

FACULTY OF
RADIOGRAPHY
& MEDICAL
IMAGING SCIENCES



UNDERGRADUATE PROSPECTUS





VISION AND MISSION

The Faculty of Radiography and Medical imaging- National University- Sudan aims to be the most respected of its kind, as evidenced by high quality of premises, up-to-date administration and governance, job- and researchdirected instruction, to produce a very high quality of graduates in their ethical, professional and scholarly contribution.

Its mission is to develop the highest standards of academic and technical excellence. The various parts of this programme aim to produce ethically responsible, innovative, critically thinking professionals committed to meeting the imaging technology needs of all communities in the Sudan and the rest of the world, appropriately and efficiently. The curriculum teaches the students how to learn and continue as lifelong learners. The Programme

ENTRANCE REQUIREMENTS

A student interested in joining the Faculty of Radiography and Medical Imaging Sciences, has to:

1. Obtain pass mark in in seven subjects including: Arabic language, religious studies, English language, mathematics, physics, chemistry and biology. International students who have not studied Arabic and religious studies may have more alternative subjects from an approved list of subjects published in the webpage of Ministry of Higher Education.
2. Achieve the percentage in Sudan School Certificate announced every year (International students may have 10% less in the School Certificate scores.
3. Apply electronically though the website of the Admission and Accreditation Office, Ministry of Higher Education, or apply directly in Admission Office in the National University, and pass the health examination, aptitude tests an interview at the Faculty of Radiography and Diagnostic Medical Imaging Sciences..
4. Pay the published fees: 15,000 SDG or US \$ 4000 [international students]

CAREER ADVICE

Students qualified with this Bachelor degree pass through a track decreed by the Health Professions Council, currently reporting to the Minister of Health. They are temporarily accredited as radiology and diagnostic imaging technician. Grads may pursue master's and doctoral degrees in the fields of radiologic technology to qualify for university teaching staff, work for the industry, or in other specialized areas. The graduate may be interested in managerial, commercial, industrial or charity career, related to one of the various specialties in the discipline

International graduates can follow the same track if they preferred to stay in the Sudan, but may also start their registration and internship in their own countries or residence

FACULTY OBJECTIVES

The objectives of The Faculty of Radiography and Medical Imaging Sciences of Radiography National University Faculty of Radiography are to:

1. Emphasize values and ethical heritage of the Sudanese Nation in its curriculum, and follow strategies that lead to strengthening these values, as an important component of the National University philosophy and message.
2. Graduate qualified technologists in the field of medical imaging technology to satisfy the needs of employment market and development plans.
3. Providing students with theoretical knowledge and practical applications in various aspects of radiological and imaging techniques
4. Qualifying students with the technical skills necessary to operate sophisticated diagnostic imaging equipment, as well as those for simple maintenance, and troubleshooting description.
5. Providing knowledge, skills and attitudes needed to administer diagnostic medical imaging units, and satisfy the requirements of quality control.
6. Acquisition of professional ethics and team-work approach.
7. Provision of theoretical and practical information needed for involvement in research, and evidence based imaging.
8. Development of self-education skills that qualify students for further continuous and graduate knowledge acquisition.
9. Contribute to community development through health services provided in its own health institutions and other institutions co-operating with it, through the following: (a) partnership in designing health programmed and plans, and implement whatever is feasible in utilizing the experience of specialists, (b) Contribution in continuous education through short and long term courses, to improve efficiency of health workers, and (c) Provision of essential equipments and supplies to improve quality of services, through partnership with the Ministry of Health.
10. Strengthen medical and health research, making use of the University's accessibility and communication privileges.

CURRICULUM OBJECTIVES [Characteristics of the Radiography graduate]

A graduate of the National University Radiography Curriculum should be able to:

1. Adopt the strategies of the National University-Sudan and abide by its objectives and rules stated in its charter.
2. Observe in his/her practice, the health professional ethics which agree with the Nation's values, beliefs and norms (as stated by Sudan Council for Health Professions), and maintain good and honest relations with his/her patients, their families, his/her colleagues across all sectors involved in health.
3. Appreciate the value of diversity and multi-ethnicity in solving imaging problems with emphatic, humane and fair practice.
4. Demonstrate knowledge of basic sciences (medical physics, anatomy, physiology, biochemistry etc..) needed for the practice of imaging technology.
5. Integrate basic, community and clinical sciences in solving imaging technology problems.
6. Use scientific knowledge in imaging technology and management of imaging units, with full awareness of evidence-based practice.
7. Manage emergency imaging needs, and decide and act properly on cases needing referrals to specialized centers or personnel. Be aware of ambulance and patient transfer facilities and contacts.
8. Accepts to work in all settings according to needs, and act to improve imaging service delivery systems both quantitatively and qualitatively.
9. Encourage community participation and act in recruiting various sectors in defining health and imaging-related problems, planning and providing suitable solutions, recognizing the community beliefs, ethics, and traditional practices, and remain accountable to their society.
10. Adhere to "health team" approach, acting as an efficient member, capable of dividing labor and responsibilities among its members, and ensuring both effectiveness and homogeneity among the members.
11. Administer the imaging "unit" or "centre" efficiently according to scientific, medical, statistical, economic and legal bases.
12. Continue to consider elements of efficiency, costing and economic implications in his/her imaging technology choices.
13. Acquire the skills of teaching, learning and communication efficiently to carry out her/his duties in imaging education and in winning the confidence of patients and their

families and societies.

14. Acquire the skills of self-learning, and contribute to availing opportunities for planning and implementing continuous education activities to upgrade his/her own abilities and those of his/her colleagues in the health team.
15. Carry health or imaging-related research, alone or with a health team, using scientific methods known in such activities.
16. Use computer in word processing, statistics and graphics to achieve success in other objectives of his/her career.
17. Acquire postgraduate qualification in the discipline of his/her choice, recognizing the needs of the society for certain specialties, particularly practice at the level of community,

EDUCATIONAL STRATEGIES AND METHODS

The learning strategies emphasize the following: (1) early acquisition of basic practical skills-including communication, (2) student-centered learning, and maximum student responsibility in the learning process, (3) problem-based and problem oriented learning, (4) community-oriented and community-based activities, (5) integration of basic science, community and imaging practice in a multidisciplinary approach, (6) self- and peer education and evaluation, (7) team-work approach, (8) a wide range of electives, (9) continuous evaluation, (10) preparation for continuous education.

The Faculty of Radiography adopts the following methods in the daily programme of activities: (1) problem-based learning (PBL) sessions- one problem/ week at most, (2) seminars and small group discussions –once/ week at least, (3) field practice in rural and primary health care settings and societies not less than 1/5th of the timetable, (4) practical sessions (hospitals, health centers, laboratory, technical) not less than 1/4th of the curriculum timetable, (5) skill laboratory (weekly) sessions, (6) lectures -not more than 1/3rd of the curriculum timetable (not more than 3 lectures/day), (7) educational assignments, reports and research activities (as many as the programme and time would allow), (8) electives -about 10% of the curriculum timetable- (about 2 hours/semester).

TIMETABLE

The college adopts the semester system. Duration of study for the bachelor's degree in radiology (B.Sc. RAD (Honors) is four years divided into eight semesters (3 phases), covering a total of over 160 credit hours. Semesters 1 comprises phase 1- shared with other health specialties. Semester 2, 3 and 4 cover core specialized courses for the B.Sc. degrees offered by the college. Semesters 6-8 include clerkship courses mostly spent in imaging units outside the college. A semester is 18-20 weeks in Phase 1 and 2, and 22-24 weeks in Phase 3. There are three compulsory Summer courses and three electives; credit hours of electives are included in the total.

Phase 1: Introductory courses and College requirements =
 Phase 2: Integrated basic science organ system courses =
 Phase 3: Clerkships

Semesters
 1
 Semesters 2-5
 Semesters 6-8

Semester 1 [24 CHs- 19 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Orientation week	-	-	-	-	-	-
2	Scientific English 1	ME-ENG-113	Long	3	-	-	3
3	Radiation Physics 1	RAD-PHYS-125	Long	3	-	2	4
4	Biostatistics	ME-STAT-117	Long	2	-	-	2
5	Computer Science 1	ME-COMP-116	2	2	-	1	2
6	Introduction to Medical Ethics	ME-ETHIC-226	Long	1	1	1	2
7	Physics for Medical Equipment & Investigations 1	ME-PHYS-115	Long	3	-	-	3
8	Medical terminology 1	P-TERM-127	Long.	3	-	-	3
9	Human Body Structure & Function (introduction- Anatomy & physiology)	PT-NAT-126	Long	2	2	2	5
				19	3	4	24

Semester 2 [23 CHs- 14 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Medical Terminology 2	RAD-TERM-215	2	2	-	-	2
2	Scientific English 2	ME-ENG-123	Long	3	-	-	3
3	Basic Biochemistry	ME-BIOCH-118	3	2	-	1	2
4	Computer Science 2	ME-COMP-124	2	2	-	1	2
5	Mathematics and Calculus	RAD-CALC-120	2	3	-	-	3
6	Introduction to Medical Imaging & Medical Education	ME-EDU-114	Long	2	-	-	2
7	Musculoskeletal System	RAD-ANAT-223	Long	2	1	2	4
8	Radiation Physics 2	RAD-PHYS-125	3	3	-	-	3
9	Behavioral Science	ME-BEHAV-129	Long	2	-	-	2
			12	21	1	4	23

Examination of longitudinal courses (+re-sits) 2 weeks

SUMMAR 1: Medical records and data collection (ME-SUM-131) 2 CHs Elective (E-132): A 1000 –word report on “Internet Sources of Health Sciences” 1CH

FIRST YEAR PROGRAMME EVALUATION

Semester 3 [21 CHs- 19 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Medical terminology-2	RAD-TERM-215	Long.	2	-	-	2
2	Radiobiology	RAD-BIO-412	Long.	2	-	-	2
3	Gross anatomy (Regional-1)	RAD-ANAT-211	4	2	-	2	4
4	Introduction to radiography (photography)	RAD-PHOT-214	2	2	-	-	2
5	Diagnostic imaging equipment-1	RAD-EQUIP-213	2	1	-	1	2
6	Patient care & Ethics	RAD-CARE-313	3	2	-	-	2
7	Radiographic technique & procedures-1	RAD-TECH-216	2	1	-	1	2
8	Man & environment(Imaging physiology)	ME-ENV-127	5	4	1	-	5
			18	16	1	4	21

Examination of longitudinal courses (+re-sits)

1 week

Semester 4 [21 CHs- 21 weeks]

	Title	Code	Weeks	Units			C H
				Th	Tut	Prac	
1	Professional skills-1 (Nursing in imaging)	ME-SKIL-221	Long.	2	-	-	2
2	Diagnostic imaging equipment-2	RAD-EQUIP-225	Long.	2	-	-	2
3	Introduction to radiography-2	RAD-RAD-228	2	2	-	2	4
4	Computer in medical imaging	RAD-COMP-314	2	2	-	-	2
5	Gross anatomy-2 (Regional-2)	RAD-ANAT-223	3	1	-	1	2
6	Radiographic techniques & procedures-2	RAD-TECH-224	3	2	-	-	2
7	Nuclear medicine physics & technique(radionuclide imaging)	RAD-NUC--315	3	1	-	1	2
8	Principles of diseases (Pathology)	ME-DIS-212	5	4	1	-	5
9	Introduction to research	ME-RES-227	2				
			20	16	1	4	21

Examination of longitudinal courses (+re-sits)

1 week

SUMMAR 2: Research methodology and scientific writing (ME-SUM231)

2 CHs

Elective (E232): Draw a map of health services in one Mu'tamadiya =2 CH

SECOND YEAR PROGRAMME EVALUATION

Semester 5 [18 CHs- 18 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Radiographic anatomy	RAD-ANAT-318	Long.	-	-	2	2
2	Special procedures- advanced techniques-1	RAD-TEC-317	Long.	1	-	1	2
3	Ultrasound physics	RAD-SON-217	3	1	1	1	3
4	CT physics	RAD-PHYS-222	2	2	1	1	4
5	Cross-sectional anatomy	RAD-ANAT-316	3	2	1	2	5
6	Basic radio-pharmacology	RAD-PHARM-319	3	1	-	1	2
7	Radiographic pathology	RAD-PATH-312	3				
8	MRI physics	RAD-MRPHYS-226	2				
			16	9	3	6	18

Examination of longitudinal courses (+re-sits) 1 week

000 work essay on management of an emergency 1CH

THIRD YEAR PROGRAMME EVALUATION

Phase 3: Practice Clerkships

Semester 6-8 – Clerkships or Hospital Department Rotations=76 CHs

Four semesters, 16 modules of four major rotation, five longitudinal courses including two elective

#	Rotation Groups	Disciplines (symbol-number)	Credit Hours	Duration (weeks)	Longitudinal Courses
1	A	Multidisciplinary clinical practice clerkship [RAD-CLIN-322,323,324]	6	Long.	
2		Professional skills-2(intervention-Radiology) [RAD-SKILL-311]	2	Long.	
3		CT techniques & Protocols [RAD-CT-TEC-326]	3	2	
4		Ultrasound technique [RAD-SON-325]	3	3	
5		MRI techniques & Protocols [RAD-MRI-327]	2	4	
6		Quality assurance [RAD-QA-328]	2	4	
7		-Advanced techniques-2(Mammography-Dental-Lithotripsy) [RAD-TECH-330]	2	5	
8	B	Clerkship department rotation [RAD-CLIN-414]	6	Long.	
9		Case studies [RAD-CASE-415]	4	Long.	
10		Radiation protection [RAD- PRO-218]	2	4	
11		Radiotherapy [RAD-THER-413]	2	4	
12		Advanced ultrasound techniques (RAD-SONO-416)	3	6	
13		Management of an imaging unit(RAD-MA G-329)	2	4	
14		Advanced Techniques-3 (New-Modalities)			
14	C	Films review & interpretation [RAD-REV-424]	2	Long.	
15		Clerkship department rotation [RAD-CLIN-322, 323,324, 414, 423]	6	Long.	
16		Graduation seminars [RAD-SEM-422]	4	4	
17		Professional Trip [ELECTIVE]			
18		Graduation project [RAD-GRAD-421]	4	8	

Rotation of the groups is as follows:

Semester 6 = A B C
 Semester 7 = B C A
 Semester 8 = C A B

CLERKSHIP EVALUATION AND GRADUATION

COURSE OUTLINE

Detailed behavioral objectives, skills, assignments and problems are listed in each course book. The lists are too extensive to be included below:

Phase 1: Semester 1, Preliminary Courses

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
SCIENTIFIC ENGLISH	ME-ENG-113, ME-ENG-123	1 and 2/Longitudinal	3+3

The sources of most health information in the World are in English. The Internet navigation to obtain information is basically in English. Some of the patients, attending clinics in Sudan, may only speak English language, especially with open-up of borders with economic development and of globalization. Passing the English language examination is an essential entry requirement to universities in Sudan. The general objectives of this course include: (1) correct pronunciation of medical terms, (2) correct reading and understanding of texts from medical books, (3) expressing one's self in good English describing his daily activities, career ambitions, present problems in health and current attempts at management, and (4) translating some pieces from English to Arabic, and others from Arabic to English, both from medical literature. Most of the content is detailed in the College Notes (NC- 113/05), the rest is achieved by self-directed learning and written assignments. The coordinators may decide to use other reference that fulfills the objectives.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
BIOSTATISTICS	STAT-117	1/Block 2 weeks	2

A two-week module on basic statistics as applied to health, to include: (1) introduction to statistics, (2) probabilities, (3) data summary, (4) presentation; measurement of central tendency; interpretation of variation (dispersion), (5) population means, (6) normal distribution; confidence interval, (7) frequency distribution, (8) sampling techniques, (9) calculation and interpretation of the concept of confidence interval, (10) the concept of p-value and its interpretation, (11) the normal and skewed frequency distribution of biomedical data, and (12) how to apply the appropriate test of significance for a given data set and a given research methodology (using t test as an example).

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
COMPUTER SCIENCE-1&2	COMP-116-124	1/Block 3 weeks	2

This is a 3-week block that introduces the following facts: (1) textbooks of medicine and allied sciences are available on CDs, in which a large volume of knowledge is saved and easily retrievable, (2) there are many software packages demonstrating methods and techniques in clinical skills including patient rapport in history taking, clinical examination, investigations and management, (3) students and teachers access the internet for the unlimited sources of information, both at their professional level and public level for health education, (4) students and future doctors are educators who have to prepare smart documents and presentations for the health team and profession at large, (4) knowledge of programmed like Word, Excel, and PowerPoint is indispensable for anyone learner or teacher, (5) computer is important for students both in the developed or developing world, more so for the latter, who might not have inherited voluminous libraries in their colleges and have to utilize the virtual libraries available all over the world, (6) medical journal as hard copies are difficult to be owned by one institution, now, most are available on-line for those who can use the computer efficiently.

The course is intensive focusing on the basic principles of (1) computer electronics and applications relevant to health science education, (2) hand-on experience in dealing with famous programmed like DOS, Word, Excel, PowerPoint, Access and Internet Explorer, (3) the use of CDs is extensively covered as well as having e-mails and navigating the internet for health information, (4) how to access medical journals, and communicate with scientists worldwide.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
PHYSICS FOR MEDICAL EQUIPMENTS AND INVESTIGATIONS (MEDICAL PHYSICS)	PHYS-115	1/Block 3 weeks	2

The basic principles of general physics are important for understanding certain mechanisms that take part in the human body, and also, the technical background of many medical equipments. A medical professional is often confronted with a method of investigation or intervention that is based on physical or mechanical process in the human being and he/she has to deal cautiously with the machine and use it correctly considering its proper maintenance and patient's and worker's safety. These include physical chemistry, gas laws, physics of light and sound, and radiation. The details of the contents include; (1) physical quantities and units, (2) measurements techniques, (3) gases and gas laws, (4) waves, (5) optics, and (6) radiation.

Most of the content is detailed in the College Notes (NC- 115/05), the rest is achieved by self-directed learning and written assignments. The coordinators may decide to use other reference that fulfills the objectives.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
INTRODUCTION TO MEDICINE AND MEDICAL EDUCATION	ME-EDU-114	1/Block 3 weeks	2

This is a three-week (2 CHs) block, starting with a simple medical problem that emphasize: (1) the meaning and message of health and health care delivery system in the country, (2) the role of the physician in, other professional and administrative staff in health care, (3) priority health problems, (4) concepts and principles of learning, (5) adult education and learning, (6) student centered learning, (7) problem-based learning, (8) instructional techniques (lecture, small group etc.), student assessment methods, (9) holistic approach, interdisciplinary and partnership concepts, (10) curriculum development, (11) programme evaluation, (12) leadership and (13) professional ethics. Students are divided into groups to spend a week in a health facility, hospital theatre, hospital outpatient, health center, various directorates and departments of Federal and State Ministries of Health, etc.. Meanwhile students are given discussion sessions on group dynamics and instructional methods, at the end of the course the groups present their field activity using a suitable audiovisual technique. Evaluation assesses the knowledge and attitudes of the students in these three areas: health system, group dynamics and instructional methods.

Most of the content is detailed in the College Notes (NC- 114/05), the rest is achieved by self-directed learning and written assignments. The coordinators may decide to use

other reference that fulfills the objectives.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
BASIC BIOCHEMISTRY	BIOCH-118	1/Block 3 weeks	3

A three-week block in Semester 1, to include: (1) atomic structure, (2) chemical bonding, (3) chemical reactions,

(4) anabolism and catabolism, (5) molecular formulae, (6) solutions and solubility, (7) molarity and molality, (8) normality and molar fraction, (9) acids and bases, (10) buffers, (11) hydrocarbons, (12) isomerism, (13) introduction to organic compounds, (14) classification of aliphatic and aromatic hydrocarbons, their properties and reactions; (15) aldehydes and ketones, alcohols, phenols and ethers acids and amines, benzenes and their derivatives; (16) carbohydrates, (17) lipids, (18) proteins, (19) vitamins, (20) enzymes and coenzymes, (21) phospholipids, (22) cholesterol, (23) nucleic acids, (24) nitrogen bases.

Most of the content is detailed in the College Notes (NC- 118/05), and in the practical notes. The rest is achieved by self-directed learning and written assignments. The coordinators may decide to use other reference that fulfills the objectives.

Phase 2: Semesters 2-5, Organ System Courses

Islamic studies (ISLAM-121) - 4 CHs longitudinal (See ISLAM-111).

Arabic language (ARAB-122) - 4 CHs, longitudinal (See ARAB-112)

English language (ENG-123) -4 CHs longitudinal (See ENG-113)

Computer (COMP-124)- 2 CHs Block

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
RADIATION PHYSIC	RAD-125	1/Block 3 weeks	3

This is a three-week-block detailing the physical aspects of all forms of ionizing and non-ionizing radiation, and start on the basics of radiation physics which include (!) structure of the atom (2) rations from the atoms (3) ionizing radiation (4)electromagnetic effect (5) x-rays and radio activity (6)nuclear characteristics (7) production of electromagnetic waves (8) interacting different types of radiations with matter and living cells (9)particular emphasis on diagnostic and therapeutic x-rays, nuclear medicine, ultrasound, CT and MRI. More detailed and specialized courses on the physics of each modality will follow.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
HUMAN BODY STRUCTURE AND FUNCTION	PA-NAT-126	2/Block 4weeks	4

Upon the successful completion of this course the student will be able to describe and explain, at a basic level, the gross anatomy and introductory histology of the human body, especially the functional aspects of major tissues, organs, and systems including respiratory, cardiovascular, digestive, urinary, reproductive, endocrine and nervous with special emphasis on the interaction between these system and the major failures producing disease. More details are needed in neurobiology. There are some formal laboratory sessions. However a self-directed optional human anatomy laboratory is running all the time for independent study.

It also includes fundamentals of mammalian physiology in a systematic pattern: function of the nervous system (neurotransmitter, sensory and motor systems), endocrine gland and their secretions, bone and muscle physiology, cardiovascular, respiratory systems, gastrointestinal and renal physiology.

In addition it includes the characteristics, features and functions of neurons, ganglia, synapses, neuroeffector autonomic nervous system and somatic reflex arch. The concepts, definitions, processes and mechanism of membrane potentials, somatic and autonomic transmission, receptor activation and production of response. The structure, organization and regulation of adrenergic and cholinergic systems. Mechanisms (pathophysiology) of diseases related to cholinergic system (e.g. myasthenia gravis, peripheral neuropathy and diarrhea) and adrenergic system (e.g. hypotension, pheochromocytoma and asthma). Introduction to drugs affecting the autonomic system, their mechanism of action, metabolism, side effects, structure-activity relationships and clinical applications.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
MAN AND HIS ENVIRONMENT (PHYSIOLOGY)	ME-ENV-126	1/Block 5weeks	4

This is a 6-week-course on the inter-relation between Man's internal and external environments, basic concepts of internal physiologic activities, body fluids, acid-base balance, biological membrane, body systems (respiratory, gastrointestinal, nervous etc..) exposed to environment, impact of environment on health, health consequences of exposure to potential environmental hazards (physical, chemical and biological), multi-disciplinary approach to environment, the role of the international organizations interested in environmental protection, principles of epidemiology, biological spectrum of environmental diseases, endemic and epidemic diseases.

Most of the content is detailed in the College Notes (NC- 126/06- Sections 1,2, and 3), the rest is achieved by self-directed learning and written assignments

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
IMAGING ANATOMY-1 & 2 (GROSS ANATOMY-REGIONAL)	RAD-ANAT-211	3/6 weeks	5
	RAD-ANAT-223	4/6 weeks	4

This is a six-week-block consisting of the following topics: (1) human skeleton, bones, joints, muscles and nerve supply and actions of the muscular system, (2) systemic anatomy of the cardiovascular, respiratory, gastrointestinal, abdominal wall, urinary, reproductive, endocrine and CNS, (3) emphasis on structures readily identifiable in images for image quality and orientation, or frequently investigated for disease, (4) identifying anatomic structure in routine and special radiographic images, ultrasound images, and in cross- transverse, sagittal and coronal images in CT and MRI.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
PRINCIPLES OF DISEASE (PATHOLOGY)	ME-DIS-212	3/5 weeks	4

This is a five-week-block on general pathology and microbiology to include: (1)revision of general histology, (2) morphology, classification, staining reactions, and pathogenicity of bacteria, viruses and fungi, (3) sterilization and disinfection, (4) basic concepts in immunity, (5) principles of inheritance, introduction to molecular biology, and genetic defects underlying inherited disorders, (6) general pathology: inflammation: causes, tissue damage and repair, neoplasia and abnormal cell growth, (7) parasites and parasitic diseases, (8) anti-microbial and antiparasitic drugs.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
DIAGNOSTIC IMAGING EQUIPMENTS-1 &2	RAD-213 and RAD- 225	3/2 weeks 4/4 weeks	2 4

This is a two-week-block which introduces the student to the basic electrical and electronic principles required for diagnostic medical imaging equipment and machinery. It helps students to operate basic radiographic equipment effectively Define radiographic equipment. The student should: (1) describe types of electrical supplies, high tension cables and feeder, (2) define line voltage drop and describe distribution of electrical energy, (3) name types of X ray generators and describe voltage wave forms, falling load principle and constant potential generators, (4) differentiate between fixed anode and rotating anode types, (5) describe the filament circuit and control of the tube current, (6) define exposure time and describe exposure switching, (7) describe beam centering and devices used for beam centering, (8) mention how to control scatter radiation, (9) list fluoroscopic equipment and describe fluorescent screen and fluoroscopic table, (10) describe methods of image intensification, and (10) list equipment for rapid serial radiography, equipment for cranial and dental radiography and mammography equipment

The student should acquaint themselves with the ultrasound, CT, MRI and Gamma Camera, and the instruments in support of these modalities (details to follow in the clerkships).

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
INTRODUCTION TO RADIOGRAPHY 1&2	RAD-214- 228	3/5weeks	4

This is a five-week-block, which includes the historical development of radiography, an introduction to medical terminology pertinent to radiology, ethical and legal issues of health care professionals, and an orientation to the programme and the health care system in relation to medical imaging. Patient assessment, infection control procedures, emergency and safety procedures, communication and patient interaction skills, and basic pharmacology and basic radiation protection are also included. The student has to (1) describe theoretical basis of radiography, (2) outline radionuclide imaging techniques, (3) describe principles of radiophotography, (4) describe and apply image recording techniques currently employed in diagnostic radiology and nuclear medicine, (5) define X ray tube and describe how X ray is generated, (6) define geometry of thickness, wavelength of beam and composition of object transmission, (7) list and operate radiological equipment common encountered in radiology units, (8) describe radiographic processing area

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ULTRASOUND PHYSICS	RAD-SONO-217	325 weeks	2

This is a two-week-block that course covers general physical principle of the various types ultrasound devices in medicine and for imaging. It also enables students perform examination of the different organs and systems of the body by ultrasound technology. The student should: (1) mention principles of sound wave generation, reflection and absorption, (2) name physical and biological effects and hazards of ultrasound waves, (3) describe various types of waves, (4) define Doppler colour and describe its effects, (5) describe the process of generation of ultrasound signals, (6) name various types of ultrasound wave generating equipment and describe operational principles of each, (7) name the various types of ultrasound examinations and read and outline routine of interpreting results, (8) utilize ultrasound machines for obstetrical and gynecological diagnostic procedures, (9) outline use ultrasound equipment for diagnostic procedures pertinent to the liver, biliary system, GIT and urinary system, (10) outline use ultrasound technique for biopsy sampling for visceral and endocrine organs, (11) describe how colour Doppler flow technique is performed, and (12) list limitations of US techniques and name alternative diagnostic techniques.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
PROFESSIONAL CLINICAL SKILLS	ME-SKIL-221+311+321	4,5 &6/ Longitudinal	2 each semester

This is a two-hour weekly session during semester 3, to include: (1) communication skills of speaking, hearing, listening, recognizing strengths and weaknesses of close-ended and open-ended questions, non-verbal communications, establishing rapport, interview and be interviewed, dealing with a difficult patient, (3) give intravenous and intramuscular injection, fix a fluid line, take venous blood and recognize normal blood cells, basic blood tests,(4) recognize shock and manage emergencies at the radiology department, (5) observe vital signs (6) observe intervention- radiological techniques, (7) abdominal ultrasound, observe all routine ultrasound examinations ,biopsy guided u/s and FNA (8) recognize the procedures in CT and MR , and show ability to operate, and observe CT guided biopsy(9) interpret emergency images. (10) interpret a normal ECG and that of myocardial infarction, (11) basic life support skills.(12) observe interventional procedures (13) attend catheter lab and angiography investigations

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
PHYSICS FOR COMPUTED TOMOGRAPHY	RAD-222	4/2 weeks	2

This is a two-week- block that describe the physical principles of CT images. The student should: (1) describe the methods of attenuation measurement, (2) describe the single detector rotation-translation (first generation) scanners, the multidetector (2nd generation) scanners, rotation scanners with movable detectors (third generation), rotation system with stationary detectors (4th generation), (3) define the volume element, (4) define the density value, (5) describe the partial volume effect and types of artifacts (6) know the principles of spiral and helical CT scanners and single slice and multi-slice spiral scanners

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
RADIOGRAPHIC TECHNIQUES AND PROCEDURES 1&2	RAD-224	4/6 weeks	6

This is a six-week-block that includes an introduction to radiographic positioning terminology, the proper manipulation of equipment, positioning and alignment of the anatomical structure and equipment, and evaluation of X ray images for proper demonstration of basic anatomy and related pathology. The student should: (1) outline parts of the human body subject radiographic imaging in X-ray units, (2) list steps of basic positions of skull radiography, (3) mention steps special positions of skull radiography, (4) list steps of radiography of the mandible and facial bones, (5) list steps of radiography of the shoulder upper limb, wrist and hand, (6) list steps of radiography of the hip, lower limb and knee, (7) list steps of radiography of the foot, (8) list steps of

radiography of the chest, ribs and sternum, (9) list steps of radiography of the pelvis, (10) list steps of radiography of various parts of the vertebral column, (11) show skill in preparation of X-ray films for the loco-motor system, chest, skull and facial bones, and (12) write reports on techniques done or attended and compile them into booklets.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
INTRODUCTION TO MEDICAL ETHICS	RAD-226	4/2weeks	2

The student should show an understanding of the (1) history of medicine; before and during the Islamic era, (2) the role of the Moslem scholars in the practice of medicine, research and medical ethics, (3) the milestones of medical education in the Islamic era, (4) the Fight of illness and the sick, the religious regulations concerning treating the sick person, how does the sick person performs his rituals: cleanliness, prayers, fasting, pilgrimage? Also, (5) the visiting of sick person, (6) managing a death episode, (7) the religious conduct when males are managing female disease and vice versa, (8) the emerging controversialities of vitro fertilization, transplantation, brain death, cloning, genetic engineering. Students should be aware of the (9) Fight of health preservation including cleanliness, sleep, moderation in eating and drinking, the jurisprudence of toxic substances and narcotics, infectious diseases, breast feeding, consanguinity marriage, quarantine, death and funerals, dissection of human body for teaching and law, (10) medical behaviour, professional ethics, responsibility of a health professional, (11) issues in protection of acts of a health professional and (12) giving an expert witness at court.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
RESEARCH METHODOLOGY AND SCIENTIFIC WRITING	ME-SUM-231	4/2weeks	2

This is a two-week- block, which focuses on the synthesis of professional knowledge, skills, and attitudes in preparation for professional employment and lifelong learning. Students are trained to perform small research projects in one of the radiology topics that enable them to collect data, review literature, obtain results and discuss their findings in the form of presentations. The student should: (1) describe research methodology listing elements of research, (2) collect up to date information on a particular topic, using proper sampling techniques (3) execute a small research project and analyze obtained data, (4) discuss the significance of the results obtained and research conclusions, and (5) write down a research paper, and (6) present his findings in front of the class and discusses it with his colleagues and staff.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
RADIOGRAPHIC PATHOLOGY	RAD-312	5/4weeks	4

This is a four-week- block that covers pathologic lesions and terminology pertinent to traditional radiology, CT, ultrasound and MRI. It describes characteristics of pathological lesions as seen by various radiographic imaging procedures and relates their features with diagnosis. The course also aims at strengthening relations between radiology technologic specialists and physicians. The student should outline the pathological features affecting the GIT, Liver & biliary system bones respiratory, cardiovascular, genitor-urinary and nervous systems.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
PATIENT CARE AND ETHICS	RAD-313	5/2weeks	2

This is a two-week-block that provides students with basic concept patient care, including considerations for psychological and physical needs of the patient and family. Routine and emergency patient care procedures should be described to the patient. The course also covers the role radiographer in patient education. The student should: (1) employ interpersonal skills to alleviate patient fears, (2) discuss responsibilities of the radiographer towards the patient, (3) discuss the scope of practice of the radiographer, (4) discuss personal, emotional and ethical aspects of death, (5) describe support mechanisms available to the terminally ill, (6) mention methods of determining the proper patient identification, (7) interact with patient family members and friends, (8) demonstrate methods assessment of the vital signs, (9) explain use of auxiliary equipment, immobilization devices and communication systems, (10) alleviate patient fears by explaining length, positioning and other aspects of the procedure, and (11) employ general safety precautions and describe specific patient safety measures and concerns

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
COMPUTER IN MEDICAL IMAGING	RAD-COMP-314	5/2weeks	2

This is a two-week- block that provides information necessary for understanding of the basic concepts of computer systems and microprocessors and the utilization and application of computer in medical imaging, radiation dose calculation and distribution, record keeping, appointment systems, and building stock-keeping. The student should: (1) outline use of computer hardware and software in medical imaging, (2) apply computer technology for patient data management system Utilize quality assurance data representation, (3) utilize computer for acquisition of data in CT, nuclear medicine radiotherapy, digital radio-imaging, and other forms of radiobiological apparatus, and (4)

utilize quality assurance data representation

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
RADIONUCLIDE IMAGING(NUCLEAR MEDICINE PHYSICS&TECHNIQUES)	RAD-315	5/2weeks	2

This is a two-week-block reviewing the natural radioactivity and the radionuclide used in the medical profession. The student should: (1) name the radioactive material used in imaging, the methods of preparation, precautions and indications, (2) describe the scintillation camera, SPECT, PET, (3) list the uses of Gallium scintigraphy, indications of bone and brain scintigraphy, (4) describe the indications and findings of scintigraphy of the thyroid, lung, heart, liver and GIT and kidneys.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CROSS-SECTIONAL ANATOMY	RAD-ANAT-316	5/4weeks	4

This is a two-week- block. This course provides adequate information on the anatomy of the various parts of the human body at various levels of cross, coronal and sagittal sections, and relates such information to tomography. The course content includes essentials information necessary for students to understand the anatomy of the body that particularly relates to diagnostic imaging, nuclear medicine and ultrasonography. Students are trained to depict locations of the various internal organs on the basis of surface anatomy and appearance in diagnostic images. Students are taught to identify various pathological changes identifiable by tomography.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
BASIC AND RADIO-PHARMACOLOGY	RAD-PHARM-319	6/2weeks	2

This is a two-week- block that discusses drugs and medicaments commonly prescribed for patients of X ray units and address indications, contraindications, side effects, and their pharmacodynamics and pharmacokinetics. The course also addresses radiochemistry and its utilization in nuclear medicine. The student should: (1) evaluate patient's illness and recognize drugs and therapies used and define significance of radiological procedures, (2) suggest appropriate plan needed for the imaging procedure required for each patient, (3) provide adequate drugs and medicament needed and register them in an appropriate way, (4) evaluate patients conditions, before, during and after the imaging procedure, (5) list rules and regulations governing drug policies in relation to radiological procedures, (6) describe thermal neutron reactors, cyclotron and fission and equilibrium within the generator system, (7) calculate conversion of units used in radio-pharmacy, (8) describe the labeling process in radiopharmaceutical preparations and identify proper methodologies in kit preparation, and (9) calculate the correct concentration, activity and dose using the decay formula

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
RURAL HOSPITAL RESIDENCY	RAD-SUM-331	6/2weeks	2

This is a two-week- block in the Summer following Semester 6, to be spent in a rural hospital as near as possible to the student's residence. A log book containing the basic radiological skills should be signed by the supervisor in the rural hospital. A confidential report should be filed mentioning the ethical and social commitment of the student during his residency.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ADVANCED TECHNIQUES AND PROCEDURES 1&2&3	RAD-317-330411	4/6 weeks	6

This is a six-week-block that includes an introduction to radiographic advanced procedures and special investigation ,ivu, Ba studies of swallow meal enema, and sailogram, angiography and catheter lab and interventional procedures and CT guided and U/S biopsy and FNA ,positioning terminology, the proper manipulation of equipment, positioning and alignment of the anatomical structure and equipment, and evaluation of X ray images for proper demonstration basic anatomy and related pathology. The student should: (1) outline parts of the human body subject radiographic imaging in X-ray units, ((2) show skill in preparation of X-ray film and patient and tray and contrast media for special investigations (3) write reports on techniques done or attended and compile them into booklets.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
RADIOBIOLOGY AND PROTECTION	RAD-SUM-218-412	6/2weeks	2

This is a two-week- block, which addresses biological hazards of radiology in various aspects of medicine and biology focusing methods of protection of radiology staff and patients from radiation hazards, influence of radiation in the laboratory and hospital environment. It also covers procedures to be followed in cases of radiological exposure emergencies and accidents. The student should: (1) define various radiological terms (radiological safety organization, maximum permissible dose MPD, shielding, monitoring, and radiation record), (2) mention hazards of radiation and general actions of ionization, (3) depict accidents that could occur in radiological units and other medical or research facilities that utilize radiation, (4) describe biologic damage, (5) explain how radiation dangers are avoided and name methods adopted to minimize such effects, (6) take appropriate action in cases of radiation, (7) describe effects of radiation on matter, (8) explain adverse effects of radiation on living organisms, (9) mention regulations and rules governing restricted areas, (10) mention the significance of continuous scanning

and surveillance for such areas, (11) name necessary investigations needed for persons overexposed to ionized radiation, (12) explain safeguards against hazards and future safe utilization radiation in nuclear medicine, (13) explain safe handling of radioisotopes and appropriate methods used for handling waste, (14) mention safeguards against electrical accidents, and (15) list safety measures adopted for radiology.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
RADIOTHERAPY	RAD-412	6, 7 or 8/2weeks	2

This is a two-week-clerkship that enables students to acquire the necessary skills in clinical situations that qualify them to participate in basic treatment techniques of radiotherapy and nuclear medicine. The course covers the physical basis of nuclear medicine. It helps students to operate equipment needed for nuclear medicine and understand physical basis of machine operation. It also addresses precautions and patient and staff safety measures to be taken in nuclear medicine. The student should: (1) define radiotherapy and nuclear medicine, (2) describe positioning for major radiotherapy and radio-nuclear procedures, (3) operate the different types of radio-nuclear equipment, outline their mechanism of operation, and take safety measures needed for operation of each equipment, (4) describe various types of radioisotope generators, (5) describe principle of isotope production, (6) describe stages of radioactive isotope disintegration, (7) outline the process of radioimmunoassay and describe the mode of action of radiopharmaceuticals, (8) perform image and data capturing, display and discuss the theoretical basis of such operations and their utilization in nuclear medicine, (9) define the computerized gamma camera system and list its properties, (10) project images on monitors, (11) attend operation and discuss mechanism of action of the various components of nuclear medicine computers, (12) define gamma camera interface, (13) compare analog differentiation to digital differentiation, and (14) discuss principles of image projection, colour and depth of picture.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ABDOMEN AND ALIMENTARY TRACT IMAGING	RAD-322	6,7 or 8/8weeks	8

This is a eight-week-clerkship that enables students to acquire the necessary skills needed in clinical the situation and qualifies them to participate in undertaking basic and special procedures for the abdomen and gastrointestinal tract (GIT) with or without contrast media, fluoroscopy. The course covers anatomy, pathology and physiology of GIT, examination of the esophagus, stomach, intestines, liver, gall bladder, bile ducts, pancreas and spleen, as well as nuclear medicine procedures for GIT and the hepatobiliary system, and applications of various imaging modalities specific for the system. The student should: (1) Describe anatomy and physiology of the GIT and hepatobiliary system, (2) list major pathological lesions of GIT and hepatobiliary system,

(3) evaluate condition of a GIT and hepatobiliary system patient and mention precautions to be taken before the procedures, (4) prepare the patient for the procedure, execute the procedure and describe patient management after the procedure, (5) list indications, contraindications and complications of each procedures and mention methods of dealing with each complication, (6) name contrast media and radiochemical needed specifically needed for imaging modalities applicable to the system and mention the mechanism of their action, complication; and methods of avoiding or alleviating those complications, (7) perform plain abdomen radiographs, contrast GIT examination with fluoroscopic control, (8) list advantages and disadvantages of the single contrast examination by barium sulphate, (9) perform double contrast examination of the stomach and colon, (10) perform ultrasound and MRI/CT for GIT, liver and the spleen, (11) describe endoscopic retrograde cholangiopancreatography, oral cholecystography and percutaneous transhepatic cholangiography, (12) describe preparations for imaging during gastroscopy, sigmoidoscopy, colonoscopy and barium enema, and (13) write reports on technological aspects of imaging procedures.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CHEST AND RESPIRATORY SYSTEM IMAGING	RAD-323	6,7 or 8/6weeks	6

This is a six-week-clerkship that enables students to acquire the necessary skills needed in clinical the situation and qualifies them to participate in undertaking basic and special procedures for the chest and respiratory system with or without contrast media, fluoroscopy. The course covers anatomy, pathology and physiology of respiratory system, examination of the larynx, trachea, lung, pleura and chest wall. It also addresses nuclear medicine procedures for chest and respiratory system, and applications of various imaging modalities specific for both. The student should: (1) describe anatomy and physiology of the respiratory system, (2) list major pathological lesions of respiratory system seen in chest images, (3) evaluate condition of a respiratory system patient and mention precautions to be taken before the procedures, (4) prepare the patient for the procedure, execute the procedure and describe patient management after the procedure, (5) list indications, contraindications and complications of each procedures and mention methods of dealing with each complication, (6) name contrast media and radiochemical needed specifically needed for imaging modalities applicable to the system and mention the mechanism of their action, complication; and methods of avoiding or alleviating those complications, (7) perform plain chest radiographs, contrast respiratory examination with fluoroscopic control, (8) mention disadvantages of chest fluoroscopy as compared to chest CT, (9) perform ultrasound and MRI/CT for chest and respiratory system, (10) describe the technical preparation and procedures for bronchography, radionuclide lung scanning, pulmonary angiography, and (11) write reports on the procedures on this system.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CARDIOVASCULAR SYSTEM IMAGING	RAD-324	6,7 or 8/4 weeks	4

This is a four-week-clerkship that enables students to acquire the necessary skills needed in clinical the situation and qualifies them to participate in undertaking basic and special projections for the cardiovascular system with or without contrast media, fluoroscopy. The course covers anatomy and physiology of CVS, examination of the heart, cardiac angiography, cardiac catheterization, nuclear medicine cardiac studies and applications of ultrasound. It also covers various types of radiographic procedures for angiography. The student should: (1) describe anatomy of the cardiovascular system (CVS), (2) list major pathological lesions of CVS, (3) evaluate condition of a CVS patient and mention precautions to be taken before the procedures, (4) prepare the patient for the procedure, execute the procedure and describe patient management after the procedure, (5) list indications, contraindications and complications of each procedures and mention methods of dealing with each complication, (6) name contrast media and radiochemical needed specifically needed for imaging modalities applicable to the system and mention the mechanism of their action, complication; and methods of avoiding or alleviating those complications, (7) perform or describe methods of preparations or performing various types of cardiography, arteriography and venography, and (8) write reports on the procedures in this system.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ULTRASOUND IMAGING	RAD-411	6,7 or 8/6weeks	6

This is a six-week-clerkship spent in a clinic or clinics providing the service. Observing and performing different U/S investigations abdomen ,pelvis, obse. and gyn A logbook containing the skills to be learned in the unit should be signed by the trainer in charge. A confidential report should be filed mentioning the behavioural or ethical and social commitments of the student during this clerkship.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CT IMAGING	RAD-412	6,7 or 8/6weeks	6

This is a six-week-clerkship spent in a clinic or clinics providing the service. Observing and performing CT Investigations and protocols brain, abdomen , chest pelvis . A logbook containing the skills to be learned in the unit should be signed by the trainer in charge. A confidential report should be filed mentioning the behavioural or ethical and social commitments of the student during this clerkship.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
MR IMAGING	RAD-413	6,7, or 8/2weeks	2

This is a two-week-clerkship spent in a clinic or clinics providing the service ,Observing and performing MRI procedures ,brain, chest, abdomen and pelvis. A logbook containing the skills to be learned in the unit should be signed by the trainer in charge. A confidential report should be filed mentioning the behavioural or ethical and social commitments of the student during this clerkship.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
IMAGING UNIT MANAGEMENT	RAD-414	6,7 or 8/2weeks	2

This is a two-week-clerkship that covers the principles of management and safety of radiology and nuclear medicine units and laboratories. This course also covers quality control, including various types of quality assurance tests, quality control testing equipment and assessment of performance of various radiological equipments. The student should: (1) abide radiation protection legislations and regulations, (2) show administrative skills of running radiology and nuclear medicine units, (3) show competence in dealing with his / her staff and superiors, (4) keep records of patients, images, therapeutics, media and other supplies, (5) show ability of improving the work environment, (6) apply quality control measures in all units and laboratories of nuclear medicine and radiology labs, (7) list quality control procedures and methods in radiology laboratories, (8) assess performance of general radiographic equipment and analyze image quality, (9) perform quality control measures for conventional tomography, (10) describe quality control measures for mobile and mammographic equipment, (11) analyze film faults and artifacts, (12) assess CT system performance and image quality, and (13) assess performance of ultrasound and NM equipment.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
GENITO-URINARY IMAGING	RAD-421	6,7 or 8/4weeks	4

This is a four-week-clerkship that enables students to acquire the necessary skills needed in clinical the situation and qualifies them to participate in undertaking basic and special projections for the genitor-urinary system (GUS) with or without contrast media, fluoroscopy. The course covers anatomy and physiology of GUS, examination of the kidneys, urinary bladder, ureters, and urethra as well as urinary catheterization, nuclear medicine procedures for GUS and applications of various imaging modalities specific for the system. The student should: (1) describe anatomy and physiology of the GUS, (2) list major pathological lesions of GUS, (2) evaluate condition of a male or female GUS patient and mention precautions to be taken before the procedures, (3) prepare the patient for the procedure, execute the procedure and describe patient management after the procedure, (4) list indications, contraindications and complications of each procedures and mention methods of dealing with each complication, (5) name contrast media and radiochemical needed specifically needed for imaging modalities applicable to the system and mention the mechanism of their action, complication; and methods of avoiding or alleviating those complications, (6) perform various types of intravenous urograms (IVU), retrograde and antegrade pyelography, urethrography and renal angiography, (7) define hysterospingography and perform ultrasound, CT and MRI for the ovaries and female reproductive tract, (8) mention precautions taken during pregnancy imaging and fetal monitoring, (9) perform pelvimetry, and (10) write reports on procedures in this system.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
MUSCULOSKELETAL IMAGING	RAD-422	6,7 or 8/6weeks	6

This is a six-week-clerkship that enables students to acquire the necessary skills needed in clinical the situation and qualifies them to participate in undertaking basic and special projections for the musculoskeletal system (MSS) with or without contrast media, fluoroscopy. The course covers anatomy and physiology of MSS, examination of the upper and lower limb bone, spine, skull, and joints as well as sinuses and orbits, nuclear medicine procedures for MSS and applications of various imaging modalities specific for the system. The student should: (1) describe anatomy and physiology of the MSS, (2) list major pathological lesions of MSS, (3) evaluate condition of a MSS patient and mention precautions to be taken before the procedures, (4) prepare the patient for the procedure, execute the procedure and describe patient management after the procedure, (5) list indications, contraindications and complications of each procedures and mention methods of dealing with each complication, (6) name contrast media and radiochemical needed specifically needed for imaging modalities applicable to the system and mention the mechanism of their action, complication; and methods of avoiding or alleviating those complications, (7) perform plain bone radiographs, radio-nuclear bone scans, computed tomography for bone disease, MRI for MSS, and positioning and techniques used for bone trauma, and (8) write reports on the procedures in this system.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CNS AND ENDOCRINE IMAGING	RAD-423	6,7 or 8/4weeks	4

This is a four-week-clerkship that enables students to acquire the necessary skills needed in clinical the situation and qualifies them to participate in undertaking basic and special procedures for the central nervous system (CNS) and endocrine system with or without contrast media, fluoroscopy. The course covers anatomy and physiology of CNS and major endocrine glands, examination of the CNS, spine, skull, pituitary gland, thyroid gland, and pineal body. It also addresses nuclear medicine procedures for CNS and endocrine glands, and applications of various imaging modalities specific for both systems. The student should: (1) describe anatomy and physiology of the CNS, pituitary, thyroid and pineal body, (2) list major pathological lesions of the brain, spinal cord and major endocrine glands, (3) evaluate condition of a CNS patient and mention precautions to be taken before the procedures, (4) prepare the patient for the procedure, execute the procedure and describe patient management after the procedure, (5) list indications, contraindications and complications of each procedures and mention methods of dealing with each complication, (6) name contrast media and radiochemical needed specifically needed for imaging modalities applicable to the system and mention the mechanism of their action, complication; and methods of avoiding or alleviating those complications, (7) list disadvantages of radionuclide imaging, (8) produce plain

skull and pituitary fossa films, (9) define neurosonography and describe computed tomography procedures for head injuries, (10) perform or state the theoretical background radio-nuclear skull and spine scans, computed tomography for the skull, brain and spine and MRI for CNS, pituitary gland, pineal gland and thyroid gland, and (11) write reports on the procedures in these system.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
GRADUATION PROJECT	RAD-431	During Semester 8/2weeks	2

This course prepares the student to conduct research as graduation project which includes research problem, objectives, and data analysis and result presentation. By the end of the project the student should be able to: (1) Introduction to research methodology and identification of research problems,(2)Learn how to collect and classify of data,(3) Formulate research objectives,(4) Design studies and research,(5) Learn how to choose sample size calculation,(6) Discuss process and analyze data.



