In general ed. M. M. Tkachenko. - K.: Book-plus, 2016. - 424 p.
5. Evaluation of the radiation and chemical environment: a study guide for study _ higher _ honey. teach _ institutions (Provided by the Ministry of Education and Science of Ukraine / edited by O.E. Levchenko / O.E. Levchenko, V.L. Savytskyi, V.F. Torbin , Saglo V.I., Barasiy M.I. - K.: SPD Chalchynska N.V., 2015. - 256
6. Radiology Kovalsky O. V. Radiology. Radiation therapy. X-ray diagnostics: tutorial . for studies _ higher _ honey. teach _ app . IV level of accreditation / O. V. Kovalskyi, D. S. Mechev , V. P. Danylevich. - 2nd edition. - Vinnytsia: New Book, 2017. - 512 p.
7. Evaluation of the radiation and chemical situation: training . help _ for universities / O. E. Levchenko [and others]. - K.: SPD Chalchynska N. V., 2015. - 256 p. 8. Protection against chemical and radiation damage factors: training . help _ for universities / O. E. Levchenko - K., 2015. - 404 p.


**Additional literature**


8. Grodzinsky D. M. Radiobiology. - K.: Lybid, 2018. - 448 p.
9. 30 years of the Chernobyl disaster. A look into the future. National of Ukraine. - K.: " Atika ", 2016. - 224 p.
10. L.P. Kindzelsky and sang Acute radiation sickness in the conditions of the Chernobyl disaster. - K. - 223 p. 2. "Radiation and the immune system ambiguity of interaction" / A.A. Chumak / Art of treatment. - 2015. - No. 10.-p. 31-32.
11. Radiation safety standards of Ukraine. Addendum: Radiation protection from sources of potential exposure (NRBU-2005/D-2017). Kyiv, 2017. - 80 p.
12. "Non-ionizing and ionizing radiation in production conditions ( hygienic and clinical aspects)", S.I. Tkach, O.Yu. Lukyanenko , V.G. Shestakov , V.V. Bagmut // Kharkiv, KhMAPO, 2014.
13. OSPU-2015
14. NRBU - 2017
15. Special processing: learn . help _ / O. E. Levchenko [and others]. - K.: Ukrainian Military Medical Academy, 2015. - 184 p.
16. Chernobyl: consequences of the catastrophe for man and nature / A. V. Yablokov [et al.]; input Art. D. M. Grodzinsky . - 3rd ed., add. and processing - K.: Universarium , 2011. - 592 p.

17. Emergency medicine. Organization of providing first medical aid to students . help _ for honey Universities II - IV levels of accreditation / V. S. Tarasyuk [and others]. - 2nd ed., corrected . - K.: Medicine, 2015. - 528 p.
18. Nuclear weapons (medical aspects): training . help _ / V. F. Torbin , V. V. Voronenko , O. E. Levchenko, Yu. M. Skaletskyi . - 174 Ternopil: TDMU, 2015. - 192 p.
19. Military toxicology, radiology, medical protection: a textbook / edited by O. E. Levchenko. - K.: SPD Chalchynska N. V., 2017. - 788 p.

**Approved:**

**В.о.Ректора /Acting Rector** **Sirhii HRIDCHIN**