

# SYLLABUS

## 1. General information on the course

<b>Full course name</b>	Radiation Medicine
<b>Full official name of a higher education institution</b>	Sumy State University
<b>Full name of a structural unit</b>	Academic and Research Medical Institute. Кафедра онкології та радіології
<b>Author(s)</b>	Ivakhniuk Yurii Petrovych
<b>Cycle/higher education level</b>	The Second Level Of Higher Education, National Qualifications Framework Of Ukraine – The 7th Level, QF-LLL – The 7th Level, FQ-EHEA – The Second Cycle
<b>Semester</b>	1 weeks across 9 semester or 1 weeks across 10 semester
<b>Workload</b>	5 ECTS, 150 hours, out of which 36 hours are working hours with the lecturer (36 hours of practical classes)
<b>Language(s)</b>	English

## 2. Place in the study programme

<b>Relation to curriculum</b>	Elective course available for study programme "Medicine"
<b>Prerequisites</b>	"STEP-1", Knowledge is required: - Latin language and medical terminology, - medical biology, - medical informatics, - human anatomy - physiology, - pathophysiology, - histology, cytology and embryology, - biological and bioorganic chemistry, - pathomorphology - pathophysiology , - pharmacology, - hygiene and ecology, - social medicine and healthcare organization, - pediatric propedeutics, - nursing practice, - radiology
<b>Additional requirements</b>	There are no specific requirements
<b>Restrictions</b>	There are no specific restrictions

## 3. Aims of the course

The purpose of the discipline is to train medical specialists who are able to solve complex tasks and solve problems in the field of radiation medicine with the formation and acquisition of professional skills in clinical, laboratory and instrumental examination of patients in compliance with the principles of medical ethics and deontology.

## 4. Contents

Topic 1 Common question of nuclear physics and hygienic aspects of radiation medicine.

Radiation medicine is a clinical scientific discipline. The importance of radiation medicine after the Chernobyl accident. Atomic structure and properties of basic elementary particles, such as radioactive transformations, types of ionizing radiation. Dosimetry. The radiation background of the Earth, its components. Technogenic and medical sources of radiation. Dose limits and principles of radiation protection.

Topic 2 Biological effects of ionizing radiation.

Biological action of ionizing radiation. General and local exposure. Radiation injuries. Radiation exposure levels, their criteria. Iodine prophylaxis, radiation protective nutrition.

Topic 3 Types of radiation damage. Acute and chronic radiation sickness. Acute local radiation damage.

Types of radiation damage. Acute and chronic radiation sickness: definition, causes, pathogenesis, classification, main forms, clinical manifestations, diagnosis, differential diagnosis. First aid, tactics and methods of treatment, principles of sorting victims and treatment of mass injuries. Features of the course of acute and chronic radiation sickness depending on internal irradiation from the standpoint of evidence-based medicine. Rehabilitation of patients. Problems of bone marrow transplantation in acute radiation sickness. Acute local radiation injuries: features of the clinic, diagnosis and treatment of persons who have undergone combined exposure from the standpoint of evidence-based medicine.

Topic 4 Effect of ionizing radiation on the embryo and fetus. Genetic lesions. The effect of small doses of radiation on the body. Long-term effects after irradiation.

Radiation effects on the embryo and fetus, protection against ionizing lesions. Small doses of ionizing radiation and their biological effect. Stochastic and non-stochastic effects. Long-term consequences of the accident at the nuclear power plant (somatic, teratogenic, genetic).

Topic 5 Methods of radiation therapy.

General data on the variety of methods of radiation therapy. Technological variants of radiation therapy methods: remote or external radiotherapy, brachytherapy and nuclear medical or radioisotope therapy (RIT). Clinical variants of radiation therapy. Fractionation of radiation therapy.

Topic 6 Palliative radiation therapy.

Palliative radiation therapy: methods, indications and contraindications.

Topic 7 Intensive care in radiation therapy and oncology.

Emergencies in cancer patients. Clinical issues, diagnosis, prevention and basic principles of emergency therapy in case of emergencies in patients with malignant neoplasms based on the principles of evidence-based medicine. Problems of pain syndrome, which often occurs in patients with cancer.

Topic 8 Radiobiology. Practical application of radioisotope methods in the diagnosis of various pathological nosologies.

Radiobiology. Practical application of radioisotope methods in the diagnosis of various pathological nosologies. Features of application of radioisotope methods in diagnosis of endocrine pathology of human body.

Topic 9 Equipment and operation of special medical institutions to provide assistance to persons exposed to ionizing radiation.

Equipment and operation of special medical institutions to provide assistance to persons exposed to ionizing radiation. Medical examination of personnel working with sources of ionizing radiation. Groups of persons of primary dispensary accounting, categories and levels of observation. Radiation safety culture.

Topic 10 Large radiation accidents and their consequences.

Medical consequences of a large-scale accident at a nuclear power plant. The main radiation accidents of the 50-90s and their consequences. Chernobyl accident. Medical, social and sanitary aspects. Acute effects of radiation at the Chernobyl nuclear power plant. The Chernobyl accident is the biggest radioecological catastrophe of our time. Laws of Ukraine on the status and social protection of citizens affected by the Chernobyl accident. Categories of the population affected by the disaster. Social problems that arise after an accident. Medical examination of the population exposed to radiation.

Topic 11 Final modular control.

Testing of theoretical knowledge and practical skills within the topics of the discipline.

## 5. Intended learning outcomes of the course

After successful study of the course, the student will be able to:

LO1	Acquire the skills of interviewing and objective examination of the patient with knowledge of the biological effects of ionizing radiation on the human body, its impact on various organs and systems. To determine etiological, pathogenetic factors and clinical manifestations, to diagnose acute and chronic radiation damage; provide emergency assistance to victims. Determine the tactics of management of victims who have been exposed to ionizing radiation.
LO2	Be able to identify and record the leading clinical symptom and clinic, course, principles of sorting and treatment of acute and chronic radiation sickness, features of combined radiation injuries. Apply in practice the principles of medical sorting of victims and the provision of emergency care.
LO3	Determine and differentiate the effects of small doses of ionizing radiation and possible biological effects; the effect of radiation on the embryo and fetus; long-term effects of ionizing radiation.
LO4	Substantiate and apply in practice the main laboratory and instrumental methods of examination, be able to perform medical manipulations. Master the main classes of pharmacological drugs used for the treatment and emergency prevention of patients depending on the severity of radiation injuries.
LO5	To master the organization of radiation control and medical care in case of major radiation accidents, the algorithm of examination of patients affected by the Chernobyl accident, the main directions of social protection and medical care for people affected by the Chernobyl accident.

## 7. Teaching and learning activities

### 7.1 Types of training

**Topic 1. Common question of nuclear physics and hygienic aspects of radiation medicine.**

pr.tr.1 "General issues of nuclear physics and hygienic foundations of radiation medicine."  
(full-time course)

Physicochemical phenomena and processes taking place in the nucleus of the atom. Basic properties of atomic nuclei. Alpha decay. Beta decay. Gamma radiation of nuclei. Nuclear chain reaction. Ionizing radiation as an environmental factor and industrial hazards. Classification of sources of ionizing radiation and their contribution to human radiation exposure. Methods of registration of ionizing radiation, quantitative and qualitative characteristics, units of measurement. Features of radiation hazard when working with sources of ionizing radiation and the principles on which radiation protection is based from the standpoint of evidence-based medicine. Dosimetry of ionizing radiation. The principle of structure of dosimeters, radiometers, their types. Assessment of the degree of radionuclide contamination of the environment, soil, water, food. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching movies with the main clinical manifestations of ionizing damage) with further discussion.

## **Topic 2. Biological effects of ionizing radiation.**

pr.tr.2 "Biological action of ionizing radiation." (full-time course)

Pathogenetic mechanism of biological action of ionizing radiation. Stages of biological action of ionizing radiation. Theories of biological action of ionizing radiation. Stages and stages of radiation damage. Changes that occur in the cell under the action of IP. The most important processes of cell destruction. Radiosensitivity, types of radiosensitivity to IP. Factors that determine the sensitivity of the body. Effects that occur in the body under the action of ionizing radiation from the standpoint of evidence-based medicine. How to correct disorders in the cell that occur under the influence of IP. Diagnostic and prognostic value of hematological, biochemical, cytogenetic and other research methods for the assessment of pathological changes in human organs and systems after exposure to ionizing radiation. The study of this topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching a training video on the topic) with further discussion. In addition, the study of this topic involves counting the number of peripheral blood cells, bone marrow as the main method of quantifying the degree of radiation damage to the body.

## **Topic 3. Types of radiation damage. Acute and chronic radiation sickness. Acute local radiation damage.**

pr.tr.3 "Acute radiation sickness. Combined radiation damage. Principles of treatment and medical sorting." (full-time course)

Acute radiation sickness caused by external radiation. Etiology, pathogenesis, diagnosis, clinic, treatment, consequences of acute radiation sickness, medical and social examination from the standpoint of evidence-based medicine. Tactics of medical service in case of mass influx of victims. Analysis of the most characteristic medical histories of persons who have suffered from acute radiation sickness. Problems of bone marrow transplantation in acute radiation sickness. Analysis of the most characteristic medical histories of persons who have suffered from acute radiation sickness. The study of this topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching a training film on the topic) with further discussion. In addition, the study of this topic involves the demonstration of patients with clinical signs of local and systemic reactions caused by the use of radiation therapy in the profile department of the medical institution (according to the cooperation agreement between the medical institution and the university), interpretation of clinical-laboratory and functional diagnostic methods acute radiation sickness.

pr.tr.4 "Acute local radiation damage." (full-time course)

Acute local radiation damage. Features of the clinic, diagnosis and treatment of persons who have undergone combined exposure from the standpoint of evidence-based medicine. The study of this topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching a training film on the topic) with further discussion. In addition, the study of this topic provides an analysis of the most characteristic medical histories of persons who have suffered from acute radiation sickness and local radiation injuries. Clinical analysis of patients with further discussion.

pr.tr.5 "Chronic radiation sickness." (full-time course)

Chronic radiation sickness caused by external irradiation. Etiology, pathogenesis, diagnosis, clinic, treatment, consequences of chronic radiation sickness, medical and social examination from the standpoint of evidence-based medicine. Chronic radiation injuries: features of the clinic, diagnosis and treatment of persons who have undergone combined exposure from the standpoint of evidence-based medicine. Principles of radiation safety for the prevention of chronic radiation sickness. Analysis of the most characteristic medical histories of persons who have suffered from chronic radiation sickness. The study of this topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching a training video on the topic) with further discussion. In addition, the study of this topic involves the demonstration of patients with clinical signs of local and systemic reactions caused by the use of radiation therapy in the profile department of the medical institution (according to the cooperation agreement between the medical institution and the university), interpretation of clinical and laboratory and functional diagnostic methods. chronic radiation sickness.

**Topic 4. Effect of ionizing radiation on the embryo and fetus. Genetic lesions. The effect of small doses of radiation on the body. Long-term effects after irradiation.**

pr.tr.6 "Effect of ionizing radiation on the embryo and fetus. Genetic lesions." (full-time course)

Deterministic and stochastic radiobiological effects. Stochastic and non-stochastic effects of radiation. Genetic, teratogenic and somatic consequences of human exposure in different periods of fetal development from the standpoint of evidence-based medicine. The concept of the risk of exposure to ionizing radiation on humans. Scheme for calculating the predicted genetic effects of irradiation. The study of this topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching a training video on the topic), analysis of the results of molecular genetic tests with further discussion.

pr.tr.7 "The effect of small doses of radiation on the body. Long-term effects after irradiation." (full-time course)

Toxicology of basic radionuclides. The effects of internal human exposure from the standpoint of evidence-based medicine. Medico-biological effects of exposure to small doses of ionizing radiation on the human body. Incorporation of radionuclides. Features of the clinic, diagnostics and treatment and prevention measures when radionuclides enter the human body. The study of this topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching a training video on the topic) with further discussion.

**Topic 5. Methods of radiation therapy.**

pr.tr.8 "Remote or external radiotherapy." (full-time course)

General data on the variety of methods of radiation therapy. Technological variants of radiation therapy methods. Remote radiation therapy (RPT), or external radiotherapy (ERT). Methods of remote radiotherapy on technological grounds: surface (short-distance) X-therapy; orthovolt (long-distance) x-therapy; telegamma therapy (remote gamma therapy); intraoperative radiotherapy (IOPT); remote therapy with heavy particles; remote megavolt X-therapy. The study of this topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching a training video on the topic) with further discussion; visiting the radiotherapy department (according to the agreement on cooperation between the medical institution and the university) and getting acquainted with the equipment used in radiation therapy.

pr.tr.9 "Brachytherapy." (full-time course)

Brachytherapy: principles of various methods (interstitial, intracavitary, application). Interstitial brachytherapy, interstitial implants, stages. Intracavitary brachytherapy; salinity of use in gynecological patients; special hollow applicators (colposts). Application brachytherapy in the treatment of gynecological diseases, inflammatory eye diseases and various skin diseases. High and low dose brachytherapy. The study of this topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching a training video on the topic) with further discussion; visiting the radiotherapy department (according to the agreement on cooperation between the medical institution and the university) and getting acquainted with the equipment used in radiation therapy.

pr.tr.10 "Radioisotope therapy." (full-time course)

Radioisotope therapy: principles and field of application in medical practice. Features of the use of systemic radioisotope therapy from the standpoint of evidence-based medicine. The study of this topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching a training video on the topic) with further discussion; visiting the radiotherapy department (according to the agreement on cooperation between the medical institution and the university) and getting acquainted with the equipment used in radiation therapy.

pr.tr.11 "Clinical variants of radiation therapy. Fractionation of radiation therapy." (full-time course)

Options for radiation therapy for clinical purposes: radical (therapeutic); palliative; salvage radiotherapy (rescue radiation therapy); preventive; adjuvant and neoadjuvant; simultaneous chepromen therapy; emergency radiation therapy; semi-total and total irradiation. Fractionation of radiation therapy: radiobiological rule of treatment; the benefits of fractionation of the course of therapy. Standard fractionation of radiotherapy; fractionation schemes. The study of this topic involves theoretical and practical work in the classroom, mastering the radiobiological principles that must be taken into account when choosing a treatment fractionation scheme to maximize radicalism while taking into account the tolerance of normal cells.

**Topic 6. Palliative radiation therapy.**

pr.tr.12 "Palliative radiation therapy." (full-time course)

Palliative radiation therapy: methods, indications and contraindications. The study of this topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching a training video on the topic) with further discussion; visiting the radiotherapy department (according to the agreement on cooperation between the medical institution and the university) and getting acquainted with the equipment used in radiation therapy. In addition, during the practical lesson it is necessary to master practical skills in choosing the method of palliative radiation therapy.

**Topic 7. Intensive care in radiation therapy and oncology.**

pr.tr.13 "Intensive care in radiation therapy and oncology." (full-time course)

Emergencies in cancer patients and radiation therapy. Clinical issues, diagnosis, prevention and basic principles of emergency therapy in emergencies in patients with malignant neoplasms based on the principles of evidence-based medicine. Problems with the pain syndrome that often occurs in cancer patients. The practical lesson involves the analysis of clinical situations with further discussion.

**Topic 8. Radiobiology. Practical application of radioisotope methods in the diagnosis of various pathological nosologies.**

pr.tr.14 "Radiobiology. Practical application of radioisotope methods in the diagnosis of various pathological nosologies." (full-time course)

Radiobiology. Practical application of radioisotope methods in the diagnosis of various pathological nosologies. Features of application of radioisotope methods in diagnosis of endocrine pathology of human body. The study of this topic involves theoretical and practical work in the classroom; analysis of clinical situations of various pathological nosologies.

**Topic 9. Equipment and operation of special medical institutions to provide assistance to persons exposed to ionizing radiation.**

pr.tr.15 "Equipment and operation of special medical institutions to provide assistance to persons exposed to ionizing radiation." (full-time course)

Equipment and operation of special medical institutions to provide assistance to persons exposed to ionizing radiation. Medical examination of personnel working with sources of ionizing radiation. Groups of persons of primary dispensary accounting, categories and levels of observation. Radiation safety culture. The study of this topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching a training video on the topic) with further discussion; visiting the radiotherapy department (according to the agreement on cooperation between the medical institution and the university) and getting acquainted with the equipment used in radiation therapy.

**Topic 10. Large radiation accidents and their consequences.**

pr.tr.16 "Large radiation accidents and their consequences." (full-time course)

Medical and psychological aspects of large-scale accidents at nuclear power plants (according to the model of the Chernobyl accident, Fukushima). Basic principles and ways to ensure radiation safety. Measures to ensure radiation safety of works. Sanctions for violation of radiation safety norms and rules in Ukraine. Current radiation safety standards of Ukraine. Basic norms of behavior and actions of the population in case of radiation accidents and radiation contamination of the area. Equipment and operation of special medical institutions to provide assistance to persons exposed to ionizing radiation. Medical examination of personnel working with sources of ionizing radiation. Groups of persons of primary dispensary accounting, categories and levels of observation. National Register of Ukraine of persons affected by the Chornobyl disaster: purpose, structure, purpose, tasks. The study of this topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching a training video on the topic) with further discussion.

### **Topic 11. Final modular control.**

pr.tr.17 "Final modular control." (full-time course)

Testing of theoretical knowledge - testing within topics 1-10.

pr.tr.18 "Final modular control." (full-time course)

Test of practical skills - performance of a practice-oriented task within the topics of the discipline (1-10).

## 7.2 Learning activities

LA1	Preparation for practical classes
LA2	Self-study
LA3	Watching educational films
LA4	Practical work with the patient in the profile department of the hospital
LA5	Analysis of clinical cases
LA6	E-learning in systems (Zoom, MIX.sumdu.edu.ua)
LA7	Interpretation of laboratory (puncture biopsy of the red bone marrow, clinical and biochemical analysis of blood, clinical analysis of urine) and instrumental (ultrasound, FEGDS) methods of examination
LA8	Individual research project (student research paper, article, thesis, etc.)
LA9	Preparation for the final modular control

## 8. Teaching methods

Course involves learning through:

TM1	Practical classes
TM2	Case-based learning (CBL). Training case studies
TM3	Research-based learning (RBL). Learning through research
TM4	Team-based learning (TBL). Team-oriented training

TM5	Brain storm
TM6	Educational discussion / debate

The discipline is taught using the latest teaching methods (CBL, RBL, TBL) which promote the development of professional abilities, stimulate creative and scientific activities and are aimed at training practice-oriented professionals.

The discipline provides students with the following soft skills: Ability to abstract thinking, analysis and synthesis. Ability to learn, master modern knowledge and apply it in practical situations. Knowledge and understanding of the subject area and understanding of professional activity. Ability to use information and communication technologies. Ability to make informed decisions; work in a team; interpersonal skills.

## 9. Methods and criteria for assessment

### 9.1. Assessment criteria

ECTS	Definition	National scale	Rating scale
A	Outstanding performance without errors	5 (Excellent)	$90 \leq RD \leq 100$
B	Above the average standard but with minor errors	4 (Good)	$82 \leq RD < 89$
C	Generally sound work with some errors	4 (Good)	$74 \leq RD < 81$
D	Fair but with significant shortcomings	3 (Satisfactory)	$64 \leq RD < 73$
E	Performance meets the minimum criteria	3 (Satisfactory)	$60 \leq RD < 63$
FX	Fail – some more work required before the credit can be awarded	2 (Fail)	$35 \leq RD < 59$
F	Fail – considerable further work is required	2 (Fail)	$0 \leq RD < 34$

### 9.2 Formative assessment

FA1	Peer assessment
FA2	Teacher's instructions in the process of performing practical tasks
FA3	Testing
FA4	Interviews and oral comments of the teacher on his results
FA5	Solving clinical cases
FA6	Checking and evaluating written assignments
FA7	Defense of an individual research project (presentation at a conference, competition of scientific works)

### 9.3 Summative assessment

SA1	Surveys, evaluation of written works, solving clinical cases, testing
SA2	Final control: differential credit (in accordance with the regulations)

SA3	Defense of an individual research project (incentive activities, additional points)
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Form of assessment:

<b>The semester of teaching</b>		<b>200 scores</b>
SA1. Surveys, evaluation of written works, solving clinical cases, testing		<b>120</b>
		120
SA2. Final control: differential credit (in accordance with the regulations)		<b>80</b>
		80

Form of assessment (special cases):

<b>The semester of teaching</b>		<b>200 scores</b>
SA1. Surveys, evaluation of written works, solving clinical cases, testing		<b>120</b>
	In case of quarantine restrictions: the survey, evaluation of written works, solving clinical cases is carried out remotely using the platforms MIX.sumdu.edu.ua, Zoom	120
SA2. Final control: differential credit (in accordance with the regulations)		<b>80</b>
	In case of quarantine restrictions the final modular control is carried out in the remote mode with use of platforms MIX.sumdu.edu.ua, Zoom	80

When mastering the materials of the module, the student is assigned a maximum of 5 points for each practical lesson (the grade is set in the traditional 4-point grading system). At the end of the academic year, the arithmetic mean of student performance is calculated. The maximum number of points that a student can get in practical classes during the academic year is 120. The number of student points is calculated by the formula 120 multiplied by the arithmetic mean and divided by 5. The form of the final module control - differential credit. The student is admitted to the final module control provided that the requirements of the curriculum are met and if he has scored at least 72 points for the current academic activity, which corresponds to the average score for the current mark "3". The final module control is carried out according to the schedule at the last practical lesson of the academic semester. Final module control (the maximum number of points that a student can score during the compilation is 80) includes control and evaluation of theoretical and practical training. The final modular control of the discipline includes answers to questions on various topics of the discipline (maximum number of points - 40; minimum - 24 points) and testing on a database of questions covering all sections of the discipline (maximum number of points - 40; minimum - 24 points). The final module control is credited to the student if he scored at least 48 points out of 80. Incentive points are added to the assessment of the discipline of individual research project (defense of student academic work 12 points, conference speech 5 points, conference presentation 4 points, abstracts 3 points. The total score in the discipline may not exceed 200 points.

## 10. Learning resources

### 10.1 Material and technical support

MTS1	Information and communication systems
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MTS2	Library funds, archive of laboratory (puncture biopsy of the worm bone marrow, clinical and biochemical analysis of blood, clinical analysis of urine) and instrumental (ultrasound, FEGDS) methods of examination
MTS3	Computers, computer systems and networks
MTS4	Sumy City Hospital Clinic № 4
MTS5	Multimedia, video and sound reproduction, projection equipment (video cameras, projectors, screens, smart boards, etc.)
MTS6	Software (to support distance learning, online survey)
MTS7	Medical equipment: X-ray machine for radiography and radioscopy, negatoscope

## 10.2 Information and methodical support

<b>Essential Reading</b>	
1	Means of Protecting the Body from the Effects of Ionizing Radiation : study guide / T. O. Zhukova, F. Pocherniayeva, V. P. Bashtan. - Kyiv : AUS Medicine Publishng, 2019, 112 c.
2	Radiology. Radiotherapy. Diagnostic Imaging : textbook / O. Kovalsky, D. Mechev, V. Danylevych. — second edition. - Vinnytsia : Nova Knyha, 2017. - 504 p.
3	Image-Based Computer-Assisted Radiation Therapy / edited by Hidetaka Arimura. - 1st ed. 2017. - Singapore : Springer Singapore, 2017. - X, 381 p.
4	Radiation Therapy for Extranodal Lymphomas / edited by Keisuke Sasai, Masahiko Oguchi. - 1st ed. 2017. - Tokyo : Springer Japan, 2017. - VII, 107 p.
5	Acute Side Effects of Radiation Therapy : A Guide to Management / A. Sourati, A. Ameri, M. Malekzadeh ; by Ainaz Sourati, Ahmad Ameri, Mona Malekzadeh. 1st ed. 2017. Cham : Springer International Publishing, 2017. XVI, 217 p.
<b>Supplemental Reading</b>	
1	Radiation medicine : texbook / D. A. Bazyka, H. V. Kulinich, M. I. Pylypenko. - K. : AUS Medicine Publishing, 2013, 224 p.
2	Radiation Therapy in Hematologic Malignancies : An Illustrated Practical Guide / edited by Bouthaina Shbib Dabaja, Andrea K. Ng. - 1st ed. 2017. - Cham : Springer International Publishing, 2017. - X, 203 p.
3	Radiation Therapy for Liver Tumors : Fundamentals and Clinical Practice / edited by Jeffrey Meyer, Tracey Schefter. - 1st ed. 2017. - Cham : Springer International Publishing, 2017. - XVIII, 288 p.
4	Radiation Therapy for Gastrointestinal Cancers / edited by Theodore Hong, Prajnan Das. -1st ed. 2017. - Cham : Springer International Publishing, 2017. - VI, 245 p.
5	Advances in Radiation Oncology / edited by Jeffrey Y.C. Wong, Timothy E. Schultheiss, Eric H. Radany. - 1st ed. 2017. - Cham : Springer International Publishing, 2017. - VIII, 271 p.

6	Endocrinology / P. M. Bodnar, P. O. Bekh, G. P. Mykhalchyshyn etc. ; edited by P.M. Bodnar. - 4-th ed., updated. - Vinnytsia : Nova Knyha, 2017, 328 p.
<b>Web-based and electronic resources</b>	
1	World Health Organization <a href="http://www.who.int/en/">http://www.who.int/en/</a>
2	Educational online platform Osmosis <a href="https://www.osmosis.org/learn/">https://www.osmosis.org/learn/</a>
3	Educational online platform Lecturio <a href="https://www.lecturio.com/medical-courses/radiology.course#/">https://www.lecturio.com/medical-courses/radiology.course#/</a>
4	Radiation protection concepts and principles <a href="https://www.who.int/ionizing_radiation/pub_meet/chapter2.pdf">https://www.who.int/ionizing_radiation/pub_meet/chapter2.pdf</a>
5	Radiation Protection and Dose Optimisation <a href="https://www.eanm.org/content-eanm/uploads/2016/12/EANM_2016-TG_RadiationProtection_lowres.pdf">https://www.eanm.org/content-eanm/uploads/2016/12/EANM_2016-TG_RadiationProtection_lowres.pdf</a>
6	Handbook of Evidence-Based Stereotactic Radiosurgery and Stereotactic Body Radiotherapy / Rajni A. Sethi, Igor J. Barani, David A. Larson, Mack Roach. - Springer International Publishing Switzerland. - 2016, 256 p. <a href="https://pdfroom.com/books/handbook-of-evidence-based-stereotactic-radiosurgery-and-stereotactic-body-radiotherapy/EjndOJZb5Rq">https://pdfroom.com/books/handbook-of-evidence-based-stereotactic-radiosurgery-and-stereotactic-body-radiotherapy/EjndOJZb5Rq</a>