Tehran University of Medical Sciences

In the Name of God

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

Pharmaceutical Nanotechnology

Degree: Doctorate of Philosophy (PhD)

Total Course Credits

Core: 18
Non-core: 6 out of 30
Thesis: 20
Total: 44

Program Description

Pharmaceutical Nanotechnology as a subdivision of pharmaceutical sciences deals with the use of nanotechnology in pharmaceutics, mainly in the area of drug delivery. It is a multidisciplinary field in which researchers from various fields of medicine, pharmaceutics, physics, chemistry, biochemistry, genetics, immunology and toxicology can collaborate in order to apply the knowledge of nanostructures, nano-biosensors, and nano-biomachines to design novel drug delivery systems. Key points of research in pharmaceutical nanotechnology include: a) Development of nano-sized carriers for drug delivery through oral, parenteral, topical, and ophthalmic routes of administration. b) Development of functionalized targeted polymeric carriers for nucleic acid delivery (siRNAs, oligonucleotides, miRNAs, aptamers). c) Development of efficient nano-based anticancer drug delivery systems.

Aims and Objectives

The aim is to provide the graduate students with an integrated training in the areas of design, preparation and analysis the nanoformulations. They should also be qualified to optimize conventional formulations and show capacity for continuing to make significant contributions in the field and conducting independent research projects.

Admission Requirements

Candidates having one of the following degrees awarded by one of the domestic or overseas universities approved by the Ministry of Health and Medical Education are considered eligible to sit for the written entrance examination:
PharmD, DDS, DVS, MD degrees or a Master's of Science degree (M.Sc.) in one of the fields of laboratory sciences, biotechnology, medical nanotechnology, medical nanobiotechnology, toxicology, pharmacology, physiology, biochemistry, biophysics, medical immunology, nutritions, genetic, genetic engineering, cellular biology, molecular biology, animal biology, medical microbiology, chemistry, polymer engineering, bioinformatics and medical engineering.
Candidates must pass both written and oral entrance exam. They should also have demonstrated proficiency in verbal and written English. Successful candidates will enter the program according to the PhD educational rules and regulations.*

*Important note: These general conditions do not necessarily exclude specific conditions of each institute or university.

Expected Competencies at the End of the Program

General Competencies*

Specific Competencies and Skills

At the end of the program, learners will gain full competency of the following:

- Knowledge on pharmaceutical systems and pharmacokinetics and biopharmaceutical rules
- Knowledge on structure and function of macromolecules, and organic compounds
- Knowledge on biochemical tests
- Knowledge on physical pharmacy rules
- Knowledge on basics of gene engineering, biomacromolecular engineering
- Knowledge on nanobiosensors, nanobiomachines, nanodrugs, vaccine and protein delivery nanotechnology
- Knowledge on nanophysics
- Knowledge on basics of cell and tissue culturing
- Knowledge on lipidic, carbonic, and polymeric nanostructures, nanofilters, and nanocrystals
- Knowledge on molecular labeling, multi drug resistance mechanisms, smart drug delivery systems, nanobiomarkers, and smart polymers
- Knowledge on immunepharmacology, immunegenetics, and nanotoxicology

Practical Competencies

At the end of the program, learners will be competent in the following skills:

- Design, preparation and quality control of nanobiotechnicals including nanodrugs, nanosensors, nanobiokits, nanobiofilters, nanobiomachines
- Targeted therapy
- Cellular image analysis
- Novel drug formulation, analysis and characterization

Educational Strategies, Methods and Techniques*

Student Assessment (Methods and Types)

Methods of Assessment

Students will be evaluated by the following methods:
Written; Verbal; Logbook-based assessment

Types of Assessment

Periodic, Comprehensive (final); Monitoring the progress and completion of the thesis.

Comprehensive exam

Students will take part in a Board Exam after passing their theoretical courses. Thee exam consists of both written and oral evaluation.

Ethical Issues*

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

The courses

Table A: Compensatory courses

Course code	Course name	Course credit		Number of hours	
		Theory	Practical	Theory	Practical
01	Principles of biopharmacy & pharmacokinetics	2	_	34	_
02	Pharmaceutics	2	_	34	_
03	Basic biochemistry	2	_	34	_
04	Immunology	2	_	34	_
05	Molecular & cellular biology	2	_	34	_
06	Organic chemistry	2	_	34	_
07	Physical pharmacy	2	_	34	_
Total credits	14				

Student will be asked to pass all or part of compensatory courses (Table 1). The composition of these courses will be determined by the department in which the student is admitted according to student's background.

Table B: Core courses

Course code	Course name	Course credits			Number of hours			Prerequisite
		Theory	Practical	Total	Theory	Practical	Total	
08	Molecular & cellular biology, Genetic	2	_	2	34	_	34	_
09	Nanobiology	2	_	2	34	_	34	08
10	Principle in nanophysics	1	_	1	17	_	17	_
11	Cell culture	1	0.5	1.5	34	17	51	08
12	Nanopharmaceutics	3	1	4	68	_	68	10
13	Biopharmacy & pharmacokinetics	2	-	2	34	_	34	_
14	Microscopic analysis of nanoparticles	1	1	2	34	_	34	_
15	Lecture 1 & 2	1	_	1	34	_	34	12
16	Advanced statistics	0.5	0.5	1	9	17	26	_
17	Bioinformatics	0.5	0.5	1	_	68	68	_
Total credits	18							
Thesis	20							
Total	38							

Table C: Non-core courses

Students should take 6 credits from total 30 credits brought bellow

Course code	Course name	Course credits		Number of hours (theory courses)	Prerequisite
		Theory	Practical		
18	Nanobiomarkers, nanobiosensors, nanobiomachines, nanobiokits	2	_	34	_
19	Advanced numeric calculation	2	_	34	_
20	Polymeric engineering	2	_	34	_
21	Nanotubes, nanocrystals, nanofilters	2	_	34	_
23	Tissue engineering	2	_	34	_
22	Gene delivery	2	_	34	_
24	Molecular immunology	0	2	34	_
25	Dynamics of biofluids	2	_	34	20
26	Advanced computing biology	2	_	34	_
27	Nanotoxicology	2	_	34	_
28	Nanobiochemistry & nanopharmacology	2	_	34	_
29	Nanomedicines & biobarriers	2	_	34	_
30	Radiopharmacy	2	_	34	_
31	Nanobiomaterials	2	_	34	_
32	Standardization of nano products	2			
Total credits	30				

Passing 6 out of 30 is required.

Academic workshops –visits:

- Biosafety workshop
- Visiting or informing students about knowledge base corporations
- Intellectual property workshop
- The faculty should hold almost two workshops about the above subjects

Comprehensive exam

Aim: To valuate students about the basic knowledges and future task oriented needs. Potency and defect detection of the curriculum and its improvement for future.

Comprehensive exam preformation:
It is a summative evaluation exam in which professors and scientists in related courses under supervision of pharmacy scientific board at ministry of health government will preform the exam.

Comprehensive exam preformation steps:
Goals determination of the exam
Preparation of requirements for exam
Preformation the exam
Analysis the results of the exam
Decision

Frequency of all-inclusive final exam preformation:
It will be preformed when students spend all educational courses.

Parameters for selecting students for participating in all-inclusive final exam:
Students that achieve the requirement criteria in final exams.
Students that achieve enough research abilities according to opinions of department managers.

Comprehensive exam results analysis:
Students should achieve at least 70% scores in comprehensive exam, 80% scores achievement in practical abilities and 75% scores achievement in professional abilities according to the opinions of department managers.

Mohammad Abdollahi, PharmD, PhD
Secretary of the Council for Pharmaceutical Education at all levels

Seyed Mansour Razavi, MD
Secretary of the Supreme Council for Medical Sciences Planning

Bagher Larijani, MD
Deputy for Education
Ministry of Health and Medical Education