In the Name of God

Islamic Republic of Iran
Ministry of Health and Medical Education
Deputy Ministry for Education

Nanomedicine

Degree: Master of Science (MSc)

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Total Course Credits

- Introductory: 22
- Core: 12
- Non-core (Electives): 2
- Thesis (MSc): 6

Program Description

While nanotechnology refers to the "research and technology development at atom and molecule levels at scales of 1-100 nm to achieve a basic understanding of phenomena and materials at the nano-level, using structures, devices and systems with new features and performance due to their small size", outstanding features of nanomedicine are using nanodevices and nanostructures, engineered at the nanoscale, to make diagnosis, provide treatment and prevent diseases. Tools used in nanomedicine range from drug delivery systems and nanobiosensors to nanorobots and nanoscaffolds. It depends on a number of disciplines, including physics, engineering, chemistry, and biology, and aims to improve the quality of life through enormous developments in health-care sectors.
Due to the increasing growth rate of science and technology in nanomedicine and more and more investments in this field, the quality of human life is expected to substantially improve in the near future. As a result, universities and higher education institutions are required to plan and implement programs for training and developing required human resources in various fields of nanomedicine. Thus, training and educating skilled human resources majored in nanomedicine to continue their studies at the PhD level is considered as the main mission of our educational program.

Admission requirements

Candidates holding at least a bachelor's degree in one of the fields of polymer engineering, chemical engineering, engineering materials, Electrical Engineering, bioelectric, Physics, Chemistry, Biology, environmental health, occupational health, nuclear medicine technology, engineering, chemical industry, engineering, medicine, food industry and agricultural engineering, or doctorate degrees in Veterinary, medicine , pharmacy, dentistry, laboratory sciences and biotechnology are qualified to apply for the entrance examination of M.S. in nanomedicine.

Expected Competencies at the End of the Program

General Competencies*

Specific Competencies and Skills

• Identification of facilities, equipments and products in the field of nanomedicine
• Participation in the design of new diagnostic - Therapeutic and drug delivery nano-systems
• Participation in teams providing services related to health
• Providing new ways to improve nanomedicine-associated processes and methods
• participation in the marketing of nanoproducts
• Assisting in implementation of nano-related educational programs at different levels
• Participation in development of guidelines and educational pamphlets in the field of nanomedicine

• Participation in the design, implementation, management and evaluation of research projects in nanomedicine
- Atomic absorption spectroscopy, infrared absorption and Raman
- Gas chromatography, HPLC and TLC
- Mass spectroscopy and nuclear magnetic resonance spectroscopy
- XRF and XRD
- Scanning probe microscopy (SPM) Electron Microscopy (SEM and TEM)
- Dynamic light scattering
- Capillary electrophoresis

- skills in finding and studying the properties of nanomaterials

Practical skills expected from students are shown in the following table:*

Skills	Minimum Times Required to Learn			
	Observations	Dependant Practice	Independent Practice	Total
Designing a Nano-based Diagnostic-Theraputic System	1	1	-	2
Cell and Tissue Culture	1	1	1	3
Nanofiber Production	-	-	-	1
Working with Laboratory Models (In Vitro and In Vivo)	1	1	1	3
Scientific Writing	1	1	1	3
Manufacturing Biological Nanostructures	1	1	1	3

*The acquisition of these skills and other practical skills can vary depending on the department.

Educational Strategies, Methods and Techniques*

Student Assessment (Methods and Types)

- Formative (Quizzes and Midterm Exam)
- Summative (Final Exam)

Examinations may be oral, written and/or computer based

Ethical Considerations*

*Note: The related document(s) can be found at http://hcmep.behdasht.gov.ir/.

Tables of the Courses

Table 1. Introductory Courses

Course Code	Title of the Course	Credits			Teaching Hours			Prerequisite courses
		Theoretical	Practical	Total	Theoretical	Practical	Total	
01	Medical Biochemistry	2	-	2	34	-	34	-
02	Polymer	2	-	2	34	-	34	-
03	Biophysics	2	-	2	34	-	34	-
04	Basics of Microbiology and Immunology	3	-	3	51	-	51	-
05	Physiology	2	-	2	34	-	34	-
06	Pharmacology and Toxicology	2	-	2	34	-	34	-
07	Quantum Physics	2	-	2	34	-	34	-
08	Molecular and Cell Biology	1.5	0.5	2	26	17	43	-
09	Instrumental analysis	1.5	0.5	2	26	17	43	-
10	Introduction to Nanotechnology	3		3	51	-	51	-
11	Medical Information Systems	0.5	0.5	1	9	17	26	-
12	Chemistry	2	-	2	34	-	34	-
13	Fundamentals of Physiopathology	2	-	2	34	-	34	-
Total				27				

Table 2. Core Courses

Course Code	Title of the Course	Credits			Teaching Hours			Prerequisite courses
		Theoretical	Practical	Total	Theoretical	Practical	Total	
14	Nanomaterials and Nanostructures	2	-	2	34	-	34	-
15	Modeling at Nanoscale	1	1	2	17	34	51	-
16	Methods of Nanostructure Fabrication	1	1	2	17	34	51	-
17	Characterization and Analysis Techniques of Nanostructures	1.5	0.5	2	26	17	43	-
18	Nanobiomedicine 1	2	-	2	34	-	34	-
19	Nanobiotechnology	1.5	0.5	2	26	17	43	-
20	Drug Delivery Systems	1	-	1	17	-	17	-
21	Nanobiomedicine 2	2	-	2	34	-	34	-
22	Nanosafety	2	-	2	34	-	34	-
23	Business Basics in Nanotechnology	1	1	2	17	34	51	-
24	Seminar	1	-	1	17	-	17	-
25	Thesis	-	-	6	-	-	102	-

Table 3. Elective Courses*

Course Code	Title of the Course	Credits			Teaching Hours			Prerequisite courses
		Theoretical	Practical	Total	Theoretical	Practical	Total	
26	Advanced Biostatistics	2	-	2	34	-	34	-
27	Applications of Nanotechnology in Food Industries	2	-	2	34	-	34	-
28	Colloid and Interface Sciences	2	-	2	34	-	34	-
29	Fundamentals of Animal Handling	1	1	2	17	34	51	-

*2 credits from elective courses must be taken by the student