



Program Specification for Master Degree: **Nuclear Medicine**

Program type: Single

**Department offering the program: Kasr El-Aini Center for Clinical
Oncology and Nuclear Medicine
(NEMROCK)**

Program Code: NUCM 800

Total credit points: 163

Academic year: 2014/2015

**Program Coordinators: Prof. Hosna Moustafa (Prof. of Nuclear Medicine)
Prof. Sherif El-Refaei (Prof. of Nuclear Medicine)
Dr. Lamia Zidan, MD (Lecturer of Nuclear Medicine)**

**External evaluators: Dr. Husain M Abdel-Dayem, MD, PhD, FACNM,
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Director Nuclear Medicine, St. Vincent's Hospital Medical Center, New York,
NY

I. Program aims

The program is a professional degree that enables candidates to specialize in the area of Nuclear medicine which is a clinical and laboratory medical specialty that uses radioactive and stable tracers to study physiologic, biochemical and cellular processes for diagnosis, therapy and research. The candidates should achieve satisfactory levels of basic knowledge, clinical and interpretational skills in all aspects of Nuclear Medicine practice, interact with community problems, respect ethical values according to community culture, and promote their medical standards through engaging in continuing medical education. The program also aims to introduce the candidate to the basics of scientific medical research.

II. Intended learning outcomes of program (ILOs)

1. Knowledge:

1- PART (1):

A) MEDICAL BIOCHEMISTRY:

- General: Describe carbohydrate metabolism, lipid metabolism , protein metabolism, nucleon protein metabolism, hormones chemistry, characteristic, mode of action, role of hormones and growth factors regulation of DNA synthesis and cellular proliferation , oncogens and protooncogens and their relations to hormones and growth factors, enzymes, CAMP and edentate cyicase system, receptors trransductal mechanism , mediators and modulators regulation of nuclear function , minerals , Ca , P, I, Fe⁺⁺, Cu, structure and biological membranes.
- Special: Define biochemistry of liver, kidney, bone, lung, nervous system, immuno chemistry, molecular biology.
- Technology: Explain RIA , receptor assay , chromatography (drug monitoring).

B) PATHOLOGY:

- General pathology: Define inflammation & infection repair , disorders of cell growth , disorders of blood flow , autoimmune disease, neoplasia.
- Special pathology: Describe heart disease blood vessels , lung , liver disease , Gall bladder & biliary passages diseases, endocrine glands, spleen , kidney , lymphomas, CNS.

C) STATISTICS: Define medical biostatistics.

D) INTERNAL MEDICINE: Point knowledge related to different nuclear medicine applications.

E) SURGERY: Point knowledge related to different medicine applications.

F) RADIOPHARMACEUTICALS: Define nuclear medicine radiopharmacy , concepts related to hot laboratory and radiopharmceutical dispensing.

G) RADIATION BIOLOGY & RADIATION PROTECTION:
Describe Basic radiobiology, Basic interaction of irradiation, Somatic effects, Diagnostic and nuclear medicine occupational exposure and risks, Sources of exposure of man to L.R Methods of radiation protection in N.M department, ALARA concept (as low as reasonably achievable

II. Part (II):

A) PHYSICS OF NUCLEAR MEDICINE: Describe structure of matter and radiation, Absorption of radiation, Radioactive decay, Production of radionuclides, Passage of charged particles through matter, Radiation detectors, factors affecting radiation detectors and measurements, Counting systems and attenuation correction techniques.

B) DIAGNOSTIC NUCLEAR MEDICINE:

Cardiovascular system: Explain myocardial perfusion, Radionuclide ventriculography.

Central nervous system: Read Brain SPECT, Cisternography.

Endocrine system: Interpret Thyroid gland, Adrenal gland, Parathyroid gland.

Gastrointestinal system: Report Salivary gland scanning, Esophageal transient, Gastro esophageal reflux, GIT transit time, Gastrointestinal bleeding, Hepatic and splenic function assessment, Biliary system imaging.

Pulmonary system: Locate Embolic, Non-embolic.

Skeletal systems: Read Bone scan, Bone density.

Read Oncology imaging, Urogenital system, Infection and Inflammation., Lymphatic system, Ophthalmology and Pediatric imaging

C) PET SCANNING AND THERAPEUTIC NUCLEAR MEDICINE:

Describe Multimodality imaging (nuclear medicine & CT)

Indicate Therapy for thyrotoxicosis, ^{131}I Therapy of DTC, MIBG therapy, of painful bone metastases, Radionuclide joint disease, radio-immunotherapy, ^{32}P for polycythemia vera & essential thrombocythemia.

D) NUCLEAR MEDICINE TECHNOLOGY:

Define The Anger camera (Basic principles). The Anger camera performance characteristics, Quality assurance of the camera, Gamma camera SPECT system, Nuclear medicine tomography, Quality assurance of SPECT imaging instrumentation, Positron camera, Hot laboratory technology, Image acquisition protocols, Image processing, Kinetic modeling .

2. Intellectual skills: By the end of the program the candidate should be able to;

- A)** Analyze symptoms & signs and construct a differential diagnosis for various disorders related to nuclear medicine applications.
- B)** Apply the basic concepts of biomedical statistics.
- C)** Able to assess the risk benefit of radiation dose introduced for diagnosis or therapy.
- D)** Employ the basic concepts related to radiation protection.
- E)** Practice the basic radiopharmacy procedures related to clinical nuclear medicine practice involving imaging and therapy procedures as well as procedures related to hot laboratory and radiopharmaceutical dispensing.
- F)** Interpret imaging studies related to sectional anatomy and nuclear medicine hybrid imaging systems.
- G)** Recognize the basic physiological, biochemical and pathological knowledge related to different nuclear medicine applications and procedures.
- H)** Recognize clinical aspects of various disorders and its related nuclear medicine applications.
- I)** Identify the basic concepts of biomedical statistics.
- J)** Review the fundamentals of radiobiology and be able to discuss the biological effects of ionizing radiation on cells & tissues as well as risk assessment based evaluation of radiation dose.
- K)** Recognize the fundamental concepts related to radiation protection and possible risks associated with irradiation during diagnostic and therapeutic application from a risk vs. benefit perspective.
- L)** Describe the fundamentals of nuclear medicine radiation physics and applied mathematics, radioactivity, radiation detection and spectroscopy, interaction of radiation with matter, radionuclide production, basic operation principles of the electronic radiation detection systems, Gamma Camera, PET imaging, hybrid imaging systems and nuclear counting statistics.
- M)** Discuss the main concepts of nuclear medicine radiopharmacy related to clinical nuclear medicine practice involving imaging, non-imaging and therapy procedures as well as concepts related to hot laboratory and radiopharmaceutical dispensing.
- N)** Recognize the basics of sectional imaging anatomy and indicate its relevance to nuclear medicine practice with hybrid imaging systems.

3. Professional and practical skills: By the end of the program the candidates should be able to;

- a) Apply with adequate competence the knowledge related to nuclear medicine physics, radiation protection strategies, radiopharmacy, radiopharmaceutical preparation and administration to the patients.
- b) Able to perform image acquisition, processing, basic related statistical procedures, mathematical and dosimetric calculations.
- c) Identify common functional and structural changes related to neoplastic and non-neoplastic disease processes and injury pertinent to nuclear medicine disorders.
- d) Advise the referring physician on the most appropriate investigation and/or sequence of investigations for the presenting clinical problem.
- e) Adapt the protocols to the needs and condition of the patient.
- f) Assess and accomplish interventions (e.g. physiological, pharmacological or mental stress related).
- g) Regulate the study analysis and interpretation according to the clinical information.
- h) Achieve a proficient level of interpretational skills in different diagnostic nuclear medicine applications including planar (static, dynamic & gated), SPECT, PET and hybrid imaging.
- i) Accurately locate and recognize anatomical structures of the musculoskeletal system, central nervous system, genitourinary system, respiratory and cardio-vascular systems and digestive tract demonstrated in sectional CT and MRI images.

4. General and transferable skills: By the end of the program the candidates should be able to;

- A)** Communicate with the patients to gain their confidence.
- B)** Communicate with other health care providers.
- C)** Guarantee the safety of both the patient and staff
- D)** Appreciate team working.
- E)** Achieve Computer skills necessary to make use of medical data bases and use the internet for communication.
- F)** Acquire administrative skills that enables them to fulfill the paper work needed

- G)** Acquire leadership skills that enable them to organize work and lead the junior and paramedical staff.
- H)** Realize different scientific methodologies and have critical reading abilities
- I)** Perform basic scientific research and demonstrate competence in writing scientific articles.

III. Academic standards.

1. Academic reference standers: The academic standers of anatomy program is adopted and accredited by the departmental council
2. External references for standards:
 - a- Syllabus for postgraduate specialisation in Nuclear Medicine: European Union of Medical Specialists (UEMS) Educational & Syllabus Committee:2006/2007 Update. Cuocolo A, Milcinski M, Bischof Delaloye A. Eur J Nucl Med Mol Imaging (2013) 37:430–433
 - b- Objectives of training in nuclear medicine. The Royal College of Physicians and Surgeons of Canada.

IV. Program admission requirements.

According the Faculty of Medicine, Cairo University Bylaws for Post Graduate Programs (July 2009), applicants should have MBBCh or equivalent degree. According to Cairo University requirements, all applicants for postgraduate studies should fulfill preliminary courses on the following subjects; Medical statistics I – English language (Toefl or equivalent degree) – Computer skills (ICDL) or equivalent computer course offered by the medical education center (MEDC). Admission to the program is open during July. Training prior to registration may be accredited according to departmental and hospital evaluation.

V. Program structure and contents.

Program duration: Three years.

Program structure: Total Credit points 163

- **First part: 1.5 years - Total credit points 61 - (Table 1)**
 - Compulsory courses; one academic year (30 weeks) 9.5 credit poin
 - Elective courses 1 credit point
 - Scientific activities 2.5 credit points

- Residency clinical training program Part 1: “one and half year”
48 credit points
- **Second part: 1.5 years - Total credit points 102 - (Table 2)**
 - Compulsory courses; one academic year (30 weeks) 18 credit points
 - Scientific activities 4 credit points
 - Residency clinical training program Part 2: “one and half year” 60 credit points
- **Master Thesis: completed during second part, 20 credit points.**

Table 1: First part

Courses	Course modules	Credit points	total	ILOs
Compulsory courses				
Medical Biochemistry	<ul style="list-style-type: none"> ● General biochemistry ● Special biochemistry 	0.75 0.75	1.5	1-a 2-b
Pathology	<ul style="list-style-type: none"> ● General pathology ● Systemic Pathology 	0.75 0.75	1.5	1-b 2-a 3-c
Statistics II	<ul style="list-style-type: none"> ● Medical biostatistics 	1	1	1-c 2-b 3-b 4-i
Internal Medicine	<ul style="list-style-type: none"> ● Internal medicine 	2	2	1-d 2-a 3-d,e,f,g
Surgery	<ul style="list-style-type: none"> ● General surgery 	1.5	1.5	1-e 2-a 3-d,e,f,g
	<ul style="list-style-type: none"> ● Radiation Protection and Radiobiology 	2	2	1-f / 2-c,d / 3-a
Elective Courses (MEDC) choose 2 courses				
○ Pharmacology of Nuclear Medicine		0.5	1	1-g / 2-e / 3-a,f
○ Basic endocrine		0.5		
Scientific activities			2.5	4-b,d,e,f,g,h,i
Residency clinical training program			48	3-

		a,b,c,d,e,f,g,h,i 4-a,b,c,d,f,g
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Table 2: Second part

Item	Credit points	ILOs.
Compulsory courses		
Nuclear Medicine Physics	2	1-a 3-a
Nuclear Medicine technology	4	1-d 3-b,e
Diagnostic Nuclear Medicine	6	1-b 2-b,h 3- c,e,f,g,h,i 4-a,b,c
Therapeutic Nuclear Medicine + PET applications	6	1-c 2-a,c,d,e 3- c,e 4-a,b,c
Scientific activities	4	4-b,d,e,f,g,h,i
Master thesis	20	4-e,h,i
Residency training program (Special NM)	60	3- a,b,c,d,e,f,g,h,i 4-a,b,c,d,f,g

Residency Training Program

- **First phase (Basic Training):**

According to the Faculty of Medicine, Cairo University Bylaws for Post Graduate Programs (July 2009), all the students should have a preliminary clinical training for 12 months. They should spend at 6 months in internal medicine and 6 months in diagnostic radiology department. During this period the students should also complete elective courses

- **Second phase (Special Training):**

All students should complete the special part of the residency-training program in the nuclear medicine unit. They should spend 36 months in order to complete the needed credit points. The students are expected to attend the outpatient clinics, nuclear medicine imaging room, hot lab, and the reporting room and share in patients care under the supervision of senior staff

members. During this period the students will attend the nuclear medicine course, prepare their thesis and participate in the scientific activities of the department.

NB: The third phase of residency training (advanced training) is part of the MD degree (12 months).

Master Thesis

All master-degree students should prepare a thesis in a topic related to nuclear medicine applications. The department and the ethical committees must approve the protocol of the research. The thesis should include a review part and a research part. The Thesis is supervised by one or more nuclear medicine staff members and may include other specialties according to the nature of the research. The thesis should be evaluated and approved by a committee of three staff members including one of the supervisors and an external member. Approving the thesis is mandatory to allow the student to sit for the final exam.

Scientific Activities:

The students should participate in the scientific activities of the departments such as:

- *Journal club.*
- *Seminars (including recent topics and controversial issues).*
- *Scientific meetings arranged by the department.*
- *Scientific meetings arranged by local or national nuclear medicine or related societies.*

Each activity is monitored and given credit points registered in a special section in the residency-training logbook. The student should collect the required points before allowed to sit for final exam.

V. Regulations for progression and program completion

After collecting the required credit points for the respective courses, the first phase of the residency training, and the scientific activities, the student will be eligible to sit for the first part examination. In case the student fails to pass the examination, he/she may proceed in the clinical training and can resubmit for the next examination. After passing the first part, the student submits a protocol for Master Thesis at the beginning of the second part. Before submitting to the final examination he/she should finish the thesis and get approval, complete phase 2 of special training program, and collect the required credit points. The candidate will receive his/her degree after passing this final examination. Master degree should be obtained within a maximum of 6 years after registration date.

VI. Assessment

A: Assessment Tools:

- **Supervision & Monitoring of the Training Program:**

According to the Faculty of Medicine, Cairo University Bylaws for Residency Training Programs, coordinators carry continuous assessment during the program. A residency training logbook including scientific activities will be kept for each student to document all his/her clinical, laboratory, interpretational or therapeutic activities as well as his/her participation in different scientific activities. The head of the department should allow the students to undergo the final examination when they complete their training program and collect the credit points needed.

- **Formal Assessment**

According to the Faculty of Medicine, Cairo University Bylaws for Post Graduate Programs (July 2009), Students should be assessed at the end of first part and at the end of the second part

1. First Part Final Exam:

- **Biochemistry**: One and half hour written exam (including short assay and multiple choice questions) + oral exam
- **Pathology**: One and half hour written exam (including short assay and multiple choice questions) + oral exam
- **Statistics**: one-hour written exam (including short assay and multiple choice questions) + oral exam
- **Internal Medicine**: Two-hour written exam (including short assay and multiple choice questions) + oral exam + clinical exam
- **General Surgery**: Two-hour written exam (including short assay and multiple choice questions) + oral exam + clinical exam
- **Elective Courses**: Two-hour (1 hour for each subject) written exam (including short assay and multiple choice questions)

2. Second Part Final Exam Part 2:

- **Nuclear Medicine**: Four written exams (Three-hours each) held on 4 separate days, including short assay questions, and MCQ (including problem solving) + oral exam + clinical exam

B: Assessment Schedule:

1. First Part Final Exam:

The written exam will be held in April/October (six days):

Day one: Biochemistry (1.5 hour)

Day two: Pathology (1.5 hour)

Day three: Statistics (1 hour)

Day four: Internal Medicine (2 hours)

Day five: General Surgery (2 hours)

Day six: Elective Courses (2 hours; 1hour for each subject)

This will be followed by the clinical and oral exams in separate days (except elective)

2. Second Part Final Exam:

The written exam will be held in May/ November (four days):

Day one Nuclear Medicine Physics (1.5 hours)

Day two: Nuclear Medicine Technology (3 hours)

Day three: Diagnostic Nuclear Medicine (3 hours)

Day four: Therapeutic Nuclear Medicine and PET imaging(3 hours)

This will be followed by the clinical and oral exams in separate days

C: Weighting Of Assessment: Marks allocated to courses

(50 marks for each credit point)

Course	Written	Oral/clinical	Clinical/practical	Total
First part				520
Biochemistry	50	25		75
Pathology	50	25		75
Statistics	30	20		50
Internal Medicine	50	25	25	100
General Surgery	50	25		75
Radiation protection and radiobiology	50	50		100
Elective Courses : Radiopharmacy Basic endocrine in NM	50			50
Second part				900
Nuclear Medicine Physics	50	50		100

Nuclear Medicine Technology	100	50	50	200
Therapeutic Nuclear Medicine and PET applications	100	100	100	300
Diagnostic Nuclear Medicine	100	100	100	300

Remarks

- It is mandatory to pass the four papers of the nuclear medicine exam separately
- Passing mark in a written exam is $\geq 60\%$

VII. Evaluation of program intended learning outcomes:

Evaluator	Tool	Sample
1. Senior Students	Questionnaire at the end of the program	All the PG students
2. Alumni	The faculty is currently developing an Alumni office for postgraduates	Not yet determined
3. Stakeholders	A meeting will be arranged during the annual conference of the department	Available representatives from: <ul style="list-style-type: none"> • Army hospitals • National medical insurance • Medical syndicate • Ministry of health
4. External Evaluators	Review the program and courses Attending the final exam.	Once before implementation Bi-annual report

5. College Quality Assurance committee	Annual program review	
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Date of approval by department council; 5/1/2015

Program Coordinators

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Dr. Lamia Zidan, MD
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Head of Department

Prof. Mona Abo El-Anin
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