

## *The Master's Program In Nuclear Physics*

There are two tracks for the Master's degree offered at the department of physics; the first track is a non-thesis track, in which students must pass a comprehensive exam after successfully finishing the courses required by the program's Study Plan.

The other track is one that requires the student, in addition to successfully finishing the courses required by the Study Plan, to conduct research, and subsequently submit and defend a Master's thesis.

### *Non- Thesis Master's Degree Track*

#### *❖ Study Plan*

#### **I. GENERAL RULES AND CONDITIONS:**

1. This plan conforms to the regulations of the general frame of the higher graduate studies programs.
2. Areas of specialty for admission in this program :
  - Bachelor degree in Physics
  - Bachelor degree in Applied Physics
  - Bachelor degree in Nuclear Physics
  - Bachelor degree in Radiation Physics

#### **II. Special Conditions: None**

#### **III. THE PLAN: Studying (33) Credit Hours as follows:**

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

Course-Number	Course Title	Credit Hours			Pre-requisite
		Theoretical	Practical	Total	
0332713	Nuclear Physics Laboratory	-	5	3	-
0302754	Quantum Mechanics-1	3	-	3	-
0352755	Quantum Mechanics for Nuclear Physics Students	3	-	3	0302754
0342756	Statistical Mechanics - 1	3	-	3	-
0302758	Generation and Interactions of Electromagnetic Radiation	3	-	3	-
0342765	Radiation Detection and Measurements	3	-	3	-
0332763	Nuclear Physics-1	3	-	3	-
0332764	Nuclear physics for Nuclear Physics Students	3	-	3	0332763

##### **2. Elective Courses: Studying (9 credit hours) from the following:**

Course-Number	Course Title	Credit Hours			Pre-requisite
		Theoretical	Practical	Total	
0332793	Elementary Particles Theory	3	-	3	-
0302750	Nuclear Reactor Theory	3	-	3	-
0342712	Acceleration of Charged Particles	3	-	3	-
0302785	Applications of Nuclear Physics	3	-	3	-
0342797	Special Topics in Nuclear Physics	3	-	3	-

##### **3. Pass the comprehensive Exam: (0302798) after successful completion of all courses.**

## Thesis Master's Degree Track

### ❖ Study Plan

#### I. GENERAL RULES AND CONDITIONS:

1. This plan conforms to the regulations of the general frame of the higher graduate studies programs.
2. Areas of specialty for admission in this program:
  - Bachelor degree in Physics
  - Bachelor degree in Applied Physics
  - Bachelor degree in Nuclear Physics
  - Bachelor degree in Radiation Physics

#### II. Special Conditions: None

#### III. THE PLAN: Studying (33) Credit Hours as follows:

##### 1. Obligatory Courses (18 credit hours):

Course Number	Course Title	Credit Hours			Pre-requisite
		Theoretical	Practical	Total	
0302754	Quantum Mechnics-1	3		3	–
0352755	Quantum Mechanics for Nuclear Physics Students	3		3	0302754
0342756	Statistical Mechanics - 1	3		3	–
0302758	Generation and Interactions of Electromagnetic Radiation	3		3	–
0332763	Nuclear Physics-1	3		3	–
0332764	Nuclear physics for Nuclear Physics Students	3		3	0332763

##### 2. Elective Courses: Studying (6 credit hours) from the following:

Course Number	Course Title	Credit Hours			Pre-Requisite
		Theoretical	Practical	Total	
0342712	Acceleration of charged Particles	3		3	–
0332713	Nuclear Physics Laboratory	–	5	3	–
0302750	Nuclear Reactor Theory	3		3	–
0342765	Radiation Detection and Measurements	3		3	–
0302785	Applications of Nuclear Physics	3		3	–
0332793	Elementary Particles Theory	3		3	–
0342797	Special Topics in Nuclear Physics	3		3	–

##### 3. Dissertation: (9) Credit Hours (0302799)

**Program : Physics/ Nuclear Physics**

**Degree Offered: Master/Thesis and Non-Thesis Track**

<i>Plan Number</i>			<b>2007</b>	
--------------------	--	--	-------------	--

---

**Course Description**

---

**0342712 Acceleration of Charged Particles**

**(3 credit hrs)**

**Pre-requisite: None.**

Principles of charged particles acceleration including principles of synchrotrons, storage rings, beam parameter determination, synchrotron light sources, medical accelerators.

**0332713 Nuclear Physics Laboratory**

**(3 credit hrs)**

**Pre-requisite: None.**

Experiments including:  $\gamma$ -ray Spectroscopy,  $\alpha$  and  $\beta$ - spectroscopy, X-ray spectroscopy, Neutron spectroscopy, coincidence experiments.

**03032750 Nuclear Reactor Theory**

**(3 credit hrs)**

**Pre-requisite: None.**

Fission and chain reactions; neutron diffusion and moderation; reactor equations; Fermi Age theory; multigroup and multiregional analysis

**0302754 Quantum Mechanics-1**

**(3 credit hrs)**

**Pre-requisite: None**

Formalism, Quantum Dynamics, Angular Momentum Theory, Central Force Problem, Approximation Methods, and Applications.

**0332755 Quantum Mechanics for Nuclear Physics Students**

**(3 credit hrs)**

**Pre-requisite: 0302754**

Identical Particles, Scattering Theory, Time- dependent perturbation Theory, Quantum Radiation Theory.

**0342756 Statistical Mechanics -1**

**(3 credit hrs)**

**Pre-requisite: None.**

Thermodynamic functions: Classical ideal gas; kinetic theory of Gases; Imperfect gas; Chemical reactions; Quantum statistics; Solids; Magnetism; phase transitions.

**0302758 Generation and Interactions of Electromagnetic Radiation**

**(3 credit hrs)**

**Pre-requisite: None**

Maxwell's equations and electromagnetic waves, classical treatment of the generation and interaction of electromagnetic waves, quantum mechanical treatment of the radiation field, coherence, emission and absorption of radiation by atoms, optically allowed and forbidden transitions, scattering and absorption of electromagnetic radiation, detection of electromagnetic radiation. Applications: synchrotron radiation.

**0342765 Radiation Detection and Measurements**

**(3 credit hrs)**

**Pre-requisite: None**

Sources of nuclear radiations, interactions of charged particles, electromagnetic radiations, interaction of neutrons with matter, counting statistics and error propagation, ionization chambers, proportional counters, Geiger-Mueller counters, scintillation

ectors, semiconductor detectors, fast and slow neutron detectors, pulse processing and shaping.

**0332763 Nuclear Physics-1 (3 credit hrs)**

**Pre-requisite: None.**

Nuclear properties; Nuclear forces; Nuclear matter; Nuclear models; Nuclear radiation Alpha; Beta, and Gamma decays; Special topics in intermediate energy; and Nuclear structure.

**0332764 Nuclear Physics for Nuclear Physics Students (3 credit hrs)**

**Pre-requisite: 0332763**

Advanced course in structure of complex nuclei, Nuclear Models, Conservation laws, Scattering and reactions.

**0302785 Applications of Nuclear Physics (3 credit hrs)**

**Pre-requisite: None.**

Trace element Analysis, Radioactivity, Nuclear medicine, Nuclear power (fission and fusion Reactions)

**0342792 Special Topics in Nuclear Physics (3 credit hrs)**

**Pre-requisite: None.**

Special subject in experimental or theoretical nuclear physics , for example :

1 –Nuclear chromodynamics, QCD, structure of nucleons, phases of hadronic matter, relativistic collision.

2– Low and medium-energy physics, nuclear force and nuclear structure, studies in weak and strong interactions. Additional or alternative contents may be introduced subject to the prior approval of the department.

**0332793 Elementary Particles Theory (3 credit hrs)**

**Pre-requisite: None.**

Basic Concepts; Leptons, Quarks and Hadrons; Experimental Methods; Space-Time symmetries, internal symmetries and Color; QCD, Jets and Gluons; Weak Interactions.

