

DANYLO HALYTSKY LVIV NATIONAL MEDICAL UNIVERSITY

Department of Radiology and Radiation Medicine



APPROVED

First Vice-Rector for

Scientific and Pedagogical Work

Associate Professor Iryna SOLONYNKO

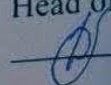
2023

**EDUCATIONAL PROGRAMME OF DISCIPLINE  
RADIATION MEDICINE**

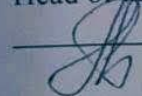
**OK 24.2**

**Second (master's) level of higher education  
Branch of knowledge 22 "Health care"  
Specialty 222 "Medicine"**

Discussed and approved at the  
methodical meeting of the department  
of Radiology and Radiation Medicine  
Protocol No 11  
from April 27, 2023  
Head of the Department

 As.Prof. Igor DATS

Approved by the profile methodical  
commission  
of medical disciplines  
Protocol No 3  
from May 04, 2023  
Head of the profile methodical commission

 Prof. Olena RADCHENKO

**DEVELOPERS OF THE PROGRAMME:**

Igor DATS - Head of the Department of Radiology and Radiation Medicine, PhD, associate professor

Yulian MYTSYK – doctor of medical sciences, professor of the Department of Radiology and Radiation Medicine

Bohdana VERVEHA - doctor of medical sciences, associate professor of the Department of Radiology and Radiation Medicine

Nataliya SKALETSKA - PhD, associate professor of the Department of Radiology and Radiation Medicine

Inna DANYLEYCHENKO - PhD, associate professor of the Department of Radiology and Radiation Medicine

Igor MAKAGONOV - PhD, associate professor of the Department of Radiology and Radiation Medicine

**REVIEWERS:**

Mykhailo SOROKIVSKY - PhD, associate professor, Head of the Department of Radiation Diagnostics of Faculty of Postgraduate Education, Danylo Halytsky Lviv National Medical University

Nataliya VOLOD'KO - doctor of medical sciences, professor, Head of the Department of Oncology and Radiology of Faculty of Postgraduate Education, Danylo Halytsky Lviv National Medical University

Head of the Department of Radiology  
and Radiation Medicine

PhD, Associate Professor Igor DATS



*Signature*

## INTRODUCTION

Programme for studying of educational discipline «Radiation Medicine»  
 according to the Standard of higher education of the second (master's) level  
 field of knowledge 22 "Health Care"  
 specialty 222 "Medicine"  
 educational programme of the master of medicine

### Description of educational discipline

Radiation medicine is one of the fundamental natural sciences in the system of higher medical education, the knowledge of which is necessary for the high-quality training of specialists in the field of health care. The constant expansion of the sphere of human contact with sources of ionizing radiation, the possibility of emergency situations, accompanied by excessive exposure of professionals and the population, made it urgent to study the effect of this factor on human health. Analysis of the consequences of the accident at the Chernobyl nuclear power plant revealed a number of deficiencies in the knowledge of doctors, which led to errors in the provision of medical care and prevention to victims of the nuclear disaster. In recent decades, radiation medicine has been replenished with new approaches in the diagnosis and treatment of radiation pathology. In this regard, the standards of higher medical education require a graduate of a higher medical educational institution to be able to carry out diagnostic and treatment measures in a timely manner and in sufficient quantity in case of accidental human exposure. Higher medical education also requires that a clinician should be able to predict the course of the acute period of radiation damage, as well as assess the risk of various remote consequences of radiation exposure.

Knowledge of radiation medicine allows the future specialist to understand the processes that occur in the human body under the influence of ionizing radiation.

STRUCTURE OF SCIENTIFIC DISCIPLINE	Amount of credits, hours,			Study year semester	Type of control	
	Total	Auditorial				IWS
		Lectures (hours)	Practical classes (hours)			
<b>Name of discipline Radiation medicine</b>	<b>1,0 credit / 30 hours</b>	<b>4</b>	<b>11</b>	<b>15</b>	<b>5 course (9/10 semesters)</b>	<b>credit</b>

**The subject of study of the educational discipline is:** ionizing and non-ionizing radiation, its main properties, physical and radiobiological foundations of radiation medicine, diagnostic methods for indicating radiation doses, the effects of radiation on the body and individual organs and systems, differentiated treatment and emergency care for acute radiation injuries, prevention of radiation injuries and methods of rehabilitation of persons injured as a result of radiation accidents.

#### **Interdisciplinary connections:**

**The study of the discipline "Radiation Medicine"** is based on the knowledge of medical physics, genetics, biochemistry, clinical pharmacology, pathological physiology and morphology, therapy, surgery, hygiene, social medicine and the organization of health care and other disciplines, which allow to understand the processes that take place in human body under the influence of ionizing radiation. It lays the foundations for the study of internal diseases, surgery with anesthesiology, pediatrics, which involves the integration of teaching with these disciplines and the formation of skills to apply knowledge of radiation medicine in the process of further education and in professional activities.

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

**1.1. The goal of teaching the academic discipline "Radiation Medicine"** is to form students' complex of knowledge, abilities and skills in radiation medicine.

**1.2. The main tasks of studying the discipline "Radiation Medicine"** are to learn to determine etiological, pathogenetic factors and clinical manifestations, to diagnose acute radiation damage and to provide emergency aid to victims, to determine the management tactics of victims who have been exposed to ionizing radiation; to determine the etiological and pathogenetic factors of chronic radiation injuries of people, to choose the tactics of managing the victims; use methods of determining the effect of small doses of radiation on the human body and determine means of prevention, treatment and minimization of the harmful effects of radiation

**1.3 Competencies and learning outcomes, the formation of which is facilitated by the discipline (relationship with the normative content of the training of higher education applicants, formulated in terms of learning outcomes in the Higher Education Standard).**

**– integral competence**

The ability to solve complex problems, including those of a research and innovation nature in the field of medicine.  
Ability to continue learning with a high degree of autonomy.

According to the requirements of the Higher Education Standard, the discipline ensures that students acquire the following **competencies**:

**- general competencies (GC):**

**GC1.** Ability to abstract thinking, analysis and synthesis;

**GC2.** Ability to learn and master modern knowledge;

**GC3.** Ability to apply knowledge in practical situations;

**GC4.** Knowledge and understanding of the subject area and understanding of professional activity;

**GC5.** Ability to adapt and act in a new situation;

**GC6.** Ability to make informed decisions;

**GC7.** Ability to work in a team;

**GC8.** Ability to interpersonal interaction;

**GC10.** Ability to use information and communication technologies;

**GC11.** Ability to search, process and analyze information from various sources

**GC12.** Determination and persistence in relation to assigned tasks and assumed responsibilities;

**GC13.** Awareness of equal opportunities and tender issues;

**GC14.** Ability to realize one's rights and responsibilities as a member of society, to be aware of the values of civil (free democratic) society and the need for its sustainable development, the rule of law, the rights and freedoms of a person and a citizen in Ukraine;

**GC15.** Ability to preserve and multiply moral, cultural, scientific values and achievements of society based on understanding the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technology, use different types and forms of motor activities for active recreation and leading a healthy lifestyle.

**- special (professional, subject) competencies (PC):**

**PC1.** Ability to collect medical information about the patient and analyze clinical data;

**PC2.** Ability to determine the necessary list of laboratory and instrumental studies and evaluate their results;

**PC3.** Ability to establish a preliminary and clinical diagnosis of the disease;

**PC4.** Ability to determine the necessary regime of work and rest in the treatment and prevention of diseases;

**PC5.** Ability to determine the nature of nutrition in the treatment and prevention of diseases;

**PC6.** Ability to determine the principles and nature of treatment and prevention of diseases;

**PC7.** Ability to diagnose emergency conditions;

**PC8.** Ability to determine the tactics of providing emergency medical care;

**PC9.** Ability to conduct medical evacuation measures;

**PC10.** Ability to perform medical manipulations;

**PC11.** Ability to solve medical problems in new or unfamiliar environments in the presence of incomplete or limited information, taking into account aspects of social and ethical responsibility;

**PC15.** Ability to conduct an examination of working capacity;

**PC16.** Ability to maintain medical documentation, including electronic forms;

**PC17.** Ability to assess the impact of the environment, socio-economic and biological determinants on the state of health of an individual, family, population;

**PC20.** Ability to conduct epidemiological and medical-statistical research on the health of the population; processing of social, economic and medical information;

**PC21.** It is clear and unambiguous to convey one's own knowledge, conclusions and arguments on health care problems and related issues to specialists and non-specialists, in particular to persons who are studying;

**PC24.** Adherence to ethical principles when working with patients and laboratory animals;

**PC25.** Adherence to professional and academic integrity, to be responsible for the reliability of the obtained scientific results.

Detailing of competencies in accordance with the NQF descriptors in the form of the "Competence Matrix".

**Matrix of competences**

<b>№</b>	<b>Competencie</b>	<b>Knowledge</b>	<b>Skills</b>	<b>Comunication</b>	<b>Autonomy and responsibilities</b>
<b>Integral competencie</b>					
The ability to solve complex problems, including those of a research and innovation nature in the field of medicine. Ability to continue learning with a high degree of autonomy.					
<b>General competencies (GC)</b>					
GC-1	Ability to abstract thinking, analysis and synthesis.	To own an abstract thinking, analysis and synthesis.	Ability to abstract thinking, analysis and synthesis.	The ability to effectively use the results of abstract thinking.	To be responsible for the results of abstract thinking, analysis and synthesis.
GC-2	Ability to learn and master modern knowledge.	Have modern knowledge.	Ability to learn and master modern knowledge. To have modern knowledge.	Ability to use modern knowledge.	To be responsible for the results of using modern knowledge.
GC-3	Ability to apply knowledge in practical situations.	To have specialized conceptual knowledge acquired in the learning process.	To be able to solve complex tasks and problems that arise in professional activity.	Clear and unambiguous presentation of one's own conclusions, knowledge and explanations, which justify them to specialists and non-specialists.	To be responsible for making decisions in difficult conditions.
GC-4	Knowledge and understanding of the subject area and understanding of professional activity.	To have deep knowledge of the structure of professional activity	To be able to carry out professional activities that require updating and integration of knowledge.	The ability to effectively form a communication strategy in professional activities	To be responsible for professional development, the ability for further professional training with a high level of autonomy
GC-5	Ability to adapt and act in a new situation.	To have deep knowledge of adaptation and action in a new situation	To be able to use the acquired knowledge to adapt and act in a new situation	Communicate effectively in a new situation	To be responsible for actions in a new situation
GC-6	Ability to make informed decisions.	To have deep knowledge to justify the decision	Be able to make informed decisions based on knowledge	To use acquired knowledge to justify a decision	To be responsible for informed decisions
GC-7	Ability to work in a team.	To know teamwork methods Have searching, processing and analyzing information from various sources.	to make informed decisions based on knowledge	To use acquired knowledge in teamwork	To be responsible for working in a team

<b>№</b>	<b>Competencie</b>	<b>Knowledge</b>	<b>Skills</b>	<b>Comunication</b>	<b>Autonomy and responsibilities</b>
GC-8	Ability to interpersonal interaction.	To have interpersonal skills	To be able to work in a team	To use acquired knowledge for interpersonal interaction	To be responsible for interpersonal interaction
GC-10	Ability to use information and communication technologies.	To have deep knowledge in the field of information and communication technologies used in professional activities	To be able to use information and communication technologies in a professional field that requires updating and integration of knowledge.	To use information and communication technologies in professional activities	To be responsible for the development of professional knowledge and skills.
GC-11	Ability to search, processing and analysis of information from various sources.	To have searching, processing and analyzing information from various sources.	To be able use the results search, processing and analysis of information.	To use the results search, processing and analysis of information in professional activity.	To be responsible for the results search, processing and analysis of information .
GC-12	Determination and persistence in relation to assigned tasks and assumed responsibilities.	Possess persistence in relation to assigned tasks and assumed responsibilities.	To be able persevere in performing assigned tasks and responsibilities.	To communicate with those around him in the performance of assigned tasks and duties.	To be responsible for the performance of one's duties and assigned tasks.
GC-13	Awareness of equal opportunities and gender issues.	To have gender issues.	To be able use knowledge of opportunities and gender issues.	To use the results of knowledge in professional activity.	To be responsible for using knowledge of opportunities and gender issues.
GC-14	The ability to realize one's rights and responsibilities as a member of society, to realize the values of a civil (free democratic) society and the need for its sustainable development, the rule of law, the rights and freedoms of a person and a citizen in Ukraine.	To have skills in to realize their rights and responsibilities as a member of society, to be aware of the values of a civil (free democratic) society and the need for its sustainable development, the rule of law, the rights and freedoms of a person and a citizen in Ukraine.	To be able use their rights and responsibilities as a member of society.	To use acquired knowledge, rights and obligations in professional activity.	To be responsible for the realization of one's rights and duties as a member of society.

№	Competencie	Knowledge	Skills	Comunication	Autonomy and responsibilities
GC-15	The ability to preserve and multiply moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technology, to use various types and forms of motor activity for active recreation and leading a healthy lifestyle.	To have the ability to preserve and multiply moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technology, to use various types and forms of motor activity for active recreation and leading a healthy lifestyle	To be able use moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technology, to use various types and forms of motor activity for active recreation and leading a healthy lifestyle.	To use moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technology. Use various types and forms of motor activity for active recreation and leading a healthy lifestyle.	To be responsible for the preservation and multiplication of moral, cultural, scientific values and achievements of society on the basis of understanding the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technology.
<b>Special ( professional) competencies</b>					
PC-1	Ability to collect medical information about the patient and analyze clinical data.	To have in-depth knowledge of interviewing and clinical examination of the patient.	To be able to use knowledge for interviewing and clinical examination of the patient.	To use the acquired knowledge for interviewing and clinical examination of the patient.	To be responsible for the interview and clinical examination of the patient.
PC-2	Ability to determine the necessary list of laboratory and instrumental studies and evaluate their results.	To have in-depth knowledge of laboratory and instrumental research and evaluation of their results.	To be able to use laboratory and instrumental research.	To use acquired knowledge to evaluate laboratory and instrumental research.	To be responsible for the assessment of laboratory and instrumental studies.
PC-3	Ability to establish a preliminary and clinical diagnosis of the disease.	To have special knowledge before establishing a preliminary and clinical diagnosis of the disease.	To be able to establish a preliminary and clinical diagnosis of the disease.	To substantiate the establishment of a preliminary and clinical diagnosis of the disease.	Be responsible for establishing a preliminary and clinical diagnosis of the disease.
PC-4	The ability to determine the necessary regime of work and rest in the treatment and prevention of diseases.	To have the knowledge to determine the necessary regime of work and rest in the treatment of diseases.	To be able to prescribe the necessary regime of work and rest in the treatment of diseases.	To substantiate the necessary mode of work and rest during the treatment of diseases.	To be responsible for prescribing the necessary regime of work and rest during the treatment of diseases.

<b>№</b>	<b>Competencie</b>	<b>Knowledge</b>	<b>Skills</b>	<b>Comunication</b>	<b>Autonomy and responsibilities</b>
PC-5	The ability to determine the nature of nutrition in the treatment and prevention of diseases.	To have knowledge to determine the nature of nutrition in the treatment of diseases.	To be able to prescribe the necessary diet for the treatment of diseases.	To justify the necessary diet in the treatment of diseases.	To be responsible for the prescribed diet during the treatment of diseases.
PC-6	Ability to determine the principles and nature of treatment and prevention of diseases.	To have knowledge to determine the principles and nature of treatment of diseases.	To be able to prescribe the appropriate treatment of diseases.	To justify the appropriate treatment of diseases.	To be responsible for the prescribed treatment. Be responsible for diagnosing emergency conditions.
PC-7	Ability to diagnose emergency conditions.	To have special knowledge to diagnose emergency conditions.	To be able to diagnose emergency conditions.	To substantiate the diagnosis of emergency conditions.	To be responsible for determining the tactics of providing emergency medical care.
PC-8	The ability to determine the tactics of providing emergency medical care.	To have specialized knowledge to determine the tactics of providing emergency medical care.	To be able to determine the tactics of providing emergency medical care.	To justify the tactics of providing emergency medical aid.	To be responsible for the prescribed treatment. Be responsible for diagnosing emergency conditions. To be responsible for determining the tactics of providing emergency medical care.
PC-9	Ability to carry out medical evacuation measures.	To have knowledge of medical evacuation measures.	To be able carry out medical evacuation measures.	To substantiate the conduct of medical evacuation measures.	To be responsible for carrying out medical evacuation measures.
PC-10	Ability to perform medical manipulations.	Have knowledge to perform medical manipulations.	To be able perform medical manipulations.	Use acquired knowledge to perform medical manipulations.	To be responsible for performing medical manipulations.
PC-11	Ability to solve medical problems in new or unfamiliar environments in the presence of incomplete or limited information, taking into account aspects of social and ethical responsibility.	To have knowledge to solve medical problems in new or unfamiliar environments in the presence of incomplete or limited information, taking into account aspects of social and ethical responsibility.	To be able solve medical problems in new or unfamiliar environments in the presence of incomplete or limited information, taking into account aspects of social and ethical responsibility.	To use acquired knowledge to solve medical problems in new or unfamiliar environments in the presence of incomplete or limited information, taking into account aspects of social and ethical responsibility.	To be responsible for solving medical problems in new or unfamiliar environments in the presence of incomplete or limited information, taking into account aspects of social and ethical responsibility.



<b>№</b>	<b>Competencie</b>	<b>Knowledge</b>	<b>Skills</b>	<b>Comunication</b>	<b>Autonomy and responsibilities</b>
PC-15	The ability to conduct an examination of working capacity.	To have knowledge for carrying out an examination of working capacity.	To be able to perform examination of working capacity.	To use acquired knowledge to carry out an examination of working capacity.	To be responsible for the conducted examination of working capacity.
PC-16	Ability to maintain medical documentation, including electronic forms.	To have knowledge of medical documentation management, including electronic forms.	To be able to maintain medical documentation, including electronic forms.	To use acquired knowledge when maintaining medical documentation, including electronic forms.	To be responsible for maintaining medical documentation, including electronic forms.
PC-17	The ability to assess the impact of the environment, socio-economic and biological determinants on the state of health of an individual, family, population.	To have knowledge to assess the influence of the environment, socio-economic and biological determinants on the state of health of an individual, family, population.	To be able to assess the influence of the environment, socio-economic and biological determinants on the state of health of the individual, family, population.	To use the acquired knowledge to assess the impact of the environment, socio-economic and biological determinants on the state of health of an individual, family, population.	To be responsible for assessing the impact of the environment, socio-economic and biological determinants on the state of health of the individual, family, population.
PC-20	Ability to conduct epidemiological and medical-statistical research on the health of the population; processing of social, economic and medical information.	To have knowledge for conducting epidemiological and medical-statistical studies of the health of the population; processing of social, economic and medical information.	To be able to conduct epidemiological and medical-statistical studies of the health of the population; processing of social, economic and medical information.	To use the acquired knowledge to conduct epidemiological and medical-statistical research on the health of the population; processing of social, economic and medical information.	To be responsible for conducting epidemiological and medical-statistical researches on the health of the population; processing of social, economic and medical information.
PC-21	It is clear and unambiguous to convey one's own knowledge, conclusions and arguments on health care problems and related issues to specialists and non-specialists, in particular to people who are studying.	To have skills to clearly and unambiguously convey one's own knowledge, conclusions and arguments on health care problems and related issues to specialists and non-specialists, in particular to people who are studying.	To be able clearly and unambiguously convey one's own knowledge, conclusions and arguments on health care problems and related issues to specialists and non-specialists, in particular to people who are studying.	To use acquired skills to clearly and unambiguously communicate one's own knowledge, conclusions and arguments on health care problems and related issues to specialists and non-specialists, in particular to students.	To be responsible for clearly and unambiguously conveying one's own knowledge, conclusions and arguments on health care problems and related issues to specialists and non-specialists, in particular to people who are studying.

№	Competencie	Knowledge	Skills	Comunication	Autonomy and responsibilities
PC-24	Adherence to ethical principles when working with patients and laboratory animals	To have skills of observing ethical principles when working with patients and laboratory animals..	To be able adhere to ethical principles when working with patients and laboratory animals.	To use acquired skills to observe ethical principles when working with patients and laboratory animals.	To be responsible for compliance with ethical principles when working with patients and laboratory animals..
PC-25	Adherence to professional and academic integrity, to be responsible for the reliability of the obtained scientific results.	To have skills to observe professional and academic integrity, bear responsibility for the reliability of the obtained scientific results.	Be able to observe professional and academic integrity, to be responsible for the reliability of the obtained scientific results.	To use the acquired skills to maintain professional and academic integrity, bear responsibility for the reliability of the obtained scientific results.	To be responsible for observe professional and academic integrity, bear responsibility for the reliability of the obtained scientific results.

### Results of study:

Integrative final program learning outcomes, the formation of which is facilitated by the educational discipline "Radiation Medicine":

- operate with knowledge about the biological effect of ionizing radiation on the human body, its impact on various organs and systems;
- learn the issues of etiology, pathogenesis, clinic, course of acute and chronic radiation sickness, local radiation lesions, the combined action of various types of ionizing radiation, modern hypotheses of the influence of small doses of radiation on the human body;
- to analyze diagnostic methods and possible clinical consequences when radionuclides enter the body, the possibility of using curative and preventive measures;
  - carry out differential diagnosis between radiation pathology and pathology of internal organs;
  - to analyze possible early and late remote consequences of human exposure: stochastic and non-stochastic effects of radiation, somatic and genetic pathology;
- learn the main social, sanitary, hygienic, eoiological and psychological aspects of accidents at nuclear plants (according to the model of the accident at the Chernobyl NPP);
- carry out medical sorting of victims of ionizing radiation at the pre-hospital and hospital stages;
- provide emergency assistance to victims of ionizing radiation at the pre-hospital and hospital stages;
- prescribe differentiated treatment for patients with radiation damage depending on the degree of severity and the period of the clinical course;
- draw up a plan of organizational measures for the prevention of radiation injuries and conducting preliminary and periodic medical examinations of workers and persons who have been excessively exposed to ionizing radiation;
- master the skills of using dosimeters and radiometers, determination of radionuclide contamination of water, food products and their suitability for consumption, use of individual and collective means of protection against ionizing radiation.

### Learning outcomes for the discipline "Radiation Medicine":

#### *To know:*

1. the nature and properties of ionizing radiation (alpha, beta, gamma, neutrons, X-rays);
2. the dosimetry of ionizing radiation;
3. the biological effect of ionizing radiation;
4. the etiology, pathogenesis, clinic and pathomorphology of radiation lesions;
5. diagnostic methods in radiation medicine;
6. the clinical course of acute and chronic radiation lesions;
7. the principles of radiation damage treatment;
8. radiotoxicology I <sup>131</sup>, Cs <sup>137</sup>, Sg <sup>90</sup>, Ry <sup>239</sup>;
9. the diagnosis, clinic and principles of treatment with the incorporation of radionuclides;
10. the impact of ionizing radiation on various organs and body systems;
11. the delayed effects of ionizing radiation;

12. the effect of small doses of ionizing radiation on the human body;
13. the principles of radiation damage prevention and their consequences;
14. the medical, psychological and social aspects of large-scale accidents at nuclear plants;
15. the principles of dispensation of persons who have been excessively exposed to ionizing radiation;
16. the national register of Ukraine of persons who suffered as a result of the Chernobyl disaster.

**To be able:**

1. to choose adequate diagnostic methods for determining radiation damage to various organs and body systems;
2. to conduct ionizing radiation dosimetry;
3. to diagnose radiation damage (degree of severity, period of clinical course, etc.) on the basis of dosimetry data, laboratory test results, and clinical signs;
4. to choose the necessary medical means for the treatment of victims of external irradiation or internal intake of radionuclides;
5. to provide emergency aid to victims of ionizing radiation;
6. to sort the victims according to the severity of the injury, choose the means and place of evacuation;
7. to prevent radiation damage;
8. to diagnose acute and chronic radiation damage;
9. to carry out sanitary and educational work with the population, based on knowledge of the impact factors that arise during accidents at nuclear plants;
10. to carry out dispensation of persons who have been excessively exposed to ionizing radiation;
11. to use the national register of Ukraine of persons who suffered as a result of the Chernobyl disaster.

**Results of studying:**

Integrative final program learning outcomes, the formation of which is facilitated by the educational discipline: conformity of learning outcomes and competencies defined by the standard

<b>Results of discipline</b>	<b>Code of programmatic result of study</b>	<b>Code of competencies</b>
To have thorough knowledge of the structure of professional activity. To be able to carry out professional activities that require updating and integration of knowledge. To be responsible for professional development, the ability for further professional training with a high level of autonomy.	PRS 1	GC1, GC2, GC3, GC4, GC5, GC6, GC7, GC8, GC10, GC11, GC12, GC13, GC14, GC15.
Understanding and knowledge of basic and clinical biomedical sciences, at a level sufficient for solving professional tasks in the field of health care.	PRS 2	GC1, GC2, GC3, GC4, GC5, GC6, GC7, GC8, GC10, GC11, GC12, GC13, GC14, GC15.
Specialized conceptual knowledge that includes scientific achievements in the field of health care and is the basis for conducting research, critical understanding of problems in the field of medicine and related interdisciplinary problems.	PRS 3	GC1, GC2, GC3, GC4, GC5, GC6, GC7, GC8, GC10, GC11, GC12, GC13, GC14, GC15.
To isolate and identify the leading clinical symptoms and syndromes according to standard methods, using the previous data of the patient's history, the data of the patient's examination, knowledge about the person, his organs and systems, to establish a preliminary clinical diagnosis of the disease.	PRS 4	GC1, GC2, GC3, GC6, GC7, GC8; PC1, PC2, PC3, PC24, PC25
To collect complaints, anamnesis of life and diseases, evaluate the psychomotor and physical development of the patient, the state of organs and systems of the body, based on the results of laboratory and instrumental studies, evaluate information about the diagnosis, taking into account the age of the patient.	PRS 5	GC1, GC, GC3, GC6, GC, GC8; PC1, PC2, PC24, PC25

To establish the final clinical diagnosis by making a reasoned decision and analyzing the received subjective and objective data of clinical, additional examination, differential diagnosis, observing the relevant ethical and legal norms, under the control of the head physician in the conditions of the health care institution.	PRS 6	GC1, 3K2, 3K3, 3K6, 3K7, 3K8; PC1, PC2, PC3, PC24.
To assign and analyze additional (mandatory and optional) examination methods (laboratory, functional and/or instrumental) of patients with diseases of organs and body systems for differential diagnosis of diseases.	PRS7	GC1, GC2, GC3, GC4, , GC6, PC2.
To determine the main clinical syndrome or what causes the severity of the victim/victim's condition (according to list 3) by making a reasoned decision and assessing the person's condition under any circumstances (in the conditions of a health care facility, outside its borders), including in conditions of emergency and hostilities, in field conditions, in conditions of lack of information and limited time.	PRS8	GC1, GC2, GC3, GC4, GC5, GC6, GC7, GC8, PC1,PC3, PC7, PC8, PC9, PC10, PC11.
To determine the nature and principles of treatment (conservative, operative) of patients with diseases (according to list 2), taking into account the age of the patient, in the conditions of the health care institution, outside its borders and at the stages of medical evacuation, including in field conditions, on the basis of a preliminary clinical diagnosis, observing the relevant ethical and legal norms, by making a reasoned decision according to existing algorithms and standard schemes, in case of the need to expand the standard scheme, be able to justify personalized recommendations under the control of the head physician in the conditions of a medical institution.	PRS9	GC1, GC2, GC3, GC4, GC5, GC6, GC7, GC8, PC1,PC3, PC6, PC7, PC8, PC9, PC10, PC11.
To determine the necessary mode of work, rest and nutrition on the basis of the final clinical diagnosis, observing the relevant ethical and legal norms, by making a reasoned decision according to existing algorithms and standard schemes.	PRS 10	GC1, GC2, GC3, GC4, GC5, GC6, GC7, GC8, PC1,PC3, PC4, PC6, PC7, PC8, PC9, PC10, PC11, PC24.
To determine tactics and provide emergency medical care in emergency situations (according to list 3) in limited time conditions according to existing clinical protocols and standards of treatment.	PRS 14	GC1, GC2, GC3, GC4, GC5, GC6, GC7, GC8, PC7, PC8, PC9, PC10.
To organize the provision of medical aid and medical evacuation measures to the population and military personnel in emergency situations and hostilities, including in field conditions.	PRS 15	GC1, GC2, GC3, GC4, GC5, GC6, GC7, GC8, PC6-PC10.
To form rational medical routes for patients; organize interaction with colleagues in their own and other institutions, organizations and institutions; to apply tools for the promotion of medical services in the market, based on the analysis of the needs of the population, in the conditions of the functioning of the health care institution, its division, in a competitive environment.	PRS 16	GC1, GC2, GC3, GC4, GC5, GC6, GC7, GC8, PC6, PC7, PC8, PC9, PC11, PC17.
To perform medical manipulations (according to list 5) in the conditions of a medical institution, at home or at work based on a previous clinical diagnosis and/or indicators of the patient's condition by making a reasoned decision, observing the relevant ethical and legal norms.	PRS 17	GC1, GC2, GC3, GC4, GC5, GC6, PC10, PC24.

To determine the state of functioning and limitations of a person's vital activities and the duration of incapacity for work with the preparation of relevant documents, in the conditions of a health care institution, based on data about the disease and its course, peculiarities of a person's professional activity, etc. Maintain medical documentation regarding the patient and the contingent of the population on the basis of regulatory documents.	PRS 18	GC1, GC2, GC3, GC4, GC5, GC6, GC7, GC8,; PC11,PC15,PC16, PC25.
To search for the necessary information in the professional literature and databases of other sources, analyze, evaluate and apply this information.	PRS 21	GC1, GC2, GC3, GC4, GC6, GC10;GC11,GC12; PC21, PC25.
To apply modern digital technologies, specialized software, and statistical data analysis methods to solve complex healthcare problems.	PRS 22	GC1, GC2, GC3, GC4, GC5, GC6,GC10; PC21, PC25.
To assess the impact of the environment on human health in order to assess the morbidity of the population.	PRS 23	GC1, GC2, GC3, GC4, GC5, GC6,GC10; PC17, PC21, PC25.
To organize the necessary level of individual safety (own and the persons he cares for) in case of typical dangerous situations in the individual field of activity.	PRS 24	GC1, GC2, GC3, GC4, GC5, GC6, GC10,GC12;
It is clear and unambiguous to convey one's own knowledge, conclusions and arguments on health care problems and related issues to specialists and non-specialists.	PRS 25	GC1, GC2, GC3, GC4, GC5, GC6; PC21.
To communicate freely in the national and English languages, both orally and in writing to discuss professional activities, research and projects.	PRS 27	GC1, GC2, GC3, GC5, GC6, GC11, GC12. PC21, PC25.

## 2. Information volume of the academic discipline

1.0 ECTS credit / 30 hours is assigned to the study of the academic discipline.

### Topic 1.

Nature, types and properties of radiation. Dosimetry of ionizing radiation. The principle of construction of dosimeters, radiometers, their types. Natural radiation background, its components and changes. Artificial sources of ionizing radiation and their use in the national economy.

### Topic 2.

Assessment of the degree of radionuclide contamination of the environment, soil, water, and food products. 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.

### Topic 3.

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. Analysis of the most characteristic disease histories of persons who have suffered acute radiation sickness.

Acute local radiation damage. Peculiarities of the clinic, diagnosis and treatment of persons who have undergone combined radiation.

Examination of personnel who work with sources of ionizing radiation. Groups of persons of primary dispensary registration, categories and levels of observation. National register of Ukraine of victims of the Chernobyl disaster: purpose, structure, purpose, tasks.

### Topic 4.

Acute local radiation injuries. Chronic radiation sickness. Etiology, pathogenesis, diagnosis, clinic, treatment. Etiology, pathogenesis, clinic, diagnosis, treatment, consequences, medical and social examination.

### Topic 5.

Delayed effects 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.

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.

**Topic 6.**

The effect of low dose of ionizing radiation on the human body. Medical and psychological aspects of large-scale accidents at nuclear plants (according to the model of the accident at the Chernobyl NPP).

Equipment and operation of special medical facilities to provide assistance to persons exposed to ionizing radiation.

**3. Structure of the discipline**

	Lectures	Practical classes	Independent work	Individual work
<b>Radiation medicine</b>				
Topic 1. The subject of Radiation medicine, its connection with other medical disciplines. The history of the development of Radiation medicine. Natural background radiation. Artificial sources of ionizing radiation. Radiosensitivity of different tissues and organs. 1. Topic 1. Nature, types and properties of radiation. Dosimetry of ionizing radiation. The principle of construction of dosimeters, radiometers, their types. IWS. Topic 1. Artificial sources of ionizing radiation and their use in the national economy. Closed and open sources of ionizing radiation.	2	2	3	-
2. Topic 2. Types of radiation damage. Acute radiation sickness. Etiology, pathogenesis, clinic, diagnosis, treatment, consequences. Acute local radiation damage. Toxicology of the main radionuclides. Features of diagnostics and clinics when radionuclides enter the human body.	2	-	-	-
3. Topic 2. Assessment of the degree of radionuclide contamination of the environment, soil, water, and food products. Incorporation of radionuclides.	-	2	-	-
4. Topic 3. Acute radiation sickness. Etiology, pathogenesis, clinic, diagnosis, treatment, consequences, medical and social examination. IWS. Topic 2. The concept of influence of ionizing radiation on the human body. Effects of ionizing radiation on different organs and systems. Radiation syndromes.	-	2	3	-
5. Topic 4. Acute local radiation injuries. Etiology, pathogenesis, clinical manifestations, diagnosis, treatment, consequences, medical and social examination. IWS. Topic 3. Experience of radiation damage to people. Radiation reaction. Radiation Safety Culture.	-	2	3	-
6. Topic 5. Delayed effects of ionizing radiation. Stochastic and non-stochastic effects of radiation. IWS. Topic 4. Somatic, teratogenic and genetic outcomes of the radiation exposure. Chronic radiation syndrome. Etiology, pathogenesis, clinical manifestations, diagnosis, treatment.	-	2	3	-
7. Topic 6. The effect of low dose of ionizing radiation on the human body. IWS. Topic 5. Medical, social, ecological and psychological aspects of large-scale accidents at nuclear plants (according to the model of the accident at the Chernobyl nuclear power plant). The role of bone marrow transplantation in the treatment of acute radiation syndrome.	-	1	3	-
<b>Total amount of hours 30 / 1,0 credit ECTS</b>	<b>4</b>	<b>11</b>	<b>15</b>	<b>-</b>
<b>Final control</b>				Credit

#### 4. Thematical plan of lectures

№	Topic	Amount of hours
1.	The subject of Radiation medicine and its correlation with other medical disciplines. The history of the development of Radiation medicine. Natural background radiation. Artificial sources of ionizing radiation. Biological action of ionizing radiation. Radiosensitivity of different tissues and organs.	2
2.	Types of radiation injuries. Acute radiation syndrome. Acute local radiation injuries. Toxicology of the main radionuclides. Peculiarities of diagnostics, clinical symptoms in case of incorporation of radionuclides.	2
<b>Total</b>		<b>4</b>

#### 5. Thematical plan of practical classes

№	Topic	Amount of hours
1.	Nature, types and properties of ionizing radiation. Dosimetry of ionizing radiation. The principle of construction of dosimeters, radiometers, their types.	2
2.	Assessment of the degree of radionuclide contamination of the environment, soil, water, and food products. Incorporation of radionuclides.	2
3.	Acute radiation sickness. Etiology, pathogenesis, clinical manifestations, diagnosis, treatment, consequences, medical and social examination.	2
4.	Acute local radiation injuries. Etiology, pathogenesis, clinical manifestations, diagnosis, treatment, consequences, medical and social examination.	2
5.	Delayed effects of ionizing radiation. Stochastic and non-stochastic effects of radiation.	2
6.	The effect of low dose of ionizing radiation on the human body.	1
<b>Total</b>		<b>11</b>

#### 6. Thematical plan of independent work of students`

№.	Topic	Amount of hours	Type of control
1.	Artificial sources of ionizing radiation and their use in the national economy. Closed and open sources of ionizing radiation.	3	Current control on practical classes
2.	The concept of influence of ionizing radiation on the human body. Effects of ionizing radiation on different organs and systems. Radiation syndromes.	3	
3.	Experience of radiation damage to people. Radiation reaction. Radiation Safety Culture.	3	
4.	Somatic, teratogenic and genetic outcomes of the radiation exposure. Chronic radiation syndrome. Etiology, pathogenesis, clinical manifestations, diagnosis, treatment.	3	
5.	Medical, social, ecological and psychological aspects of large-scale accidents at nuclear plants (according to the model of the accident at the Chernobyl nuclear power plant). The role of bone marrow transplantation in the treatment of acute radiation syndrome.	3	
<b>Total</b>		<b>15</b>	

**7. Individual cases** (disease histories, forensic medical reports, toxicological research reports, course and diploma, master's theses) are not provided for in the educational programme.

## 8. Methods of study

Types of educational activities of students according to the curriculum are: lectures, practical classes and independent work of students (IWS), in the organization of which teachers' consultations play a significant role.

In the process of studying the discipline "Radiation Medicine", the following methods of teaching students are used:

- by type of cognitive activity:
  - explanatory and illustrative;
  - reproductive;
  - problematic presentation;
  - logics of knowledge:
    - analytical;
    - inductive;
    - deductive
- by the main stages of the process:
  - formation of knowledge;
  - formation of abilities and skills;
  - application of knowledge;
  - generalization;
  - fixing;
  - verification;
- according to the system approach:
  - stimulation and motivation;
  - control and self-control;
- by sources of knowledge:
  - verbal - lecture, explanation;
  - visual - demonstration, illustration;
- by the level of independent mental activity:
  - problematic;
  - partially searchable;
  - research;
  - method of problem-based teaching

## 9. Methods of control

**control** is carried out at each practical lesson in accordance with specific goals, during the individual work of the teacher with the student for those topics that the student works on independently and which are not included in the structure of the practical lesson. Objective (standardized) control of theoretical and practical training of students is used. The following means of diagnosing the level of students' training are used: testing, solving situational problems, control of practical skills.

At each practical lesson, the student answers 20 questions (tests on the topic of the practical lesson, standardized questions, the knowledge of which is necessary to understand the current topic, questions of the lecture course and independent work related to the current lesson; demonstrates knowledge and skills of practical skills in accordance with the topic of the practical lesson ).

The form of final control in the study of "Radiation Medicine" is a semester credit, which consists in assessing the student's learning of the educational material solely on the basis of the results of his performance of certain types of work in practical classes, completed all educational classes and obtained a number of points not less than the minimum when studying the discipline . The semester credit for the discipline is carried out after the end of its study, before the beginning of the examination session.

### Methods and means of standardized assessment when compiling the final control

#### *Regulations for the semester assessment*

The form of the final control is standardized, includes the control of theoretical and practical training and is conducted at the last lesson based on the results of the training.



**10. Current control** is carried out during training sessions and is aimed at checking students' assimilation of educational material. Forms of assessment of current educational activities are standardized and include control of theoretical and practical training.

**10.1. Assessment of current educational activities.** During the evaluation of the mastery of each topic for the current educational activity, the student is assigned a 4-point (national) grade. At the same time, all types of work provided for by the discipline program are taken into account. The student must receive a grade on each topic for further conversion of grades into points on a multi-point (200-point) scale.

Test control of theoretical training is conducted by writing a test of 20 questions, the correct answer to questions 1–18 is assessed at 1 point, questions 19 and 20 are assessed at 2 points. The maximum number of points for the entire test is 22 points, the minimum number of points that a student must score to pass the theoretical part of the practical lesson is 9 points (50% of correct answers). At each practical lesson, the teacher evaluates the knowledge of each student on a four-point scale.

**Excellent ("5")** - The student correctly answered 90-100% of tests of format A. Correctly, clearly and logically and completely answers all standardized questions of the current topic, including questions of the lecture course and independent work. Closely links theory with practice and correctly demonstrates performance (knowledge) of practical skills. Solves situational tasks of increased complexity, knows how to summarize the material. Completed planned individual work.

**Good ("4")** - The student correctly answered 70-89% of tests of format A. Correctly and essentially answers the standardized questions of the current topic, lecture course and independent work. Demonstrates performance (knowledge) of practical skills. Correctly uses theoretical knowledge when solving practical tasks. Able to solve situational tasks of easy and medium complexity. Possesses the necessary practical skills and methods of their implementation in an amount that exceeds the required minimum.

**Satisfactory ("3")** - The student correctly answered 50-69% of tests of format A. Incompletely, with the help of additional questions, answers standardized questions of the current topic, lecture course and independent work. The student can not independently construct a clear, logical answer. During the answer and demonstration of practical skills, the student makes mistakes. The student solves only the easiest tasks.

**Unsatisfactory ("2")** - The student answered less than 50% of tests of format A. Does not know the material of the current topic, cannot construct a logical answer, does not answer additional questions, does not understand the content of the material. During the response and demonstration of practical skills, he makes significant, gross mistakes. At each practical lesson, the student's knowledge is evaluated according to the four-point system "5", Control of solving situational problems is carried out in a practical session by assessing the quality and completeness of their implementation, the ability to interpret the obtained results. For the practical part of the lesson, the student can gain:

4 points if the work is completed in full and the student freely and correctly explains the situational task and gives an assessment;

2 points if the work is completed with some errors, the student cannot fully explain the situational task and give an assessment;

0 points if the work is not completed or the student cannot explain the situational task and give an assessment.

The final grade for the class is determined by the sum of the results of the test control and the performance of practical work as follows:

Sum of points	Grade according 4-score scale
from 22 to 26	5
from 17 to 21	4
from 11 to 16	3
< 9 points for test control or 0 points for the practical part	2

**The material for students' independent work**, which is provided in the topic of the practical lesson simultaneously with the classroom work, is evaluated during the current control of the topic in the corresponding classroom lesson. Evaluation of topics that are assigned to independent study and are not included in the topics of classroom training sessions are monitored during the final control.

**11. The form of final control of the success of studies in the study of "Radiation Medicine" is a semester assessment.**

Semester credit is a form of final control, which consists in assessing the student's learning of the educational material based solely on the results of his performance of certain types of work in practical classes. Semester assessment of subjects is carried out after the end of its study, before the beginning of the examination session.

**12. Scheme of accrual and distribution of points received by students:**

*The maximum number of points* that a student can score for the current educational activity in the discipline is 200 points.

*The minimum number of points* that a student must score for the current educational activity in the discipline is 120 points.

*The calculation of the number of points* is carried out on the basis of the grades received by the student on a traditional scale during the study of the discipline, by calculating the arithmetic mean (AM), rounded to two decimal places. The obtained value is converted into points on a multi-point scale as follows:

$$x = \frac{AM \times 200}{5}$$

Below is the calculation table on a 200-point scale:

4-score scale	200-score scale	4-score scale	120-score scale	4-score scale	120-score scale	4-score scale	120-score scale
5	200	4,45	178	3,92	157	3,37	135
4,97	199	4,42	177	3,89	156	3,35	134
4,95	198	4,4	176	3,87	155	3,32	133
4,92	197	4,37	175	3,84	154	3,3	132
4,9	196	4,35	174	3,82	153	3,27	131
4,87	195	4,32	173	3,79	152	3,25	130
4,85	194	4,3	172	3,77	151	3,22	129
4,82	193	4,27	171	3,74	150	3,2	128
4,8	192	4,24	170	3,72	149	3,17	127
4,77	191	4,22	169	3,7	148	3,15	126
4,75	190	4,19	168	3,67	147	3,12	125
4,72	189	4,17	167	3,65	146	3,1	124
4,7	188	4,14	166	3,62	145	3,07	123
4,67	187	4,12	165	3,57	143	3,02	121
4,65	186	4,09	164	3,55	142	3	120
4,62	185	4,07	163	3,52	141		
4,6	184	4,04	162	3,5	140		
4,57	183	4,02	161	3,47	139		
4,52	181	3,99	160	3,45	138		
4,5	180	3,97	159	3,42	137	Less than 3	Insufficient
4,47	179	3,94	158	3,4	136		

*Independent work* of students is evaluated during the current control of the topic in the corresponding lesson. The learning of topics that are assigned only to independent work is controlled during the final control.

Points from the discipline are independently converted both to the ECTS scale and to the 4-point (national) scale. Points from the ECTS scale are not converted into a 4-point scale and vice versa.

Points of students studying in one specialty, taking into account the number of points scored in the discipline, are ranked on the ECTS scale as follows:

Asesment ECTS	Statistical indicator
A	The best 10 % of students
B	Next 25 % of students
C	Next 30 % of students
D	Next 25 % of students
E	Last 10 % of students

At each practical lesson, the student answers 20 questions (tests on the topic of the practical lesson, standardized questions, the knowledge of which is necessary to understand the current topic, questions of the lecture course and independent work related to the current lesson; demonstrates knowledge and skills of practical skills in accordance with the topic of the practical lesson ).

The form of final control in the study of "Radiation Medicine" is a semester credit, which consists in assessing the student's learning of the educational material solely on the basis of the results of his performance of certain types of work in practical classes, completed all educational classes and obtained a number of points not less than the minimum when studying the discipline . The semester credit for the discipline is carried out after the end of its study, before the beginning of the examination session.

Points from the discipline	Assesment according 4-point scale
From 170 to 200 points	5
From 140 to 169 points	4
From 139 points to minimal amount of points which is necessary to get by student	3
Lower than minimal amount of points which is necessary to get by student	2

The ECTS grade is not converted to the traditional scale, as the ECTS scale and the four-point scale are independent.

The objectivity of the evaluation of students' educational activity is checked by statistical methods (correlation coefficient between the ECTS grade and the grade on the national scale).

### 13. Methodical materials

The list and content of initial methodological support for the study of the discipline "Radiation Medicine" includes:

- synopsis or extended plan of lectures on the course of radiation medicine;
- thematic plans of lectures, practical classes, independent work of students;
- assignments for practical classes and independent work;
- questions, problems, tasks for current and final control of students' knowledge and skills.

#### *The list of questions for the final control of Radiation Medicine for students of the 5th year of the Faculty of Medicine*

1. The nature and properties of ionizing radiation (alpha, beta, gamma, neutrons, X-ray).
2. The concept of dose, dose power. Exposure, absorbed, equivalent, effective dose equivalent. Units of the International System (SI).
3. Methods of dose determination. Types of dosimeters.
4. Radioactivity (concept; units, types of radioactive decay).
5. Methods of determining radioactivity.
6. Natural and artificial sources of radiation. their contribution to the formation of the total population exposure dose.
7. Basic provisions of the Norms of Radiation Safety of Ukraine (NRSU-1997/ D - 2000, OSPU-2000).
8. The radiation situation after the accident at the Chornobyl Nuclear Power Plant (NPP).
9. Tasks and structure of special medical institutions for providing medical care to persons who have been exposed to excessive ionizing radiation.
10. Preventive measures in the period of environmental contamination with radioactive substances.
11. Determination and assessment of the degree of radionuclide contamination of water and food products.
12. Modern understanding of the main mechanisms of biological action of ionizing radiation.
13. The role of free radicals in cell damage due to the action of ionizing radiation.
14. Pathogenesis of radiation damage to tissues.
15. Radiosensitivity of various body tissues.
16. The value of hematological (hematomorphological) research methods for detecting pathological changes in human organs and systems after exposure to ionizing radiation.
17. The principle of the cytogenetic method and its importance for detecting pathological changes in human organs and systems after exposure to ionizing radiation.
18. The importance of biochemical, biophysical and other research methods for identifying pathological changes in human organs and systems after exposure to ionizing radiation.
19. Effect of ionizing radiation on hematopoietic organs.

20. Effect of ionizing radiation on digestive organs.
21. Impact of ionizing radiation on the cardiovascular system.
22. Impact of ionizing radiation on the pulmonary system.
23. Impact of ionizing radiation on the central nervous system.
24. Impact of ionizing radiation on the endocrine system.
25. Methods and value of physical dosimetry for assessing the degree of human damage in nuclear production accidents.
26. Criteria and value of biological dosimetry.
27. Etiological factors (consequences of various types of ionizing radiation).
28. Clinical and biological criteria for the diagnosis of acute radiation sickness (ARS).
29. Pathogenesis of acute radiation sickness.
30. General and clinical classification of radiation lesions.
31. Clinical signs of the period of primary reaction of ARS.
32. Clinical signs of the hidden (latent) period of ARS.
33. Clinical signs of the period of exacerbation of the disease.
34. Principles of ARS diagnosis and sorting at the stages of medical evacuation.
35. Treatment of ARS depending on the period of the disease and the experience of treating victims of the accident at the Chernobyl NPP.
36. Peculiarities of ARS diagnostics due to combined irradiation.
37. Features of the ARS clinic as a result of combined irradiation.
38. Peculiarities of treatment of ARS as a result of combined irradiation.
39. The principles of medical and psycho-social rehabilitation of persons who have undergone ARS.
40. Classification, clinic, treatment of chronic radiation sickness.
41. Classification, diagnosis and clinic of radiation burns.
42. Treatment of radiation burns depending on the degree of severity and period of the clinical course and experience of treatment of persons injured in the accident at the Chernobyl NPP.
43. Prevention of radiation damage.
44. Biological effects of small doses of ionizing radiation.
45. Somatic consequences of radiation exposure.
46. Teratogenic effects of radiation
47. Genetic consequences of the radiation spill.
48. Stochastic and non-stochastic effects of radiation.
49. Organization of medical assistance in case of radiation accidents.
50. Organization of radiation control in the event of accidents at nuclear plants.
51. Ways of entry of radionuclides into the body.
52. Distribution of incorporated radionuclides in the body.
53. Effective half-life. Determination of the half-life and effective half-life of a radionuclide.
54. Radiotoxicology Cs<sup>137</sup>. Emergency aid when it enters the body.
55. Radiotoxicology of Sr<sup>90</sup>. Emergency aid when it enters the body.
56. Radiotoxicology I<sup>131</sup>. Emergency aid when it enters the body.
57. Methods of determining the presence of radionuclides in the body.
58. The main directions in the treatment of internal contamination of the body with radionuclides.
59. Preventive and therapeutic measures for incorporation of I<sup>131</sup> (single prevention)
60. Dispensation of personnel of nuclear plants.
61. Medical examination of the population exposed to ionizing radiation as a result of a radiation accident.
62. Categories and levels of observation.
63. Medical consequences of large-scale accidents at nuclear production.
64. Social protection of people exposed to accidental exposure and psychological aspects of nuclear accidents.
65. Purpose and tasks of the National Register of Ukraine of persons affected by the Chernobyl disaster.

#### 14. Recommended literature

##### *Basic:*

1. Means of protection of the body against the action of ionizing radiation [Text]: training manual. for students higher education Institutions of the Ministry of Health of Ukraine/L. M. Vasko, V. F. Pocherniaeva, V. P. Bashtan. - K. : VSV "Medicine", 2019.-112 p.
2. Medicine of emergency situations [Text]: Textbook / B. D. Khalmuradov, P. B. Volyanskyi. - K. : Center for Educational Literature, 2018.-256 p.

3. Radiology. Radiation therapy. Radiation diagnostics [Text]: Textbook for students. higher medical studies institution. IV year of accreditation / O. V. Kovalskyi, D. S. Mechev, V. P. Danylevich. - 2nd ed. - Vinnytsia: Nova Kniga, 2017. - 512 p.

4. I.M. Hudkov. Radiobiology: Textbook for higher education. educational institutions. -K.: NUBiP of Ukraine, 2017.-485p.; table 50. Ill. 105. Bibliography: 30 titles.

5. Bebeshko V.G., Kovalenko O.M., Bily D.O. Acute radiation syndrome and its consequences. Ternopil: TDMU, 2016. - 424 p.

6. Chernobyl disaster. See ed. V.G. Baryakhtar. - K.: Science. dumka, 1995. - 575p.

7. Radio-biophysical and medical-hygienic consequences of the Chernobyl disaster: ways of understanding and overcoming. Practical guide for a family doctor / V.G. Bebeshko, B.S. Proster, M.I. Omelyanets - Uzhgorod: TDV "Patent", 2017. - 504 p.

***Additional:***

1. Study of the frequency and doses of irradiation due to X-ray diagnostic procedures / A.V. Kutsak, A.I. Sevalnev, M.I. Kostenetskyi et al. Herald of problems of biology and medicine. 2017. Issue 2 (136). P. 70–74.

2. Research on the content of cesium137 and strontium90 in food products with an assessment of population exposure doses and possible negative health consequences. / A. V. Kutsak, A. I. Sevalnev, M. I. Kostenetsky and others. Herald of problems of biology and medicine. 2017. Issue 1(135). P. 75–78.

3. Kostenetskyi M. I., Sevalnev A. I., Kutsak A. V. Radioecology of the living environment of the population of the Zaporizhia region. Zaporizhzhia: ZDMU Publishing House, 2017. 151 p.

4. Atomic Radiation Is More Harmful to Women. <https://www.genderandraradiation.org/wp-content/uploads/2017/05/corrected-radiationwomenfnal.pdf>.

5. Fukushima Catastrophe at 6: Normalizing Radiation Exposure Demeans Women and Kids and Risks Their Health. <https://www.counterpunch.org/2017/03/06/fukushima-catastrophe-at-6-normalizing-radiation-exposure-demeans-women-and-kids-and-risks-thei>

6. 20 years of the Chernobyl disaster. A look into the future. National report of Ukraine. - K.: "Atika", 2006. - 224 p.

7. Standards of radiation safety of Ukraine. Supplement: Radiation protection from sources of potential exposure (NRSU-97/D-2000). Kyiv, 2000. - 80 p.

**15. Informational resources**

When studying the discipline, due to the use of local and global computer networks, students use the following information resources and knowledge bases:

- Wikipedia (<http://uk.wikipedia.org>)

- Electronic versions of educational and methodological support:

- Methodological recommendations for practical classes and independent work on radiation medicine for students of the 5th year of the Faculty of Medicine in the specialty: 222 - "Medicine", field of knowledge 22 "Health Care".

Access method: <http://misa.meduniv.lviv.ua/course/index.php?categoryid=635>