

**Faculty of Science**  
**Physics Department**

**Study Plan Program for Master Degree in Medical Physics**  
**(Non-Thesis track)**

<b>Plan number</b>			<b>2015</b>
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**First: General Rules & Conditions:**

- 1- This plan conforms to valid regulations of the programs of graduate studies.
- 2- Specialties of admission:

- ❖ The First priority: Bachelor's in Physics, Bachelor's in Applied Physics, Bachelor's Medical Physics, Bachelor's in Radiation Physics, Bachelor's in Nuclear Engineering.
- ❖ The Second Priority: Bachelor's in Medical Radiography Technologies or equivalent.

**Second: Special Conditions:**

- ❖ None

**Third: Study Plan: studying (33) Credit Hours as follows:**

**1. Obligatory Courses (24 credit hours):**

Course No.	Course Title	Credit hrs	Theory	Practical	Pre-Requisite
0302720	Anatomy and Physiology	2	2	-	-
0302722	Radiation Laboratory	1	3	-	0342765
0302730	Ultrasound and Magnetic Resonance Imaging	3	3	-	-
0302740	Physics of Radiotherapy	3	3	-	0342765
0302744	Radiation Protection	3	3	-	0342765 or simultaneous
0342765	Radiation Detection and Measurements	3	3	-	-
0302770	Nuclear Medicine	3	3	-	0342765

Course No.	Course Title	Credit hrs	Theory	Practical	Pre-Requisite
0302787	Physics of Diagnostic Radiology and computed Tomography	3	3	-	0342765
0302790	Practical Training	2	-	6	The department approval
0302794	Research Methodology	1	1	-	-

**2. Elective Courses: Studying (9) Credit Hours from the following:**

Course No.	Course Title	Credit hrs	Theory	Practical	Pre-Requisite
0332776	Radiation Biology	3	3	-	0342765 or simultaneous
0302777	Special Techniques in Radiotherapy and Brachytherapy	3	3		0302740
0302779	Accelerator Physics for Medical Purposes	3	3	-	-
0302780	Signal and Imaging Processing	3	3	-	0302787
0302795	Special Topics in Medical Physics	3	3	-	-

**3. A comprehensive exam (0302798).**

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**Course Description for Master Degree in Medical Physics**  
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**0302720 Anatomy and Physiology**

**2 Credit Hours**  
**(Pre-requisite: None)**

Anatomical nomenclature, bones, thorax, abdomen, endocrine system, respiratory system, digestive system, urinary system, reproductive system, circulatory system, pathology. Homeostasis; general aspects. Blood and body fluids; formation, function and fate

**0302722 Radiation Laboratory**

**1 Credit Hour**  
**(Pre-requisite: 0342765)**

The laboratory course gives some experience in practical aspects of medical physics as applied to radiation therapy. The course complements the theoretical introduction of both the radiation physics and applied dosimetry courses through 12 sessions in the radiation lab. The student is exposed to the operation of various therapy units and dose measuring devices, and to the techniques for measurement of different physical parameters which characterize radiation beams used in radiation therapy.

**0302730 Ultrasound and Magnetic Resonance Imaging**

**3 Credit Hours**  
**(Pre-requisite: None)**

Physics of diagnostic ultrasound, Doppler and color-flow instruments; acoustical power and intensity levels for clinical equipment; biological effects. Physics and technology of magnetic resonance imaging (MRI), emphasizing techniques employed in medical diagnostic imaging, pulse sequences, hardware, imaging techniques, artifacts, and spectroscopic localization.

**0302740 Physics of Radiotherapy**

**3 Credit Hours**  
**(Pre-requisite: 0342765)**

Production and properties of ionizing radiations that are used in radiation therapy for cancer patients, and their biological effects. Physics of the interaction of various radiation types with body-equivalent materials. External beam instrumentations and applied dosimetry. Treatment planning using single beam and combination of beams.

**0342744 Radiation Protection****2 Credit Hours****(Pre- requisite: 0302740 or simultaneous)**

The development of a radiation technology and its applications, the need for radiation protection, the unifying concepts ( binding and energy levels for different elements, dose and energy ...etc.) in radiation protection, principles of protection against ionizing radiation, radiation dose calculations for different types of radiation inside and outside the body.

**0342765 Radiation Detection and Measurements****3 Credit Hours****(Pre-requisite: None)**

Radiation sources, interactions and energy deposition by ionizing radiation in matter; concepts, quantities and units in radiation physics. Isotope production, measurement of activity, standards, Spectrometry, measurement techniques and detectors. Precision, errors, detection limits. Radioanalytical methods. Principles and methods of radiation dosimetry. Radiation dosimetry fundamentals, radiation detection instrumentation.

**0302770 Nuclear Medicine****3 Credit Hours****(Pre-request: 0342765)**

Radionuclides used in medicine and methods of production. Preparation of labeled materials and radiopharmaceuticals. 'In vivo' and sample measurement techniques. Principle of tracer kinetics. Radionuclide imaging, design and evaluation of cameras and scanners. Gamma-ray emission tomography and positron tomography. Dynamic studies. Clinical applications of radionuclide techniques.

**0302776 Radiation Biology****3 Credit Hours****(Pre- requisite: 0302740 or simultaneous)**

Some properties of ionizing radiation; the effect of radiation at the molecular and sub cellular levels; cellular effects of radiation; radiation cell survival in Vivo; The effect of radiation at the tissue level; genetic effects of ionizing radiation; physical, biological and chemical factors which modify the biological effect of radiation. radiation and cancer.

**0302777 Special Techniques in Radiotherapy and Brachytherapy****3 credit Hours****(Pre- requisite: 0302740)**

Techniques deal with specific problems that usually require equipment modifications, special quality assurance procedures and heavy involvement and support from clinical physicists. These include Stereotactic irradiation; Total body irradiation (TBI) with photon beams; Total skin

electron irradiation (TSED); Intraoperative radiotherapy (IORT); Endorectal irradiation; Conformal radiotherapy and intensity modulated radiotherapy (IMRT); Image guided radiotherapy (IGRT); Respiratory gated radiotherapy.

Radiation therapy with neutrons, protons and heavy ions; Fast neutrons, a form of high-LET radiation, a reduction in the difference in radiosensitivity related to the position of the cells in the mitotic cycle, repair and clinical relevance of the different repair mechanisms Heavy ions and the advantage of better physical selectivity of protons with the radiobiological advantages of fast neutrons for some tumor types.

**0302779 Accelerators Physics for Medical Purposes**

**3 Credit Hours**  
**(Pre- requisite: None)**

The course will provide an Introduction of the most used accelerators in medicine. The novel concept, description, design and associated parameters for linear accelerators, cyclotrons and synchrotrons will be discussed and compared. Beam instrumentation, accelerator controls and the use of these accelerators for medicine, and therapy, will be presented. The aim will be the understanding of their applications and limitations. In additions, new concepts in medical accelerators: Cyclinacs, proton linacs will be introduced.

**0302780 Signal and Image Processing**

**3 Credit Hours**  
**(Pre-requisite: 0302787)**

Signals and vectors. Generalized Fourier series representation. Amplitude and phase spectra of signals. Energy and power content of signals. The Fourier Transform and applications. Power and Energy spectral densities. Correlation functions. The discrete Fourier transform (DFT) and the Fast Fourier Transform (FFT).

Digital image processing concept, fundamental of image processing, image enhancement and restoration, image synthesis (tomographic imaging), image data processing (hardware and software) and image operation studies( arithmetic operations and digital filters).

**0342787 Physics of Diagnostic Radiology and Computed Tomography**

**3 credit Hours**  
**(Pre-requisite: 0342765)**

X-ray production for diagnostic radiology. Physics of x-ray diagnostic procedures and equipment, general imaging considerations. The conceptual, mathematical and statistical aspects of imaging science, and a survey from this formal viewpoint of various medical imaging modalities, including film-screen radiography and x-ray computed tomography. Digital radiography.

**0302790 Practical Training****2 Credit Hours  
(The department approval)**

**Training the students at the Jordan University hospital or other hospital accredited by the University of Jordan for training purposes ( two days per week), during a period of one semester as follows :**

**A. Training in radiation therapy:**

The object of the training program in radiotherapy is to educate and train physicists in the practice of radiation oncology physics. To accomplish this goal, adequate structure, facilities, staff, patient resources and educational environment will be provided.

**B. Training in diagnostic imaging:**

The object of the training program is to educate and train physicists in the practice of diagnostic imaging techniques which use x-ray, nuclear magnetic resonance and ultrasound waves.

**C. Training in nuclear medicine:** The training program in nuclear medicine physics should concentrate on calibration of nuclear medicine equipment, calculation measurement of doses and following the procedures which are done in nuclear medicine exams.

**0302794 Research Methodology****1 Credit Hour  
(Pre- requisite: None)**

Basic of scientific research, with emphasis on the systematic process of identification and defining of research problems, collection and analysis of data, the ethics of scientific research; development of a research proposal and training of the student on reading of research papers

**0302795 Special Topics in Medical Physics****3 Credit Hours  
(Pre- requisite: None)**

Terminology related to medical physics, Forces on and in the body; Physics of the skeleton; Heat and cold in medicine; Pressure; The physics of the lungs and breathing; Physics of the cardiovascular system; Electricity within the body; Application of electricity and magnetism in medicine; Exponential growth and decay in medicine.