

UNIVERSITY OF NIGERIA, NSUKKA
SCHOOL OF POSTGRADUATE STUDIES

PGD, M.Sc and Ph.D

**PROGRAMMES FOR MEDICAL RADIOGRAPHY AND
RADIOLOGICAL SCIENCES**

2017

DEPARTMENT OF MEDICAL RADIOGRAPHY AND RADIOLOGICAL SCIENCES

PGD, M.Sc. AND Ph.D REVISED CURRICULUM DEGREE PROGRAMMES

LIST OF APPROVED POST-GRADUATE SUPERVISORS

S/N	NAME OF STAFF	QUALIFICATIONS	AREAS OF SPECIALIZATION
1.	PROF K.K. AGWU	Ph.D, M.Sc, M.Sc (Equiv) DCR(London)	Medical physics, medical Imaging, Medical Radiography
2.	DR(MRS) F.U.IDIGO	Ph.D, M.Sc., M.Sc., B.Sc Hons	Radiology Admin and Mgt, Medical Imaging, Medical Radiography.
3.	DR C.U.EZE	Ph.D, M.Sc., B.Sc Hons	Medical Imaging, Medical Radiography.
4.	DR M.C. OKEJI	Ph.D, M.Sc, B.Sc Hons	Radiation and Environmental Protection, Medical Imaging, Medical Radiography.
5.	DR K. OCHIE	Ph.D, M.Sc. B.Sc Hons	Medical Imaging, Medical Radiography.
6	DR S.O.I. OGBU	Ph.D, M.Sc. B.Sc Hons	Medical Imaging, Medical Radiography
7	DR(MRS) A.C ANAKWUE	Ph.D, M.Sc. B.Sc Hons	Medical imaging, Medical Radiography

UNIVERSITY OF NIGERIA, NSUKKA

PGD, M.Sc and Ph.D PROGRAMMES OF THE DEPARTMENT OF MEDICAL RADIOGRAPHY AND RADIOLOGICAL SCIENCES

1.1 PHILOSOPHY

Medical Radiography and Radiological Sciences involves the use of ionizing and other forms of radiant energies in the diagnosis, treatment and management of diseases and is an indispensable arm of modern medical science being the pivot of modern diagnostic medicine.

The postgraduate programme of this Department is based on identified need to provide graduates of Medical Radiography and other suitably qualified candidates the opportunity to undertake advanced and specialized professional studies in medical radiography, radiological sciences and related areas. These areas are presently experiencing acute shortage of manpower both in the private and public sectors of the economy.

It is designed to widen the knowledge, skill and employment opportunities of the graduates in the key specialties of the profession including radiation and environmental protection.

1.2. SCOPE

The scope of the programme will include specialization in any of the following areas:-

- Medical imaging
- Radiation and Environmental Protection
- Radiological Education
- Radiotherapy and Oncology
- Radiology Administration and Management.

1.3. OBJECTIVE

The programme is aimed at providing students with up-to-date theoretical, practical and interdisciplinary skills required in the various specializations of the subject.

1.4. EMPLOYMENT OPPORTUNITIES

The present acute shortage of qualified medical radiographers and radiological scientists in Nigeria and Africa makes the job prospects very bright for graduates of this Department. Successful graduates of these programmes are equipped for career in clinical medical imaging including medical ultrasound, computerized tomography and radiotherapy in private and government owned health establishments all over the nation. Career opportunities also exist in research institutions for the fabrication of components in x-ray technology. Tertiary health and educational institutions are grossly understaffed in these specialties including the ever-expanding area of environmental protection agency to mention a few.

1.5. ADMISSION REQUIREMENT: PGD, M.Sc. and Ph.D.

A. Postgraduate Diploma programme:

Admission Requirements:

The following may qualify for admission into Post-graduate Diploma (PGD)

- (i) Holders of professional qualifications such as Diploma of the College of Radiographers of London D.C.R. (London), R.T. (ARRT) USA, CAMRT (Canada), D.I.R. (Nig) or their equivalents.
- (ii) Candidates who have obtained third Class Honours degree in Medical Radiography from University of Nigeria or other recognized universities with GPA not less than 2.00 on a 5-point scale or its equivalent.

Duration of the Programme:

Full-time:	A minimum of two (2) semesters A maximum of four (4) semesters
Part-time:	A minimum of four (4) semesters A maximum of six (6) semesters

Masters of Science (M.Sc) Degree Programme in Medical Radiography:

Admission Requirements:

- (i) Graduates of the University of Nigeria or of other recognized Universities who have obtained the approved degree of Bachelor of Medical Radiography with at least second class honors or its equivalent.
- (ii) Candidates with university third class honors degree of the University of Nigeria in Medical Radiography or professional qualifications such as D.I.R. (London) T.T. DRRT (USA), CAMRT (Canada) D.I.R. (Nig.) plus the appropriate postgraduate diploma (PGD) of recognized universities with at least credit level pass.
- (iii) For M.Sc. in Radiation and Environmental Protection and Medical Physics candidates with a good second class honors degree from the University of Nigeria or other recognized universities in Chemistry or Geology may be considered.
- (iv) For M.Sc. in Radiology Administration and Management, candidates with a good second class honors degree from the University of Nigeria or recognized universities in the Health Sciences, Public Health and Management may be considered.

(v) **Duration of the Programme:**

- Full-time: A minimum of four (4) semesters
A maximum of eight (8) semesters
- Part-time: A minimum of six (6) semesters
A maximum of ten (10) semesters

Areas of Specialization:

1. Medical Imaging (with options in)
 - Medical Ultrasound
 - Computerized Tomography(CT)
 - Magnetic Resonance Imaging (MRI)
 - Nuclear medicine
 - Conventional Radiography
2. Radiation Therapy and Oncology
3. Radiation and Environmental Protection
4. Radiography Education
5. Radiology Administration and Management

DOCTOR OF PHILOSOPHY (PhD.) IN MEDICAL RADIOGRAPHY

Admission Requirements:

- Graduates of the University of Nigeria or of other recognized universities who have obtained the degree of Master in Medical Radiography or related area with a CGPA of at least 3.5/5.0
- The candidates must have five credit passes in English, Mathematics, Physics, Biology, and Chemistry: Qualifying exam for undergraduate admission in the department.
- Candidates must have a minimum of second class lower division in Bachelor's degree from an approved university with a CGPA of 3.0/5.0.

Duration of the Programme:

- Full-time: A minimum of six (6) semesters
A maximum of ten (10) semesters
- Part-time: A minimum of eight (8) semesters
A maximum of fourteen (14) semesters

Areas of Specialization:

- i. Medical imaging
- ii. Radiation and Environmental Protection
- iii. Radiological Education
- iv. Radiology Administration and Management
- v. Radiotherapy Technology and Oncology

Requirements for Graduation

The candidate must pass all registered courses, present all seminars and defend the thesis before a panel with an external examiner appointed by the university

Numbering of Stress Areas.

0. Research Methodology
 1. Instrumentation
 2. Imaging Modalities and Optics
 3. Radiation and Environmental Protection
 4. Therapy Technology
 5. Administration
 6. Education
 7. Seminar
 8. Anatomy/Physiology/Pathology
 9. Thesis

COURSE WORK:

PGD Courses:

The PGD programme consists of course work, seminars and project work. Each student shall register for a minimum of 29 credit units consisting of the following:

First Semester

Course Codes	Course Title	Units
RGS 0691	Research Methodology	2
RGS 0611	Radiation Physics, Dosimetry and Protection	2
COS 101	Introduction to Computer Sciences	2
BIC 203	Chemistry of Biological Molecules and Biochemical Catalysis	2
PYS 202	Renal and Gastro-Intestinal Physiology	2
RGS 0651	Health Administration	2
COM 351	Biostatistics in Health Technology	2
Total		14Units

Second Semester

Course Codes	Course Title	Units
RGS 0622	Radiographic Image Processes	2
RGS 0682	Radiographic Anatomy	2
RGS 0624	Radiographic Pathology and Image Critique	2
RGS0612	Advanced Radiographic Equipment and Instrumentation	2
PYS 204	Cardiovascular and Respiratory Physiology	3
RGS 0692	Project	4
Total		15Units

COURSE DESCRIPTION

RGS 0691 Research Methodology: 2 Units

Exposure to practical application of statistical/Biostatistical tools and methods. Mean, mode, median array, range, standard deviation, graphs and graphing and chart. Data collection method, Data presentation and analysis. The scientific method and types of scientific research projects. Research design and projects. Research design and sampling methods. Inferences. Validity and Reliability issue and their Importance.

RGS 0612 Advanced Radiographic Equipment and Instrumentation 2 Units

Filament circuits, Tomographic Units and attachments. Tube rating, Autotimers and applications. Fluoroscopic Units. Interlock circuits. Image Intensifiers and Television Tubes. Quality Assurance in Radiology.

RGS 0622: Trends in Radiographic Imaging and Optics 2 Units

The radiographic image and its relation to signal transfer, Transfer characteristics based upon modulation transfer function. Quality of radiographic image-noise resolution and contrast. Receiver observe image receptor requirement for various specialized procedures. Variables modifying the selection of exposure factors. Quality assurance. Introduction to other imaging modalities.

RGS 0623 Radiographic Pathology and Image Critique 2 Units

Definition of common pathological conditions. Basic presentation and manifestation of various pathological conditions and disease entities on radiographs covering the major organs and systems of the body.

RGS 0638 Radiation Physics, Protection and Dosimetry 2 Units

Wave and Quantum method of Energy Transfer; Electromagnetic spectrum. Electron emission and solid state physics. Photoelectric. The atom ionization. Radioactivity and Radioactive decay. Half life. Geiger-Natural Law. Units of activity and measurement, K Capture, Special relativity. Production and interaction of X and Gamma radiations. Attenuations and inverse square law. Effects of filtration

RGS 0651 Health Administration**2 Units**

Management principles and functions. Leadership Dynamics and supervision. Motivational theories. Organizational structure. Interpersonal and intersectorial Relationships. Performance evaluation. Industrial and Public relations. Collective bargaining. Inventory, vital statistics and records. Budgeting and financial control. Communication processes.

RGS 0692 Project Report**2 Units**

Each student works selected and approved topic. With practical application of the theories and principles. Learnt in RGS 0691.

Course Requirements for M.Sc.**Core Courses:**

Irrespective of specialization, all M.Sc degree candidates shall register and pass the following compulsory courses:

M.Sc. Core compulsory Courses**First Semester**

Courses	Title	Units
PGC 601	ICT and Research methodology	3
RGS 603	Advanced Concepts in Medical Radiography Practice	2
RGS 673	Professional posting and case reports	3
RGS 601	Advanced Computer in Health Sciences	2
Sub-total		10 Units

Second Semester

Courses	Title	Units
RGS 602	Advanced Statistics in Health Technology	2
RGS 672	Research Seminar	2
RGS 692	Dissertation	6
Sub-total		10 Units

Medical Imaging

Common Courses

First Semester

Courses	Title	Units
RGS 661	Image Formation and processing	2
RGS 663	Application of Digital systems in radiography	2
RGS 681	Cross-sectional Anatomy in	2
Sub -total		6 Units

Diagnostic Medical Ultrasound

First Semester

Courses	Title	Units
RGS 613	Physics of medical ultrasound	2
RGS 611	Instrumentation and Quality Assurance in ultrasound	2
RGS 621	Small Parts scanning	2
Sub-total		6 Units

Second Semester

Courses	Title	Units
RGS 682	Human Embryology	2
RGS 622	Obstetrics Sonography	2
RGS 624	Abdominal and Pelvic sonography	2
RGS 626	Echo - cardiography and Vascular sonography	2
Sub-total		8 Units

Computerized Tomography

First Semester

Courses	Title	Units
RGS 625	CT of the musculo-skeletal system	2
RGS 623	Patient Management and Contrast Media in CT	2
RGS 627	CT of the Abdomen and Pelvis	2
Sub-total		6 Units

Second Semester

Courses	Title	Units
RGS 628	CT of the Head and Central Nervous System	2
RGS 604	Other applications of CT	2
RGS 614	CT Physics and Instrumentation	3
Sub-total		7 Units

Magnetic resonance Imaging (MRI)

First Semester

Courses	Title	Units
RGS 605	Basic Physical Principles of MRI	2
RGS 615	Instrumentation and Quality assurance in MRI	2
RGS 629	MR Imaging techniques for head and Central nervous System and Bones	2
Sub-total		7 Units

Second Semester

Courses	Title	Units
RGS 618	Pulse sequences and Contrast Agents	2
RGS 616	MR Imaging techniques for chest and abdomen	2
RGS 606	MRI Artefacts and Safety Considerations	2
Sub-total		6 Units

Nuclear Medicine

First Semester

Courses	Title	Units
RGS 607	Basic Physical Principles of Nuclear Medicine	2
RGS 617	Instrumentation and Quality assurance in Nuclear Medicine	2
RGS 631	Nuclear Medicine techniques for head and Central nervous System and Bones	2
Sub-total		6 Units

Second Semester

Courses	Title	Units
RGS 638	Radiopharmaceuticals	2
RGS 632	Nuclear Medicine techniques for chest and abdomen	2
RGS 608	Safety Considerations in Nuclear Medicine	2
Sub-total		6 Units

Medical Radiography

First Semester

Courses	Title	Units
RGS 633	Imaging and critique of the musculo-skeletal system	2
RGS 609	Patient Management and Contrast Media in radiography	2
RGS 637	Radiographic Imaging and critique of the Abdomen and Pelvis	2
Sub-total		6 Units

Second Semester

Courses	Title	Units
RGS 638	Radiographic Imaging and critique of the Head and Central Nervous System	2
RGS 684	Normal and Pathological Pattern recognition in Radiography	2
RGS 612	General Physics and Instrumentation in Radiography	2
Sub-total		6 Units

Radiation Therapy and Oncology

First Semester

Courses	Title	Units
RGS 641	Radiobiology	2
RGS 643	Oncology	2
RGS 645	Treatment Planning & Patient care in Radiotherapy	2
Sub-total		6 Units

Second Semester

Courses	Title	Units
RGS 642	Radiotherapy Physics	2
RGS 612	Radiotherapy Equipment	2
RGS 644	Clinical Radiotherapy	2
Sub-total		6 Units

Radiation and Environmental Protection

First Semester

Courses	Title	Units
RGS 631	Radiation Physics, Detection and Dosimetry	2
RGS 633	Air Pollution from Fossil-Fuelled Industrial Processes And Aerosol Physics	2
RGS 635	Nuclear Reactors, Nuclear fuel Processing and reactor waste	2
RGS 641	Radiobiology	2
Sub-total		8 Units

Second Semester

Courses	Title	Units
RGS632	Hazard Assessment from radioactivity and oil spillage Released into the environment	2
RGS 634	Radiation protection and environmental monitoring	2
RGS 636	Legislation and Economics of Environmental Protect	2
RGS 638	Microwaves, Lasers and Environmental Noise	2
Sub-total		8 Units

Radiography Education

First Semester

Courses	Title	Units
RGS 651	Educational Administration and Planning in Radiography	2
RGS 661	Curriculum Planning in Medical Radiography	2
RGS 663	Educational Psychology in Radiography	2
RGS 665	Radiological Health Education	2
Sub-total		8 Units

Second Semester

Courses	Title	Units
RGS 664	Instructional Teaching and Evaluation in Radiography	2
RGS 662	Educational Innovations in Radiography	2
RGS 668	Philosophy of Radiography Education	2
Sub-total		6 Units

Radiology Administration and Management

First Semester

Courses	Title	Units
RGS 653	Health Economics and Budgeting	2
RGS 655	Dynamics of Health Management	2
RGS 657	Health Laws and Regulations	2
Sub-total		6 Units

Second Semester

Courses	Title	Units
RGS 652	Health Planning Policy formulation and Implementation	2
RGS 654	Health Personnel and Office Management	2
RGS 656	Health Care Environment and Organization Behaviour	2
Sub-total		6 Units

COURSE DESCRIPTION FOR MASTERS PROGRAMMES:

COMMON CORE COURSES

PGC 601 ICT and Research Methodology 2Units

In-depth research work aimed at acquiring full knowledge and presentations in scholarly writing of the concepts, issues, trends in the definition and development of statistics. Major steps in research: selection of problem, Literature review, Design, Data collection, analysis and interpretation, conclusions. Study of various research designs, Historical, Case studies, Surveys, Descriptive, Cross sectional, Experimental, etc. Analysis, surveys, and synthesis of conceptual and philosophical foundations of Statistics. Identification of Research problems and development of research objectives and hypotheses. Method of Project/Dissertation Writing. Application of appropriate advanced ICT tools relevant for data gathering, analysis and result presentation. Essentials of Spreadsheets. Internet Technology, Internet search Engines, Statistical Packages. Principles of scientific research. All registered Masters Degree students must attend a solution-based interactive workshop to be organized by The School of Post-Graduate Studies for a practical demonstration and application of the knowledge acquired from the course conducted by selected experts.

RGS 602 Advanced Statistics in Health Technology 2 Units

Acquisition of techniques for the study and measurement of population. Sources and types of health data. Measure of central tendencies and variations. Biostatistical technique to health care delivery and Utilization. Analysis of health needs in specific high risk population.

RGS 601 Advanced Computer in Health Sciences: 2 Units

Operating systems. Computer appreciation, soft and hardware mechanisms. Computer requirements for imaging systems. Data processing. Data methods and programming. Computer aided medical diagnosis.

RGS 603 Advanced Concepts in Medical Radiography and Radiological Sciences Practices 2 Units

Philosophy, Optimum health, illness-health-illness Continuum .Holism. Quality assurance. Theory construction. Helping and caring processes.

RGS 673 Professional Posting in Specialty Area: 2Units

Laboratory and field based planning development and Validation of knowledge in cognitive, affective and psychomotor domains applied in the specialty areas.

RGS 671 Research Seminar:

2 Units

Course designed to present and analytical frame. To enable students focus in a number of issues in the health field related to their specialty areas. Critical appraisal of Health theories. Application of theories of specific situation. Topics to be approved by supervisor. Presentation by students at departmental colloquium.

RGS 692 Dissertation:

6 Units

An in-depth analysis and thoroughly researched and original presentation of the results of the project report.

MEDICAL IMAGING

RGS 661 Image Formation and Processing:

2 Units

The concept of object and image. Relationship between object and image. Detectors and detecting problem. The general image processing problem. Discrete representation and models for imaging systems. The general theory of image restoration. Image sampling. Interactive image processing. Clinical applications. The eye and the brain as a stage in and imaging system. Spatial and contrast relationship. Perception of moving images. Quantitative measures of investigative performance. Fourier transforms (Temporary and spatial modulation transfer, function, correlation techniques).ROC analysis.

RGS 663 Application of Digital Systems in Radiography:

2 Units

Advantages of digital techniques. Image quality considerations. Digital imaging methods (film digitization, digital video fluoroscopy, scanning beam devices) large areas solid state detectors. Image manipulation in digital radiography: Operations on single and multiple images, multiple fluoroscopy: Digital angiographic imaging, subtraction techniques. System components. Digital scanned projection radiography (computed radiography). Clinical applications and quality assurance. Quantitative data analysis from digital fluorograms.

RGS 681: Cross-sectional Anatomy in Imaging.

2 Units

Anatomic and Physiologic Relationships within the Abdominal cavity; Anatomic and physiologic relationships within the Thoracic cavity; Anatomic and physiologic relationships within the Pelvic cavity; Anatomic and Physiologic Relationships within the cranium.

Diagnostic Medical Ultrasound

RGS 611: Instrumentation and Quality Assurance in Ultrasound

2 Units

Ultrasound transducers, operating standards, equipment calibration, resolution, gray scale photography and image critique; functions of the components of processing, scan converter displays, image and display techniques, film and methods of permanent image recording; and emerging technologies. Types of scanners, types of models, Doppler units, duplex scanners. 3-D ultrasound unit. Principles of ultrasound bone dosimetry. Equipment installation, equipment maintenance. Component spare parts fabrication. Advanced quality assurance in ultrasonography.

RGS 682 Human Embryology

2 Units

Gene transcription, regulations of gene expression, induction and organ information, cell signaling; Primordial germ cells, the chromosome theory of inheritance, meiosis, chromosomal abnormalities, structural chromosome abnormalities; Morphological changes during maturation of the gametes, spermatogenesis, ovarian cycle, ovulation, fertilization, cleavage, blastocyst formation, embryonic stem cells Abnormal implantation; Gastrulation: formation of embryonic mesoderm, ectoderm and endoderm; Neural crest cells, neural tube defects. Blood and blood vessels, capillary haemangioma; Developments of the fetus, fetal membrane and placenta, preeclampsia, structure of the placenta and circulations; Circulation and function of the placenta, Erythroblastosis fetalis and fetal hydrops; Amnion and umbilical cord, placental changes at term and end of pregnancy; Amniotic fluid, fetal membranes in twin, twin defects, preterm, birth defects, maternal serum screening; Skeletal system: neurocranium, viscerocranium, cranio defects and skeletal dysplasia, striated skeletal musculature, cardiac and smooth muscle; Formation of the body fluid, serous membranes. Formation of diaphragm and thoracic cavity; Formation and position of the heart tube, cardiac loop; Formation of the atrial and ventricular septa; Vascular development, umbilical veins circulation before and after birth, lungs, trachea. Development of digestive system including liver, pancreas. Urogenital system Genital system, vagina, uterine and vaginal defect, descent of testes. Head and Neck Facial defects, central nervous system: Brain, cranial nerves, autonomic nervous system. Integumentary stem, epidermis.

RGS 613 Physics of Medical Ultrasound.

2 Units

The nature of sound waves, piezo-electric effect, generation and detection of ultrasound, properties of ultrasound waves, interaction of ultrasound with tissue, attenuation of ultrasound beam, focusing and steering, Doppler shift frequency and applications in ultrasound diagnosis. Vascular measurement parameters. Doppler Effect – Flow, Stenoses, Doppler Equation, Doppler

Angle; Colour – Doppler Instruments – Colour-Doppler Principle, Performance and Safety – Performance Measurements, Output Measurements, Bio-effects and safety considerations.

RGS 621 Small Parts Scanning

2 Units

Anatomy of the small parts, indications for scan, scanning protocols, image appreciation and critique. Breast Ultrasound, The thyroid and Parathyroid Glands, The scrotum, The Prostate Gland, The Musculoskeletal system, Penile Ultrasound. Eye ultrasound.

RGS 622: Obstetric Ultrasonography

2 Units

First trimester ultrasound; Problems of early pregnancy; Routine second trimester screening-assessment of gestational age; The placenta, cervix and amniotic fluid; umbilical cord and chorioamniotic membrane; Fetal head and neck; fetal thorax, abdomen and pelvis, Routine second trimester screening- assessing fetal anomaly; Twin pregnancy; Growth disturbances- Large- and Small- for-date fetuses.

RGS 624 Abdominal and Pelvic Sonography

2 Units

Indications for abdominal scan. Review of anatomy of abdominal and pelvic organs. Scanning protocols for abdominal and pelvic organs. Image appreciation and technique. Introduction to Abdominal and Pelvic scanning Techniques and Protocols; The vascular system, - The liver; The Gall bladder and the Biliary system; The Pancreas; - The Gastrointestinal Tract ; The urinary system; The spleen; The Retroperitoneum; The Peritoneal cavity and Abdominal Wall; Abdominal Applications of Ultrasound contrast Agents; Ultrasound Guided Interventional Techniques; Normal Anatomy and physiology of the female pelvisThe Sonographic and Doppler Evaluation of the female pelvis; Pathology of the uterus, ovaries and the adnexa; The role of ultrasound in evaluating female infertility.

RGS 626: Echocardiography and vascular sonography

2 Units

The anatomy of the heart and related vasculature; scanning protocols for 2-D echo, duplex scanner and Doppler techniques A study of vascular anatomy, physiology, hemodynamics, wave form analysis, and treatment of vascular disease; carotid duplex/color flow imaging, upper and lower extremity arterial and venous duplex/color flow imaging, and ankle brachial indices. renal, intracranial, vein mapping, hemodialysis graft, plethysmography, and venous insufficiency duplex/color flow testing including the clinical history, physical assessment, and appropriate scanning protocol.

X-ray Transmission Computerized Tomography

RGS 625: CT of the musculoskeletal system

2 Units

Anatomy and Imaging of the Musculoskeletal System; anatomy; clinical indications; patient preparations; study protocol; guidelines for modifications; artefacts; windowing; indications and case studies of these regions.

RGS 623: Patient management and contrast media in CT

2 Units

Patient assessment and communication; intravenous injections; adverse reactions and management; interventional procedures after-care. Patient Care, Radiation Safety and Medical Ethics; Ethical and Legal Issues; Patient Education and Preparation; Radiation Safety and Measuring Radiation Dose; Patient Monitoring and Code Procedures; Vital Signs; Infection Control.

RGS 627: CT of the Abdomen and Pelvis

2 Units

Exam procedures, labeled anatomy and case studies for exams in the chest, abdomen, pelvis and the vessels of these regions as well as special procedures including PET/CT fusion imaging, CT arthrography, CT colonography, Clinical indications, scan protocols, contrast enhanced studies, artefacts, image appreciation and technique.

RGS 628: CT of the Head and Central Nervous System

2 Units

Indications for CT of head and CNS, scanning protocols and modifications, patient preparations, contrast enhanced studies, artefacts, image appreciation and critique. Exam procedures, labeled anatomy and case studies for exams in the Head and Neck and the Central Nervous system, and the vessels of these regions as well as special procedures including PET/CT fusion imaging.

RGS 604: Other Applications of CT

2 Units

Strategies in 3D image generations. CT simulation. Dual photon bone densitometry. Radiation therapy planning with CT, cardiac synchronization, calcium scoring, and left ventricular cardiac function; Special Imaging Techniques; Positron Emission Tomography / Computed Tomography (PET/CT)

RGS 614: CT Physics and Instrumentation

3 Units

Physical basis for CT; reconstruction softwares, CT number, radiation dose. Computed Tomography Defined; The principles of sectional imaging Overview of CT System Components; CT Scanner Designs Including Multi-Row Detector, Electron Beam, PET/CT Scanners and Cone

Beam CT in Oncology; Operator's Console; Host Computer; The Gantry; Patient Table; The CT X-ray Tube; Collimation; Detectors: Composition, Function, Single and Multi-Row; Picture Archiving and Communication System; Image Reconstruction Including Back Projection, Convolution, Iterative Reconstruction and Cone Beam Reconstruction; Retrospective Reconstruction; Retrospective Reconstruction; Volume Rendering; Filming and Archiving. CT Artifacts: Beam Hardening, Partial Volume Averaging, Motion; Metal, Edge Gradient Effect, Equipment-Induced and Cone Beam.instrumentation. Quality assurance tests.

Magnetic resonance Imaging (MRI)

RGS 605 Basic Physical Principles of MRI

2 Units

Introductory Concepts, Nuclear Magnetism, Longitudinal and Transverse Magnetization, Resonance, Longitudinal and Transverse Relaxation, Magnetism, resonance and MR signal generation; advanced MR pulse sequences and scanner functional options, Magnetic Resonance Imaging theory and application, flow phenomena & the principles of vascular MR imaging.

RGS 615 Instrumentation and Quality assurance in MRI

2 Units

Types of magnets used in MR system, types of coils, configurations and major features, encoding and image formation, slice selection and installation, requirements, shimming designs, MR system hardware, pulse sequence design, relaxation, MR equipment QA and MR facility design, MR equipment QA and MR facility design; data acquisition and processing and the physical principles of image formation. Image Weighting, MR Instrumentation, RF Coils, Technical Adjustments, Image Acquisition and Reconstruction.paramagnets and common contrast agents. Image optimization in MRI and trade-offs.

RGS 629 MR Imaging techniques for head and Central nervous System and Bones

2 Units

Introduction Neuro, Brain, Cranial Nerves, Pituitary Gland, Introduction Spine, Cervical, Thoracic, Lumbar; Musculoskeletal, Shoulder, Elbow, Wrist, Knee, Foot & Ankle. Typical clinical indications, selection and modification of MR scanning techniques and imaging protocols, together with normal and abnormal MR image appearances.anatomical landmarks for imaging.; guidelines for modifications;; image appreciation and critique. Advanced Neuro.

RGS 618 Pulse sequences and Contrast Agents

2 Units

MR image weighting and contrast; imaging procedures, Pulse Sequences, Imaging Parameters. Diffusion Weighted Imaging, Perfusion Weighted Imaging, Functional Imaging, MR

Spectroscopy, Advanced Body Imaging: Contrast Enhanced MR Angiography, Oral & IV contrast Agents.

RGS 616 MR Imaging techniques for chest and abdomen

2 Units

Clinical indications, scan protocols, guidelines for modifications.

Introduction Body, Upper Abdomen. MR Angiography. Typical clinical indications, selection and modification of MR scanning techniques and imaging protocols, together with normal and abnormal MR image appearances. with review of the principal applications in disease assessment and normal and abnormal appearances.

RGS 606 MRI Artefacts and Safety Considerations

2 Units

An introduction to MR artefacts, scanning features and safety in the MR environment. MR image artefacts and avoidance strategies, particular requirements for MR imaging of paediatric patients; patient care, MR safety. Patient Dependant Artifacts, System Dependant Artifacts, Patient Preparation, Environmental Safety, Patient Safety and Comfort.

RADIATION AND ENVIRONMENTAL PROTECTION

RGS 631 Radiation Physics, Detection and Dosimetry

2 Units

X-ray production and angular distribution of continuous spectrum energy levels and characteristics. Radioactive decay, chains equilibria nuclear models and Fission. Interaction of EMR with matter; slowing down and Absorption of both electrons and neutrons. Detection and dosimetry: their relationship and units of measurements. Dose meters. Gas, air and tissue equivalence. Scintillation/Solid state detectors and applications. Reactors, accelerators and isotopic sources. Measurement of activity, standards and shielding. Spectrometry and measurement techniques. Radioanalytical methods, "in vitro" and "in vivo".

RGS 632 Hazard Assessment From Radioactivity, Oil Spillage on the Environment

2 Units

Sources of environmental radioactivity, atmospheric Discharges and radioactive waste. Hazard assessment- principles objectives, dose limits, critical pathway analysis, emergency measures associated with reactor accidents; fission product inventory, proportions released from overhead fuel, atmospheric dispersion, emergency measures. Association with reactor accidents; fission product inventory, proportions released from overhead fuel, atmospheric dispersion, emergency reference levels and plans. Control measures for oil wells and pipelines. Strategy for assessing oil spillage monitoring programmes and safety measures. Sampling and significance of results.

RGS 633 Air Pollution from – Fuelled Industrial Processes and Aerosol Physics: 2 Units

Size of the problem, fuel usage in industry. Types of Air pollutant. Large scale industrial pollution. Methods of reducing pollution-chemical gas cleaning and chimney design. Nature of aerosol. Stokes law, settling rates (monodisperse), relaxation times. Limits of applicability to aerosol clouds. Cunningham corrections, heterogeneous aerosols and differential settler. Accelerated motion. Hidy and Brock equations, laminar and turbulent flow. Brownian motion. Stokes-Einstein diffusivity, root mean square displacement Probability densities in 1, 2, 3 dimension. Coagulation, Deposition on fixed sphere by diffusion. Survey of aerosol Control devices.

RGS 634 Radiation Protection and Environmental Monitoring 2 Units

Systems of dose limitations. External radiation control; industrial and medical x-ray installations, gamma and beta sources. Personnel monitoring-film badge, TLD, quartz fibre electrometers, biological monitoring. Radiation protection in factories and factory regulation. Administrative procedures and role of international bodies e.g. ICRP. Environmental monitoring. Monitoring of air, water, soil, food samples, neutral levels. Comparison of physical, chemical methods of analysis, applicability and sensitivity. Transport of radioactive materials; design of packaging, Transport regulation.

RGS 635 Nuclear Reactors, Nuclear Fuel Processing and Reactor Waste: 2 Units

General survey of present nuclear power production. And nuclear fuel resources. Reactor physical: neutron induced fission, energy releases, neutron cycle in thermal reactors. Reactor control and safety of operation. Shielding and monitoring. Management of nuclear fuel. Transportation to reprocessing plant and irradiated Fuel handling. Layout of fuel reprocessing plant. Plutonium Separation and fabrication of new fuel. Classification of Radioactive waste and disposal pathways.

RGS 636 Legislation and Economics of Environmental Protection: 2 Units

Legislation and organization of radiation protection in Nigeria. Anti pollution legislation. International legislation and organization. Environmental pollution optimum level and economic consequences.

RGS 637 Microwaves, Lasers and Environmental Noise: 2 Units

Sources of microwaves detection and physical properties. Propagation of electromagnetic waves. Radiation of electromagnetic waves and application of Radar and microwave. Microwave diathermy, lasers, Biological hazards and safety limits. General principles of sound, vibration and aerodynamics propagation of sound, transmission, absorption and insulation. Physical control of noise, measurement, DB analysis and presentation of result. Noise hazards, elementary

RGS 645 Radiobiological Aspects of Radiotherapy 2 Units

Radiation genetics and mutation. Types of tumours and repair mechanism. Mechanisms of spread, cellular control mechanisms. Cancer. Biological basis for radiotherapy of human tumours.

RADIOLOGY ADMINISTRATION AND MANAGEMENT

RGS 652 Health Planning, Policy Formulation and Implementation 2 Units

Health planning processes, need assessment, and implementation. Health facility planning and location. Installation of models and evaluation of programme. Effectiveness. Critical examination of health policies. National policy on health. The role of medical radiographer and other professional interest groups in the health care. Hospital organization. Research and development in the health care system. Role of the world health organization and other international agencies.

RGS 653 Health Economics and Budgeting: 2 Units

Examination of current thinking in the field of health economics and its role in planning health services. Overview of financial and cost accounting. Analysis of economic concepts. Health care financing, budgeting and budgetary control. Comparative allocation of resources. Options appraisal and evaluation. Cost-benefit analysis (CBA) and application. Total and marginal costing etc. medical audit, quality assurance, inventory control health issuance. Financial accounting, records and management.

RGS 654 Health Personnel and Office Management 2 Units

Executive management lines of Authority, Management by committees. Job evaluation, design and analysis. Recruitment and selection, performance appraisal. Delegation of functions. Organization of meetings. Decision making and communication techniques. Forms and styles of leadership. Leadership and staff training and welfare scheme. Managerial function and supervisory techniques. Human resources management and development in health services system. Office administration, records and management.

RGS 655 Dynamics of Health Management 2 Units

Analytical evaluations of specific cases peculiar to health care delivery system: sectoral analysis of health policy implementation. Professional dynamics: Resources utilization.

RGS 656 Health Care Environment and Organizational Behaviour 2 Units

Purpose of organization and structure. Communication processes. Health information system records and statistics. Professional responsibility and information control. Inter-departmental and intersectoral relationships. Group dynamics. Formal and informal group influence. Health services organization. Public and industrial relations. Principles of collective bargaining and joint consultative council. Evaluation and application of management principles in health care practices. Politics of health care delivery. Professionalism in the health care system. Comparative health care.

RGS 657 Health Laws and Regulations 2 Units

General principles of Nigerian law, law of tort, Contract and negligence, national, state and local legislations on health policy. Law of equity. Workmen Compensation act and pension scheme. Professional Responsibilities and the law. Ethics and practices. Occupiers Liability: Medical confidentiality.

RADIOLOGICAL EDUCATION

RGS651 Educational Administration and Planning in Radiography and Radiological 2 Units

Medical radiography and radiological education in Nigeria. Staff-personnel administration, student-personnel administration, student-personnel administration, school plan, finance and business management.

RGS 661 Curriculum Planning in Medical Radiography and Radiological Sciences Education 2 Units

Intensive study in theory and practice of curriculum. Radiological education and curriculum theory. A model for devising and appropriate curriculum theory for Nigeria.

RGS 662 Educational Innovations in Medical Radiography and Radiological Sciences: 2 Units

Concept of Innovation. Relevant innovation and radiological education. Process of innovation and barrier factors.

RGS 663 Educational Psychology in Medical Radiography 2 Units

Critical analysis and evaluation of selected learning theories. Learning environments. Learning disabilities.

PH.D COURSE WORK

First Semester

Courses	Title	Units
RGS 703	Advanced Research Methodology	3
PGC 701	Synopsis and Grant Writing	3
RGS 721	Entrepreneurship Studies	3
RGS 711	Current trends in radiography practice	4
Sub-total		13 Units

Second Semester

Courses	Title	Units
RGS 772	Research seminars I	2
RGS 774	Research Seminars II	2
RGS 776	Research Seminars III	2
RGS 592	Thesis	12
Sub-total		18 Units

PhD Coursework Description

RGS 703 Advanced Research Methodology

2 Units

Introduction to research; Philosophies and the language of research theory building; Thinking like a researcher; Problems and Hypotheses; Research design; Methods of data collection; Attitude measurement and scaling; Questionnaire designing – Reliability and Validity; Sampling techniques; Processing and analysis of data; Ethical issues in conducting research; Report generation, report writing, and APA format. Critical thinking skills; Critiquing research; Proposal writing; Academic Dishonesty: Cheating, plagiarism.

PGC 701 Synopsis and Grant Writing

3 Units

Identification of types and nature of grants and grant writing: mining of grant application calls on the internet. Determining appropriate strategy for each grant application. Study of various grant application structures and contents and writing of concept notes, detailed project description, budgeting and budget defense. Study of sample grant writings in various forms and writing of mock research and other grants. Identification of University of Nigeria synopsis structure and requirements (Introduction, Methodology and Results). Determining the content of each sub-unit of the synopsis. Steps in writing the synopsis from the Dissertation/Thesis document. Structural and Language Issues. Common errors in synopsis writing and strategies for avoiding them. The roles of the student and supervisor in the production of synopsis. All

registered PhD students must attend a solution-based interactive workshop to be organized by the School of Post-Graduate Studies for a practical demonstration and application of the knowledge acquired from the course, conducted by selected experts.

RGS 721 Entrepreneurship Studies

2 Units

Entrepreneurship: Definition and philosophy, History, and Role within the economy; Entrepreneurship in different contexts: Social, Organizational and Individual; Types of new ventures: Franchises, Family businesses, Business-within-a-business (entrepreneurship), and Start-ups; Entrepreneurial style: Nature vs. Nurture, Strengths and weaknesses, Sustainable across time and organizational settings; Creative problem-solving: Courage to create, Overcoming obstacles, Selling your idea to others; The entrepreneurial management process: Opportunity and the entrepreneur, Analyzing and testing opportunity, Preparing for the future - planning for growth; Business concepts/models: From solution to innovative product/service, From product/service to business concept (value proposition), From business concept to feasibility study; Ethics and social responsibility: Dilemmas and choices (partners vs. solo, money and control, technology and innovation, etc.), Giving back to the community, Case studies; Entrepreneurs as role models: Famous (and not so famous) entrepreneurs and what we can learn from them, Differences in experience and leadership style.

RGS 711 Current trends in radiography practice

2 Units

Tele-radiology; Diagnostic imaging in emergency room; Interventional radiology; US of tendons and muscles; Molecular imaging; Osteoporosis imaging; Nanotechnology in imaging; Team building and Team working.

RGS 772 Research seminars I

2 Units

Candidates present seminar on topics in the candidate's specialty.

RGS 774 Research Seminars II

2 Units

Candidates present seminar on topics in the candidate's specialty.

RGS 776 Research seminars III

2 Units

Candidates present seminar on topics in the candidate's specialty and research.