

**KADUNA STATE UNIVERSITY**  
**COLLEGE OF MEDICINE**  
**FACULTY OF ALLIED HEALTH SCIENCES**  
**DEPARTMENT OF RADIOGRAPHY**



**CURRICULUM FOR UNDERGRADUATE  
STUDENTS**

**2020 (1<sup>st</sup> Edition)**

## **INTRODUCTION**

Medical Radiography involves the use of ionizing radiation (including X-rays) and other forms of radiant energy such as ultrasound and nuclear magnetic resonance in the diagnosis and treatment of diseases. Medical radiography is an arm of modern Medical Sciences and the pivot of modern diagnostic medicine.

There is rapid scientific and technological advancement in the field of modern medicine that can only be fully and effectively harnessed with enhanced university educational training. University training is a pre-requisite for proper understanding and application of modern technology as well as for the necessary innovative approach in carrying out complex radiographic procedures.

There are only four institutions in the whole of Northern Nigeria besides Kaduna State University (KASU) that are offering a University based education in Medical Radiography. In fact, the course is currently being offered in only 9 institutions in the country, namely. University of Calabar; University of Nigeria, Enugu Campus; University of Maiduguri; University of Lagos; Nnamdi Azikiwe University, Bayero University Kano, Usmanu Danfodio University, Ahmadu Bello University Zaria and Kaduna State University. The current programme is the fifth one in the entire Northern Nigeria.

## **DEPARTMENTAL MISSION STATEMENT**

The mission of the department is to provide appropriate and adequate training opportunity for the application of high technology and conventional medical imaging systems in medicine to aid diagnosis, treatment, management and research.

## **VISION STATEMENT**

1. Students are provided with the kind of experience that will enable them to develop their full potential in open, honest, friendly and stimulating environment where people are kindly accepted, valued and ideas discussed without reservations.
2. Every staff is respected, committed and takes part in the decision-making process to provide services and quality education.

## **RATIONALE**

1. The acute shortage of Medical Radiographers in Nigeria has received the attention of governments at various levels. The need to remedy this situation becomes more imperative today as many medical establishments and hospitals continue to acquire state-of-the-art diagnostic and therapeutic radiologic equipment.

2. Rapid scientific and technological advances can only be effectively harnessed to optimum practical application and utilization with enhanced university education.
3. The Radiographer of today needs to carry out complex radiological investigations in the hospital, design or innovate parts of equipment and accessories and apply modern management technique to organize his department for maximum efficiency.

### **PHILOSOPHY OF THE PROGRAMME**

The philosophy of the Kaduna State University (KASU) Bachelor of Radiography degree program in the Department of Medical Radiography is to provide an educational atmosphere that imparts students with a desire for learning, excellence in clinical performance and intellectual curiosity. The program is maintained with the highest standard of excellence, and the faculty is committed to providing the students with basic and advanced knowledge in the art and science of radiography as well as developing in them, a spirit of understanding and compassion for their patients. The program provides a competency based education (CBE) with Case-based Learning (CBL) process that enable students to attain both the problem solving knowledge and the technical ability necessary to be highly skilled competent professional radiographers of international standard that can address and handle the emerging technological needs in medical radiography in accordance with the guidelines of the National Universities Commission (NUC) and the Radiographers Registration Board of Nigeria (RRBN).

The global trend for radiography practice in University-based training due to great advances in the sophistication and diversity of medical imaging equipment as well as the scientific knowledge, its application and expertise required for this practice of radiography.

The training in Radiography will prepare graduates to become confident members of healthcare teams and competent supervisors of laboratories and other clinical settings.

#### **AIM:**

The aim of introducing this course is to address the acute shortage of manpower, especially in this part of the country. There are only a handful qualified Radiographers now practicing in the entire Northern region with an estimated population of over 80 million. The primary objective of the B. RAD program is to provide a social and professional atmosphere in which the students can obtain the skills and attitudes necessary for an eventual position in the field of Medical Radiography and improve the dearth of qualified Radiographers in Northern Nigeria.

## OBJECTIVES

The program is designed to fulfill the following objectives:

- a. To produce Radiographers with relevant practical and technological competence in the practice of radiography at the primary, secondary and tertiary levels of health-care delivery.
- b. To produce radiographers who can assume professional positions involving the use of the most complex radio-diagnostic equipment and procedures,
- c. To produce professionals with a high level of proficiency in conventional radiography and with a good working knowledge of other imaging modalities including Therapeutic Radiography,
- d. To produce professionals who will be eligible for postgraduate studies, research and development.

## ADMISSION REQUIREMENT

Candidates seeking admission into Bachelor of Radiography (B.RAD) in the Faculty of Allied Health Sciences must have passed the Secondary School Certificate Examination NECO/West African Examination Council with Minimum of 5 credits including English Language, Mathematics Biology, Chemistry and physics in not more than two sittings. Candidates can be admitted into the programme at 100 level or 200 level.

### A. UTME Requirements (100 level)

- i) The compulsory UTME subjects are Biology, Chemistry and Physics and English. Candidates must obtain the appropriate cut - off points of the University in UTME.
- ii) Candidates entering into 100 level from College of Basic and Remedial studies (CBRS) must also have a minimum of 2.40 GPA as well as sit for UTME with not less than 200 points and must also possess the required minimum 5 credits in English Language, Mathematics, Biology, Chemistry and Physics in not more than one sitting.

### B. Direct Entry Requirements (200 level)

- i) Candidates must have a minimum of upper credit at Advanced level in Biology, Chemistry and Physics together with 5 O/level passes at credit level.
- ii) **Board/Council Certified Diplomas** in X-ray/dark room technician  
**Note:** Holders of Board/Council certified diplomas may be required to undergo an entry screening examination.
- iii) Minimum of 10 points for IJMB.
- iv) Candidates with a minimum of second-class upper degree in any of the Basic sciences from a recognized university.

### **Inter-University Transfer Mode**

Students can transfer into 200-Level courses provided they have relevant qualifications and the requisite CGPA

### **Registration Guidelines**

All Students who were successfully admitted into the department at the beginning of each academic year in accordance with the rules made by the University senate shall observe the following steps during registration:

- i) Each student should come with original copies of all relevant credentials and supportive documents
- ii) Clearance Slips must be collected by each student from the faculty
- iii) Further Screening in the Academic Planning Unit
- iv) Each student will pay some dues and other charges for registration
- v) Activation of Matriculation number as well as collection of pins
- vi) Each student will be required to do online registration, providing all his/her basic information. Students will be required to show originals of their certificates alongside their passport photographs.
- vii) They must obtain list of courses to be taken from different Faculties as well as signatures of all appropriate University Authorities and lecturers involved.
- viii) All completed registration forms must be printed, photocopied; each photocopy should be submitted to the departments, Faculty, College and Academic Planning Unit of the University.
- ix) All new students must attend Orientation organized by the Faculty.

### **Duration of the Programme**

#### **Minimum duration**

The Bachelor of Radiography (B.RAD) shall run for a minimum period of five (5) academic sessions for entry through UME and four (4) academic sessions for direct entry.

#### **Maximum duration**

For Bachelor of Radiography the maximum period of study permissible shall be nine (9) academic sessions for entry through UME and eight (8) academic sessions for direct entry.

### **Repeating a Class**

Students shall be allowed to repeat a class (level) only once. Students shall not be allowed to repeat 100 level.

## **Attendance in Laboratory Practical, Seminars, Tutorials, Clinical Sessions, Community trips and Theatres**

Attendance to all these (above) are compulsory for all students at the appropriate levels.

### **Progression from one level to another Level**

#### **100 Level to 200 Level:**

Student must pass all the **core courses** (Mathematics, chemistry, physics and biology). Scores obtained by a student in the courses under each **course** shall be summed and least average of 40% shall be the pass mark for each **course**.

#### **200 Level to 300 Level:**

A student must pass all the courses registered at Level 200. Students who fail  $\leq \frac{1}{4}$  of the total credits registered at Level 200 shall **resit** the failed courses. A candidate who fails more than  $\frac{1}{4}$  to  $\leq \frac{1}{2}$  of the credits registered or failed any resit exams shall **repeat** the level. A candidate who fails more than  $\frac{1}{2}$  of the credits registered would be advised to withdraw.

#### **Note: The following applies to levels 200 and above**

1. **GSP** courses are not determinants of progression but they are determinants of graduation (students shall be allowed to carry over GSP courses).
2. For scores obtained by each student, an average of 50% shall be the pass mark for each **course**.
3. **Re-sit** students can only obtain a maximum score of 50% in each of the courses.
4. **Any** withdrawal decision reached at any level in any department is also withdrawal from the entire Faculty.

#### **300 Level to 400 Level:**

A student must pass all the courses registered at Level 300. Students who fail  $\leq \frac{1}{4}$  of the total credits registered at Level 300 shall **resit** the failed courses. A candidate who fails more than  $\frac{1}{4}$  to  $\leq \frac{1}{2}$  of the credits registered **or** fails **any** resit exam shall **repeat** the level. A candidate who fails more than  $\frac{1}{2}$  of the credits registered would be advised to withdraw.

#### **400 Level to 500 Level:**

A student must pass all the courses registered at Level 400. Students who fail  $\leq \frac{1}{4}$  of the total credits registered at Level 400 shall **resit** the fail courses. A candidate who fails more than  $\frac{1}{4}$  to  $\leq \frac{1}{2}$  of the

credits registered **or** fails **any** resit examination shall **repeat** the level. A candidate who fails more than ½ of the credits registered would be advised to withdraw from the Faculty.

### **RRBN examination system**

There will be two (2) professional examinations taken at the end of year 3 and year 5 alongside school exams. Suitable external examiners shall **review** questions for the professional examinations in 300level and 500level. The examination should be on the following courses:

**Part I:**(1<sup>st</sup> Professional Examination) - at the end of 300 levels: Basic/radiation Physics; Hospital Practice and Care of Patients: Radiographic Anatomy, Physiology, Biochemistry and General Pathology. Candidate must pass this examination at first attempt before proceeding to 400 level.

**Part II:**(2<sup>nd</sup> Professional Examination) - at the end of 500 level: Radiographic Technique. Equipment for Diagnostic Radiography, Radiographic Photography and Image Processing. Candidate must pass this examination at first attempt before graduation.

There will be no re-sit for the RRBN professional examinations. Any student that fails this examination at first attempt must repeat the entire session with all the registered courses.

To qualify for the examination, students should have taken part in 75% of the academic programme. Records of clinical training (Log books) must be presented before admission into Practical and Viva-voce examinations.

### **STRATEGY FOR IMPLEMENTATION**

For academic inputs at 100 level which require the teaching of basic sciences such as Chemistry, Physics, mathematics, biology and the Use of English, the Kaduna State University has adequate teaching facilities and manpower in handling and examining these ancillary courses.

For the academic inputs at 200 & 300 levels, which require the teaching of Anatomy, Biochemistry Physiology. Pathology and Clinical Biochemistry, the College of Medicine, Kaduna State University has an adequate facilities and staff that are participating in the teaching and evaluation of these courses.

The 3<sup>rd</sup> and 4<sup>th</sup> and 5<sup>th</sup> year (Clinical) will be spent in the departments of Radiology of Barau Dikko Teaching Hospital, for Clinical training and other approved clinical sites.

**Mode of Study:** Candidates are required to register on full time. No part time registration will be allowed.

**Type of Course System:** -A Course credit system will be adopted, where by instruction is by course, specified into course units.

**Course Coding System:** A system of identifying a course using the combination of 3 letters and 3 digits according to Kaduna State University standard would be used. The 3 letters for Medical Radiography are RDG, while the first of the three number digits donates the Level.

**Classification of Degree**

The B.RAD programme in Kaduna State University (KASU) is Unclassified

**Passing grade**

A passing grade of at least C in each examination is essential for graduation.

**COURSE SUMMARY PER SEMESTER**

**100 Level Courses**

**1<sup>st</sup> Semester courses**



<b>Course Code</b>	<b>Course Title</b>	<b>Credit unit</b>
BIO 101	General Biology I	2
BIO 103	General Biology Laboratory I	1
CHM 101	General Chemistry I	2
CHM 103	Inorganic Chemistry I	2
CHM 105	Practical Chemistry-I	1
CSC 111	Introduction to Computers	2
PHY 101	General Physics Laboratory I	1
PHY 103	Mechanics, Thermal Physics and Waves	3
MTH 107	Sets & Number Systems	2
GST 101	Communication in English	2
GST 103	Nigerian People & Culture	2
GST 125	Contemporary Health Issues	2

***TOTAL 1<sup>st</sup> SEMESTER CREDIT UNIT=22***

**2<sup>nd</sup>Semester Courses**

<b>Course Code</b>	<b>Course Title</b>	<b>Credit Units</b>
BIO 102	General Biology II	2
BIO 104	General Biology Laboratory II	2
CHM 104	Introduction to organic Chemistry	2
CHM 106	Practical Chemistry II	2
CHM 108	Introductory Physical Chemistry	1
PHY 102	Behavior of Matter	2
PHY 104	Practical Physics II	1
MTH 102	Elementary Mathematics II	3
CSC 102	Introductory computer	2

***TOTAL 2<sup>nd</sup> SEMESTER CREDIT UNITS=16***

**100 Level TOTAL (1<sup>st</sup>& 2<sup>nd</sup> SEMESTERS) CREDIT UNITS = 22 + 16 = 37**

**200 Level Courses**

**1<sup>st</sup> Semester courses**

Course Code	Course Title	Credit Units
PHY 213	Radiation physics-I	2
RDG 205	Hospital procedure & care of patients	1
ANT 213	Gross anatomy-I (Upper & lower limbs)	2
ANT 215	Embryology and Medical Genetics	1
ANT 211	Histology of basic tissues	1
HPH 221	General principles, Blood & body fluid	2
HPH 223	Cardiovascular and Respiratory Physiology	2
HPH 225	Endocrinology and Reproductive Physiology	2
BCH 201	General biochemistry-I	2
BCH 203	General biochemistry-II	1
AHS 201	Biostatistics	2
CSC 201	Introduction to Computer Science for DE	2
GST 201	Communication in English	2
GST 203	History and Philosophy of Science	2

***TOTAL 1<sup>st</sup> SEMESTER CREDIT UNIT=22***

**2<sup>nd</sup> Semester courses**

Course Code	Course Title	Credit Units
PHY 226	Radiation physics-II	3
ANT 222	Gross anatomy-II (Thorax, abdomen, pelvis & perineum)	3
ANT 224	Histology-II	2
GST 202	Logic philosophy and Human Existence	2
HPH 224	GIT and Renal physiology	2
HPH 226	Neurophysiology & special senses	2
RDG 204	Introduction to Radiography Procedure	2
BCH 202	General biochemistry-II	2
BCH 204	Practical biochemistry-II	1
GST 204	Peace studies and conflict Resolution	2
HPH 222	Practical Physiology	1

***TOTAL 2<sup>nd</sup> SEMESTER CREDIT UNITS=22***

***200 Level (1<sup>st</sup> & 2<sup>nd</sup> Semesters) TOTAL Credit Units = 44***

**300 Level Courses**

**1<sup>st</sup> Semester courses**

Course Code	Course Title	Credit
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		<b>Units</b>
RDG 301	Radiographic Technique – I (Positioning)	<b>3</b>
RDG 303	Radiographic Anatomy & Physiology – I	<b>2</b>
RDG 305	Radiation Biology,	<b>2</b>
	Dosimetry & Protection	<b>2</b>
PCL 301	Introductory Pharmacology I	<b>2</b>
ANT 301	Gross Anatomy – III (Head, Neck & Sp. Senses)	<b>3</b>
ANT 303	Neuroanatomy	<b>2</b>
BCH 301	Clinical Biochemistry & Immunology	<b>2</b>
PAT 301	General Pathology I	<b>2</b>
	Radiographic Contrast Media	<b>2</b>
EEP 301	Entrepreneurship and Innovation	<b>2</b>

***1<sup>st</sup> SEMESTER TOTAL Credit Units=24***

**2<sup>nd</sup> Semester courses**

<b>Course Code</b>	<b>Course Title</b>	<b>Credit Units</b>
RDG 302	Physics of Cross Sectional Images	<b>2</b>
RDG 304	Radiographic Technique – II (Positioning)	<b>3</b>
RDG 306	Radiographic Image Production – I	<b>2</b>
RDG 308	Radiographic Anatomy & Physiology – II	<b>2</b>
RDG 310	Radiographic Equipment – I (Operation)	<b>2</b>
PCL 302	Pharmacology for medical imaging	<b>2</b>
RDG 312	Clinical Posting – I	<b>3</b>
MMB 314	Medical Microbiology & Parasitology	<b>2</b>
RDG 316	Psychology and Medical Sociology	<b>2</b>

***2<sup>nd</sup> SEMESTER TOTAL Credit Units =20***

**300 Level TOTAL (1<sup>st</sup>& 2<sup>nd</sup> SEMESTERS) CREDIT UNITS=46**

**400 Level courses****1<sup>st</sup> Semester courses**

<b>Course Code</b>	<b>Course Title</b>	<b>Credit Units</b>
RDG 401	Radiographic Technique-III	3
RDG 403	Radiographic Equipment-II	2
RDG 405	Radiographic Image Production-II	2
RDG 407	Clinical Radiography Posting –II	3
RDG 409	Principles of Radiotherapy & Oncology	2
RDG 411	Computed Tomography	2
RDG 415	Magnetic Resonance imaging	2
RDG 417	Ultrasound Imaging I	2
EEP 401	Business Creation and Growth	2
RDG 413	Radiographic Anatomy and Physiology-III	2
RDG 419	Artificial Intelligence	2

*1<sup>st</sup> SEMESTER Total Credit Units=24*

**2<sup>nd</sup> Semester courses**

<b>Course Code</b>	<b>Course Title</b>	<b>Credit Units</b>
RDG 402	Radiographic Technique-IV	3
RDG 404	Radiographic Equipment-III	2
RDG 406	Radiographic Imaging-III	2
RDG 408	Clinical Radiography Posting –III	3
RDG 410	Research Methodology –I	2
RDG 412	Community Health	2
RDG 414	Radiographic Anatomy and Physiology- IV	2
RDG 416	Image Critique/Pattern Recognition	2
RDG 420	Radionuclide Imaging	2
RDG 422	Mammography	2
RDG 424	Introduction to Angiography	2
RDG 418	Research Seminar (Departmental Seminar)	2

*2<sup>nd</sup> SEMESTER TOTAL CREDIT UNIT=24*

*400 Level (1<sup>st</sup>& 2<sup>nd</sup> Semesters) TOTAL Credit Units =48*

**500 Level courses**  
**1<sup>st</sup> Semester courses**

<b>Course Code</b>	<b>Course Title</b>	<b>Credit Units</b>
RDG 501	Radiographic Technique-V	3
RDG 503	Radiographic Equipment-IV	2
RDG 505	Radiographic Imaging-IV	2
RDG 507	Medical Ethics and Jurisprudence	3
RDG 509	Research Methodology II	2
RDG 517	Ultrasound Imaging II	3
RDG 511	Quality Assurance	2
RDG 513	Community Health (by Community Medicine Dpt.)	2
RDG 514	Research Seminar	3

*1<sup>st</sup> SEMESTER TOTAL CREDIT UNIT=22*

**2<sup>nd</sup> Semester courses**

<b>Course Code</b>	<b>Course Title</b>	<b>Credit Units</b>
RDG 502	Radiographic Technique-VI	3
RDG 504	Radiographic Equipment-V	2
RDG 506	Radiographic Imaging-V	2
RDG 508	Clinical Radiography Posting –V	6
RDG 510	Research Project	5

*2<sup>nd</sup> SEMESTER TOTAL CREDIT UNITS=18*

*500 Level (1<sup>st</sup>& 2<sup>nd</sup> Semesters) TOTAL Credit Units=40*

TOTAL CREDIT UNITS REQUIRED FOR GRADUATING WITH BACHELOR IN RADIOGRAPHY (B.RAD) DEGREE: TOTAL CREDIT UNITS (100 LEVEL + 200 LEVEL + 300 LEVEL + 500 LEVEL (38 + 44 + 46 + 48 + 40) = 216 Credit **Units** for **ALL** Courses.

**SUMMARY OF CREDIT LOAD**

<b>Level</b>	<b>Credit unit</b>	<b>Cumulative</b>
100	38	38
200	44	82
300	46	128
400	48	176
500	40	216

## **COURSE DESCRIPTION**

### **DESCRIPTION OF NON-DEPARTMENTAL COURSES FOR BACHELOR IN RADIOGRAPHY DEGREE (B. RAD) PROGRAMME**

#### **100 LEVEL COURSES**

##### **BIO 101: GENERAL BIOLOGY I (ZOOLOGY I)**

Animal cell structure, organization, and functions of the cellular organelles; Diversity, characteristics, and classification of animals; Animal reproduction and interrelationship.

##### **BIO 102: GENERAL BIOLOGY II (ZOOLOGY II)**

A generalized survey of the animal kingdom based mainly on study of similarities and differences in their external features with examples from Platyhelminthes, Annelids, Arthropods, Fishes, Amphibians, Reptiles, Birds and Mammals.

##### **BIO 103: GENERAL BIOLOGY III (BOTANY I)**

Plant cell structure and organization: functions of plant cell organelles, Diversity, characteristics and classification of plants: Plant reproduction; heredity and evolution; elements of ecology and types of habitats.

##### **BIO 104: GENERAL BIOLOGY IV (BOTANY II)**

A generalized survey of the plant kingdom based mainly on study of similarities and differences in their external features with examples from viruses, bacteria, protozoa, algae, fungi, bryophytes. Pteridophytes, gymnosperms and angiosperms.

##### **CHM 102: INORGANIC CHEMISTRY**

Principles of atomic structure, isotopes, empirical and molecular formulae: Electronic configuration, periodicity and building up of the periodic table:

Hybridization and shapes of simple molecules; Extraction of metals; Comparative chemistry of Group IA and IVA elements; Preparation, Properties, structure and application of some selected compounds. Introduction of Transition metal chemistry and nuclear chemistry.

##### **CHM 101: ORGANIC CHEMISTRY**

Historical survey of the development and importance of organic chemistry; IUPAC Nomenclature and classification of organic compounds,

Homologous series, Covalent bonds and hybridization to reflect the tetravalency of carbon in organic compounds, electronic theory

In organic chemistry; Qualitative and quantitative organic chemistry; Determination of empirical and molecular formulae; Simple techniques of writing structural formulae Isolation and purification of organic compounds: saturated hydrocarbons; structural isomerism; Properties and reactions of alkanes and cycloalkanes, mention of their chemistry and uses in petroleum; unsaturated hydrocarbons; alkenes, alkynes, Cycloalkanes: cis-trans isomerism; Simple electrophilic addition reactions; Polymerization.

### **CHM 103: PHYSICAL CHEMISTRY**

Principles of atomic structure, isotopes, empirical and molecular formula; Nuclear structure, atomic fission and nuclear energy; The electronic structure and arrangement of electrons in atoms; Electronic configuration of 1<sup>st</sup> and 2 rows of elements; Properties of gases: equation of state, kinetic and molecular theory of gases, and heat capacities of a gas; Equilibrium and thermodynamics; Thermo chemistry, Enthalpy of reactions, bond energies, thermodynamic cycles. Hess' law. Born Haber cycle, the meaning of  $K_a$ ,  $K_p$  and  $K_c$ , Le Chatelier's principle,  $pH$ , ionic equilibrium, buffers, indicators, solubility product, common ion effect, redox reactions Electrode potentials, electrolytes and electrolysis; Kinetics: The Position of equilibrium and the rate at which it is attained; Factors influencing the rate of reactions Introduction of activation and catalysis.

### **CHM 104 & CHM 105: PRACTICAL CHEMISTRY I & II**

Laboratory instructions and experimental products shall be conducted for the candidates from the following subject areas:

**Physical:** Determination of heats reaction, effect of solutes on boiling points of solvents, partition coefficient; Determination of molecular mass by Dumas and Victor Meyer methods

Measurements of rate of equation and activation energy; other experiments based on the scope of the lectures and as approved by the Department

**Organic:** Safety precaution instructions, classification of organic compounds by their solubility in common solvents; Qualitative analysis for

Common elements in organic compounds, identification and classification of acids and bases functional groups; Identification of the following:

neutral functional groups, alcohols, aldehydes, ketones, esters, anhydrides and others; Acetylation of aniline as an example of the preparation of solid aniline derivative; An electrophilic addition reaction

**Inorganic:** Qualitative and quantitative analysis; molarity, concentration and percentage purity.

**PHY 101: MECHANICS**

Space and time, frames of reference, units and dimension, kinematics; Fundamental laws of mechanics, statics and dynamics; **Galilean** invariance; Universal gravitation; Work and energy; Rotational dynamics and angular moments conservation laws

**PHY 103: ELECTRICITY AND MAGNETISM**

Electrostatics: Conductors and currents; Dielectrics; Magnetic fields and induction; Maxwell's equations; Electromagnetic oscillations and waves and their applications.

**PHY 102: BEHAVIOUR OF MATTER**

Molecular treatment of properties of matter, elasticity: Hook's law; Young's shear and bulk modulus; Hydrostatics; Bernoulli's and continuity equations, Turbulence, Reynolds number. Viscosity; Laminar flow, Poiseuille's equation; Surface tension; adhesion, cohesion, capillarity, drops and bubbles; Temperature; the Zeroth law of thermodynamics; heat; gas laws of thermodynamics; Kinetic theory of gases Applications.

**PHY 104 & PHY 105: PHYSICS PRACTICALS I & II**

This introductory course emphasizes quantitative measurements, the treatment of measurement errors, and graphical analysis. A variety of experimental techniques will be employed. The experiments include studies of matter, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, viscosity, etc., covered in the above physics course.

**MTH 101: ELEMENTARY MATHEMATICS I (ALGEBRA AND TRIGONOMETRY)**

Elementary set theory: subsets, union, intersection, complements, Venn diagram, Real numbers, Integers, Rational and irrational numbers. Real sequences and series. Theory of quadratic equations, Binomial theorem. Circular measure. Trigonometric functions of angles of any magnitude, trigonometric formulae.



## **MTH 102: ELEMENTARY MATHEMATICS II (CALCULUS I)**

Function of a real variable, graphs, limits and idea of continuity. The derivative, as limit of rate of change: Integration as an inverse of differentiation: methods of integration, definite integrals; Applications areas, and volumes.

## **200 LEVEL COURSES**

### ***ANATOMY***

#### **1. ANT 213: Introductory Anatomy & Gross Anatomy of the Upper and Lower Limbs**

Philosophy, Methodology, Language and general descriptive terms in Anatomy. Skin, fascia, muscles, bones, joints, bloodvessels, nerves, lymphatic, etc. The pectoral girdle and associated joints (Sternoclavicular, acromioclavicular). Muscles acting on the shoulder joint, The axilla and Brachial Plexus, The Anatomy of the Breast, Blood supply. Venous drainage and lymph drainage, Flexor and Extensor-Compartments of arm, The elbow joint, and muscle acting on it. The flexor and extensor compartment of the fore-arm, Wrist Joint, and muscles acting on it. The anatomy of the hand, The blood supply and Anastomosis of the upper limb (around 17 scapula, humerus, elbow and hand), Dermatomes of the upper limb. The front of the thigh I (Femoral triangle, femoral canal and hernia, subsartorial canal). The front of the thigh II: The medial side of the thigh; The gluteal region; The back of the thigh; The popliteal fossa; The front of the leg and the dorsum of the foot; The lateral side of the leg; The back of the leg; The sole of the foot (arches of the foot); The hip joint and the knee joint; The tibio-fibular joints, ankle joint and the joints of the foot. Dermatomes of the lower limb. Surface anatomy, applied and radiological anatomy of the upper and lower limb. Gross anatomy shall include classroom lectures and dissection sections. Examinations shall include both written and practical examinations and viva-voce.

Man. The lower limb Introduction, lymphatic and venous drainage, blood supply of lower limb. The thigh-anterior medial posterior compartment, clinical aspects, drainage of limbs, the thigh — posterior compartment, popliteal fossa. The hip joint e.t.c. Leg-Anterior Lateral Posterior compartment. Dorsum of foot, knee joint and muscles acting on it. Inversion and Eversion. Ankle joint, muscles acting on it, dermatomes of the lower limb.

#### **2. ANT 211: Histology of Basic Tissues (2CU)**

Introduction to histological techniques for light microscopy, units of measurements in microscopy. Components of the cell, cell cycle, chromosomes, protein secretion and transcription of DNA. General histology of the basic tissue; including special connective tissues, epithelial tissues,

muscle tissues, nervous tissue, lymphoid tissues, cartilage, bone and blood. The course will have a laboratory component.

- 3. ANT 215 (Embryology and Medical Genetics):** General embryology including Oogenesis, gametogenesis, development of ovarian follicle, ovulation, fertilization, cleavage, formation of blastocyst, implantation, folding of embryo, placentation that is formation and functions of placenta and umbilical cord; fetal membranes and development of limbs. Mitotic changes in oocytes, formation and function of the zonapellucida, follicular growth. Preovulatory menstruation, post-ovulation atresia. Spermatogenesis and the spermatozoa. Testis before and at puberty, seminiferous epithelium. Spermatogenic cycles and time rotations in spermatogenesis, cycles and seasons—puberty, oestrous and menstrual cycles, ovulation, pseudopregnancy and pregnancy, delays in reproduction. Fertilization- egg and sperm transport, capacitation, acrosome reaction and sperm penetration. Immediate response to sperm penetration, prenuclear development and syngamy. Errors of fertilization, fertilization in vitro. Pre-embryonic period- cleavage, embryonic cell differentiation, foetal membranes, implantation and formation of placenta at birth. Development of Cardiovascular system, Integumentary system, Respiratory system, Digestive system, Urological system. Developmental anomalies and clinical syndromes.

Introduction to genetics, chromosomal abnormalities, single gene disorders and multi factorial disorders.

#### **4. ANT 222: Gross Anatomy of Thorax, Abdomen, Pelvis and Perineum**

##### **Anatomy of Thorax**

The thoracic cage; apertures and its frame work:Anatomy of the lungs and pleurae, respiratory movements; superficial structure,Thoracic duct, Sternal joints, Sternocostal joints, Interchondral joints Costochondral joints, Costovertebral joints, Joints and Ligaments of the Vertebral column,intercoastal arteries and veins, internal thoracic artery, mediastina and diaphragm,Lateral parts and pleurals, Roots of the lungs, Lobes of the lungs, Intrapulmonary structure, heart and large vessels;Sternocoastal surface of the heart, Surface anatomy of the heart Chambers of the heart, Structure of walls of heart,.trachea, bronchi; lymphatic drainage of thorax; correlation of course with clinical medicine; regional anatomy, surface anatomy and radiological anatomy. The student will dissect the thorax.

##### **Anatomy of Abdomen**

The Abdominal walls including planes; hernia, peritoneal cavity. Diaphragm, Abdominal viscera – stomach, intestines, liver, pancreas, spleen, pancreas, kidneys and suprarenal. The blood vessels and nerves in the abdomen, Lymphatic GIT. Applied anatomy, surface and radiological anatomy. The student will dissect the abdomen.

### **Anatomy of Pelvis and Perineum**

The bony pelvis, joints of the pelvis, determination of sex of pelvic bones. The pelvic organs – male and female. Pelvic walls and floor, pelvic peritoneum, viscera, nerves and vessels. The perineum – male and female; external genitalia – correlation with reproduction, child birth and other clinical aspects. Superficial/Deep perineal pouches, The student will dissect the pelvis and perineum.

### **5. ANT 211: Histology of Basic Tissues (2CU)**

Introduction to histological techniques for light microscopy, units of measurements in microscopy. Components of the cell, cell cycle, chromosomes, protein secretion and transcription of DNA. General histology of the basic tissue; including special connective tissues, epithelial tissues, muscle tissues, nervous tissue, lymphoid tissues, cartilage, bone and blood. The course will have a laboratory component.

### **6. ANT: Anatomy Practical (I & II)**

## **PHYSIOLOGY**

### **1. HPH 221: General Principles Blood and Body Fluids (2 Credit Units)**

**General physiology;** Introduction to Physiology (different fields of physiology and their relationship with other field of science), homeostasis and control systems of the body, it also covers **cellular physiology** including cell structures and organelles, cell membrane, cell juncture, cellular transport passive and active, Dynamic resting membrane potentials and its causes, Electrolyte changes, Homeostasis and positive/negative feedback mechanism and its significance. Osmosis, diffusion, active transport, Cell organelles — forms and functions, Intracellular communications, receptors and ions channels. Cells signalling, introduction to patch clamp technique.

**Excitable Tissues and Autonomic Nervous System;** Basis of RMP, AP, graded potentials, synapses types mechanism and properties, neuromuscular junction, Mechanisms of skeletal muscle contraction, structure of skeletal muscle, types of muscle fibers, types of contraction, excitability changes, ionic changes, mechanical changes, Metabolic changes, thermal changes. Fate of lactic acid, effect of successive stimuli tetanus, and effect of loading, Fatigue and its causes, comparison between skeletal, smooth and cardiac muscles. Electrophysiology of the heart, cardiac cycle, venous

return, circulatory adjustment to exercise. General, origin, distribution and functions of parasympathetic and sympathetic nervous system, Pharmacology of autonomic nervous system, Classification, comparison between sympathetic and Parasympathetic, sympathetic, origin distribution, function. Parasympathetic origin distributed and functions, Types of automatic receptors and the receptors pharmacology, adrenergic fibers and receptor, distribution and catecholamine, sympathomimetics and sympatholytics, cholinergic fibers and receptors acetylcholine, sites cholinergic blockers, ganglionic blockers muscarinic and nicotinic receptors. Atropine, parasympathomimetics and parasympatholytics.

**Blood, Immunology, and blood vessels**, general functions of blood, composition of blood, plasma proteins, types, origin and its functions. Red blood cells structure, functions, haemoglobin and its functions and haemoglobinopathies, Erythroperosis and factors affecting it, Anemia, degradation of Hemoglobin, bilirubin and development of jaundice, Fe<sup>3+</sup> metabolism, Blood coagulation, bleeding time and mechanism of blood coagulation, clotting time, hemophilia and purpura, Role of Ca<sup>2+</sup> and platelets in blood coagulation. It also covers blood cells, classification, basis and type of immunity, role of lymphocytes, T-lymphocyte, immunoglobulins, humoral and cell mediated immunity. It explains the basis of immunological diseases, blood groups and Blood transfusion .Arteries, arterioles, vein, venules, capillaries, Interstitial fluids (IF) and vessels through which they flow. Lymph and lymph vessels, Cerebrospinal fluid and its vessels.

## **2. HPH 223 : Cardiovascular and Respiratory Physiology (2 Credit Units)**

**Cardiovascular physiology**; Functional anatomy of the heart, functional organization system of the CVS, cardiac properties, Cardiac cycle, study of cardiac cycle, ECG, pulse, heart sound, Jugular venous pulse, Innervations of the heart, heart rate and its regulation, Cardiac output and factors affecting it, Types of blood vessels, and peripheral resistance. Arterial blood pressure, types, factors affecting, maintaining and regulating it. Types of shock, Effect of haemorrhage, edema, types and causes. Pulmonary circulations, Coronary circulation, environmental effect on CVS, exercise, flight high attitudes, Heart failure, myocardial infarction. The basis of heart Automaticity (a) Sinoatrial node (pace maker) (b) Atrioventricular node (c) The Bundle of Hiss, Stanius experiment Heart Block, fibrillation, Refractory period of the cardiac muscle: Extra systole External manifestations of cardiac Activity: Apex beat, Heart Sounds, Control of cardiac activity, Nervous control, Reflex control: Intracardiac reflex responses – Reflex effects of the pericardium, reflex effects of the coronary pulmonary, atria and ventricular vessels, Effects of vascular reflexogenic zones, Reflex effects of visceral receptors. Effects of the cerebral cortex on cardiac Activity. Humoral control of

Cardiac Activity, effects of electrolytes:  $K^+$  &  $Ca^{2+}$  ions, effects of neurotransmitters, effects of hormones: Thyroxine, insulin, Gonadal hormones, Adrenaline and nor adrenaline. Types of shock, Effect of haemorrhage, edema, types and causes. Pulmonary circulations, Coronary circulation, environmental effect on CVS, exercise, flight high altitudes, Heart failure, myocardial infarction.

**Respiratory physiology;** Introduction, general functions of respiratory passage, factors protecting respiratory alveoli. I.P.P. its significant, surfactant, respiratory work., lung volumes and capacities, vital capacities and its significant, Dead space, Neural regulation of respiration, peripheral, central and chemical regulation of respiration, centres of respiration in medulla oblongata, hypoxia, cyanosis, effect of high altitude on respiration, Role of respiratory system in maintaining Acid-Base Balance, effect of exercise on respiration, effect of diving on blood gases.

### **3. HPH 225: Reproductive and endocrine physiology**

Physiology of pregnancy and endocrine-related changes: Pregnancy and fetal development, physical and physiological changes of pregnancy. The antenatal period: Antenatal medical team, antenatal care. Complications of Pregnancy: ectopic pregnancy, gestational diabetes, pre-eclamptic toxemia, eclampsia, ante partum hemorrhage, placenta-previa, Back pain, Sacroiliac joint dysfunction, sciatica, pregnancy associated osteoporosis, nerve compression syndromes (carpal tunnel syndrome, posterior tibial nerve compression), circulatory disorders (varicose veins in the legs, hemorrhoids, muscle cramp, thrombosis and thromboembolism). Physical and physiological changes of labor: the stages of labor, signs of labor, normal labor and delivery, labor pain and causes of labor pain, the effect of labor on maternal and fetal physiology, the effect of labor on the pelvic floor and perineum, the duration of labor, positioning in labor.

An in-depth explanation into the Female genital system structure, structure of ovary, graafian follicle, structure of uterus fallopian tubes, mechanism of female puberty, ovarian cycle, oogenesis, menstrual cycle, vaginal cycle, ovulation, female contraception hormones, control of pregnancy, factor maintaining pregnancy, formation of placenta, functions and hormones of placenta, delivery, mechanism and hormonal control, hormones acting on female breast, mechanism of lactation, prolactin hormone abnormalities of lactation. It also discusses the male genital organ, structure of testis, spermatogenesis, hormonal control and temperature, function of testosterone hormone, mechanism of male puberty sperm and sperm count. Physiology of menopause, coitus, fertilization physiological abnormalities of human reproduction:- pubescence abnormalities, chromosome Abnormalities, abnormalities of genital tract, differentiation, infertility, Abnormalities of menstrual

cycle: - Secondary amenorrhoea, dysmenorrhoea, oligomenorrea, menorrhagia, metrorrhagia, Eunuchoidism.

General functions of hormones, nature of hormones, mechanisms of action and control. Hypothalamic releasing factors, pituitary glands anterior, pituitary posterior hormone functions, hormones, function and control. GH function and its abnormalities, and other releasing factors under control of hypothalamus, thyroid gland hormones T<sub>3</sub> and T<sub>4</sub> physiological function and its abnormalities, Adrenal (mineralocorticoids, glucocorticoids and sex hormones), Adrenal cortex structure and hormones steroid hormones, functions and its abnormalities. Medullary Hormones, calcium functions and homeostasis, Hormones regulating serum calcium (PTH, Calcitonin, Vitamin D, Calcitriol, Calciferol, pancreatic hormones, hormones regulating glucose, diabetes mellitus, pineal gland hormones, melatonin.

#### **4. HPH: Introduction to Practical Physiology I&II**

A basic practical demonstration of some important areas covered in human physiology I-IV. Blood Grouping, Packed Cell Volume, WBC, RBC, Differential Count, Pulse Rate and Blood Pressure, e.t.c.

#### **5. HPH 222:GIT and Renal Physiology**

- i. Renal physiology**, Introduction, General functions of the kidney, Structure of kidney, nephron structure. Differences in nephron structure. Mechanism of urine formation, GFR, tubular transport, absorption and tubular secretion, Blood flow to kidney auto regulation of blood flow, blood vessels, arteries, arterioles, vein, venules, capillaries, Interstitial fluids (IF) and vessels through which they flow, Lymph and lymph vessels, Cerebrospinal fluid and its vessels. Cortical and Juxtaglomerular apparatus, and determination of renal blood flow. Clearance, insulin and Para amino hippuric acid clearance, glomerular filtration rate, factors affecting it, Proximal convoluted tubules, loop of henle, and distal convoluted tubule, Differences between cortical and medullary nephron, vasa recta, and tubular transport in glucose maximal. Role of urea and other electrolytes concentrate urine, concentration of urine and renal regulation of body water (osmolarity) and diabetes insipidus. Renal regulation of blood (ECF) volume, micturition reflexes innervation of urinary bladder, Role of kidney in acid base balance, Basis of dialysis, Diuretics, excretion of hormones Gluconeogenesis. Counter-current system. Water volume and ionic regulation. Micturition. Abnormalities of renal function. The skin function, temperature regulation, abnormalities of temperature regulation

mechanism; factors regulating metabolism. Conditions for measuring basal metabolic rate. Compartmentalization and composition of body fluids. Determinants of Glomerular Filtration Rate: Glomerular capillary filtration coefficient (K<sub>f</sub>) Bowman's capsule Hydrostatic pressure, Glomerular capillary, colloid Osmotic pressure Organic solutes that are reabsorbed: Glucose, amino acids, organic acids, peptides and proteins, urea. Organic solutes that are reabsorbed and secreted: Urea. Inorganic ions that are reabsorbed: Mg<sup>2+</sup>, Ca<sup>2+</sup>, PO<sub>4</sub><sup>2-</sup>, SO<sub>4</sub><sup>2-</sup>, HCO<sub>3</sub><sup>-</sup> Inorganic ions that are secreted: Renal handling of H<sup>+</sup> ions. Inorganic ions that are reabsorbed and secreted: K<sup>+</sup>, Na<sup>+</sup> Renal handling of Na<sup>+</sup> and water Renal handling of Fe, vitamins, carbohydrates, proteins and lipids Renal Failure- proteinuria. Loss of concentrating and diluting ability, Acidosis, Abnormal Na<sup>+</sup> metabolism, Control of Glomerular Filtration: Activation of the sympathetic. Hormonal and Autocrine control of Renal Circulation – Angiotensin II. Endothelial – Derived Nitric Oxide – prostaglandins and Bradykinin; Autoregulation of GFR. Mechanism of urine concentration counter – current mechanism; current multiplier system. Quantity, composition and properties of urine.

- ii. GIT** Introduction to GIT: Functions of GIT. Methods of studying the functions and structure of the G.I.T: Layers, Neural and Humoral control, Autonomic innervations of the G.I.T. Sympathetic and Parasympathetic Gastro-intestinal reflexes Functional types of movements in the G.I.T; Propulsive and mixing. Hormonal control of G.I.T. Motility. Oral Cavity: Mastication. Salivary glands, functions of Saliva, Salivary reflexes, Inhibition of salivary secretion. Physio-anatomical consideration of the stomach; Functions of the stomach, mixing and propulsion of food in the stomach, regulation of gastric motility. Gastric Secretion; Composition, properties and functions of gastric juice. Effects of Nutrient patterns on gastric secretion. Regulation of gastric secretion Stomach (gastric) emptying.
- Vomiting; Composition, properties and functions of pancreatic juice, effects of Nutrient composition on pancreatic secretion, functions of the liver, Composition, properties and functions of bile ejection, regulation of production and secretion of bile by the liver, mechanism of gall bladder emptying, gall stones. Intestinal glands- villi and microvilli, types of intestinal digestion Uniqueness of intestinal secretion of enzymes, small intestine motility control — neural, hormonal and small intestine reflexes, intestinal reflexes and intestinal inhibitory reflexes, gastro-intestinal reflex.

Large intestine and Rectum, Colonic mortality, defecation, control of colonic and rectal motility myogenic and neural control Physiology of absorption, mechanism of absorption, absorption in the mouth, Stomach, small and large intestines (Note: absorption of CHO, proteins, fats, water, sodium e.t.c.) Location and functions of the Alimentary canal, Sensations of satiation, hunger and thirst; appetite physiology of Gastrointestinal disorders, Appendicitis, Diarrhoea, constipation cancerous tumours eating disorders peptic ulcer Jaundice. Effects and factors, which modify it Nervous influences, Humoral factors, Biological rhythms, Sex, Age & posture Indices of Cardiac Activity: Stroke (Systolic volume Cardiac Output, Heart work, Venous return. Functions of the liver, Composition, properties and functions of bile ejection. Regulation of production and secretion of bile by the liver. Mechanism of gall bladder emptying. Gall stones. Intestinal glands-villi and microvilli. Types of intestinal digestion Uniqueness of intestinal secretion of enzymes small intestine motility control of small intestine motility – Genic, neural, hormonal small intestine reflexes. Intestino-intestinal and anointestinal inhibitory reflexes; gastro-intestinal reflex . Large intestine and Rectum, Colonic mortality, defecation, control of colonic and rectal motility myogenic and neural control Physiology of absorption, mechanism of absorption, absorption in the mouth, Stomach, small and large intestines (Note: absorption of CHO, proteins, fats, water, sodium e.t.c.) Location and functions of the Alimentary canal, Sensations of satiation, hunger and thirst; appetite physiology of Gastrointestinal disorders, Appendicitis, Diarrhoea, constipation cancerous tumours eating disorders peptic ulcer Jaundice. physiology of peptic ulcer, gastrin and vomiting. C.C.K., other G.I. Hormones, Functions of duodenum, jejunum and ileum secretions, Digestion and mechanism of absorption of fat, absorption, motility and functions, proteins, carbohydrate, water and vitamins, large intestine secretions, absorption, motility and functions Defecation. Diarrhea, Liver and Biliary System Including histological structure of liver, liver functions and liver functions test, jaundice and causes, types of hepatitis. Biliary system, structure of gall bladder, function of gall bladder, Structure and functions of bile salts, bile pigments direct and indirect bilirubin Gall stone and exocrine functions pancreas, hormonal and nervous control of pancreatic secretion, diseases of biliary system and pancreas.



## 6. HPH 226: (NEUROPHYSIOLOGY AND SPECIAL SENSES):

The central Nervous system- brain and the spinal cord. The Peripheral nervous system. Sensory system including receptors, types and pathway of sensation, pain sensation, analgesic system, disturbances of sensation thalamus, sensory cortical areas, sensory functions of cerebral cortex, reaction to sensation. Reflex arc, Properties of reflex arc, general reflexes, spinal reflexes, stretch reflex, Muscle tone. Motor system sensory cortical areas including motor cerebral cortex, basal ganglia, cerebellum, temperature control, hypothalamus, limbic system, reticular formation, higher functions of cerebral cortex, learning and memory abnormalities, Speech and its abnormalities, temperature control, Excitation, action potential, development of resting membrane potential, action potential in skeletal, cardiac and other smooth muscles, characteristics of action potential in nerve tissue. Nerve cell- morphology of a nerve cell, types of nerve fibres, propagation of action potential in different types of nerves, salutatory and neighborhood conductions. Synapse- morphology of synapses, types of synapses, synaptic transmission of impulses, properties of synaptic transmission, synaptic junction. Applied physiology. Neuromuscular junction- morphology of a neuromuscular junction, neuromuscular transmission, transmission of impulse at neuromuscular junction. Applied physiology-myasthenia gravis. Muscles- Morphology of skeletal, cardiac and other smooth muscles. Molecular basis of muscle contraction- structure and function of the contractile protein, structure and function of regulatory proteins. Mechanism of contraction, excitation and coupling in muscle contraction. Applied physiology of muscle contraction. Autonomic Nervous System (ANS)- general description of the ANS, basic physiology of the ANS and homeostasis Posture reflex function of spinal cord, sleep and EEG mechanism and abnormalities.

**Special senses;** including eye structure cornea, lens, vitreous humor, ciliary body and aqueous humor structure and functions of retina, visual pathway, accommodation reflex and pupillary light reflex, Colour vision, theories, visual activity, visual field, area 17, 18, 19 and 8, Mechanism of retina stimulation, Abnormalities and lesions of visual pathway, Hearing including introduction. Physical properties of sound including structure of external ear, Middle ear and internal cochlea, Structure of cochlea, basement membrane, organ of corti, mechanism of hearing, hearing pathway, abnormalities of hearing, hearing test, physical properties of sounds, area 42, 22. Sensation linear and rotational, utricles, saccules pathway, equilibrium, smell sensation including structure of smell receptors mechanism of stimulation, olfactory nerve, olfactory bulb and limbic system. Taste sensation on the

tongue, types of taste, mapping of different taste sensation ant 2/3 path ways, to cortex and Abnormalities.

## **BIOCHEMISTRY**

### **BCH 251- GENERAL BIOCHEMISTRY I (1 CU)**

(Chemistry and Functions of Amino acids and Proteins)

Structure, properties and classification of amino acids; pH, pKa and buffer; Peptides. Reaction of specific amino acids; separation and sequence analysis of peptides; chemistry of proteins and enzymes including their basic structural levels, and types of bonds stabilizing them; Properties, functions, and classifications of proteins.

### **BCH 253- GENERAL BIOCHEMISTRY II (2 CU)**

(Chemistry and Functions of Carbohydrates, Lipids and Nucleic acids)

Classification and physical properties of carbohydrate, structure of glucose: projection and perspective formulae; structure and properties of other monosaccharide; Chemistry, classification and properties of lipids, methods of analyses of lipids; lipoproteins, membranes and membrane structure. Chemistry of nucleic acid, (bases, sugars and phosphoric acids, nucleosides, nucleotides, and nucleic acids). The structure and roles of RNA and DNA.

### **BCH 254- GENERAL METABOLISM (2 CU)**

(Carbohydrate metabolism, Lipids metabolism, Amino acids Metabolism, Nucleic acid metabolism)

Degradation and digestion of carbohydrates; Storage polysaccharides and cell walls. Glycogenesis, glycogenolysis glycolysis, tricarboxylic acid cycle, Phosphogluconate pathway, cori cycle, calvin cycle and gluconeogenesis, glyoxylate cycle. Disorders of carbohydrate metabolism; Oxidation of fatty acids. Formation and oxidation of ketone bodies, biosynthesis of fatty acids, triacylglycerols, phospholipids, glycolipids, cholesterol, Acetyl CoA as a central precursor for biosynthesis of lipids. Genetic disorders of lipid metabolism.

Metabolism of amino acids and their derivatives; urea cycle; metabolism of inorganic nitrogen and sulphur cycle. Genetic Disorders of amino acid metabolism. Metabolism of purines and pyrimidines, Nucleosides and Nucleotides. Disorders of Nucleic acid metabolism. Genetic code, gene structure. Replication, Transcription and Translation. Genetic diseases and gene therapy.

## **BCH 255- CELL BIOCHEMISTRY AND INTRODUCTION TO METABOLISM (2 CU)**

Cell theory, Major cell organelles, their functions, and Preparation of subcellular fractions and methods for studying cellular components; Prokaryotic versus Eukaryotic cells. Elementary treatment of membrane structure (the fluid mosaic model) and functions in the eukaryotic cell; Definition and types of metabolisms; concept in Bioenergetics; Introduction to Glycolysis). Flow of energy and matter in the biosphere. The laws of thermodynamics and their applications to biological systems. Concept of free energy and free energy changes in biochemical processes. Endergonic and exergonic reactions. Thermodynamics of open systems; disequilibrium as a condition for life. Metabolic pathway as an open thermodynamic system. Concept of equilibrium and non-equilibrium reactions. High energy compounds and their importance in biochemical reactions, chemical potential, electrochemical potential. Electron transport chain and oxidative phosphorylation. Regulation of ATP production.

## **BCH 258- GENERAL BIOCHEMISTRY PRACTICALS (1 CU)**

(General Biochemistry practical I & II)

Introduction to the laboratory and laboratory equipment. Safety, housekeeping, washing and drying of glassware in the laboratory. Accuracy of measurement and transfer of liquids and solids. Qualitative and quantitative tests for amino acids and proteins. Introduction to photometry and colorimetry; standard curve and absorption spectra; Biuret method and the estimation of proteins. pH and buffer systems.

Qualitative test for carbohydrates; thin layer chromatographic separation of sugars. Estimation of glucose in biological fluids (blood and urine). Analysis of lipids for double bonds and free fatty acids; separation by thin layer chromatography.

## **DESCRIPTION OF RADIOGRAPHY DEPARTMENTAL COURSES FOR BACHELOR IN MEDICAL RADIOGRAPHY DEGREE (B. RAD) PROGRAM,**

### **PHY 213 RADIATION PHYSICS-I**

Electrostatic, capacitance and uses in Radiological equipment. Basic X-ray circuitry. Electromagnetic induction, mutual and self-induction; principles and construction of transformer:

transformer parameters, uses of mutual and self-inductance in Autotransformers and High-tension transformers. Solid state conductor devices, principles and uses in radiology. Concept of energy, wave and quantum methods of energy transfer. Bohr's atom and application in radiology. Rectification, production of X-rays, radioactivity and radioactive decay. Half-life, counters, units of activity and measurement. K-capture, the atom. Isotopes. Isobars. Nuclear binding energies. Interaction of X and gamma radiation: attenuation and inverse square law: effect of filtration. Luminescence and their applications.

### **PHY 226P: RADIATION PHYSICS-II**

Optical spectra and X-rays. Hydrogen spectrum, Bohr theory of hydrogen atom, Excitation potentials, X-rays spectra, X-ray Absorption Edges. X-ray Fluorescence. X-ray Interaction with matter. Reduction in intensity due to absorption, filtration and inverse square law. X - ray measurement of Intensity, measurement of dose-rate, exposure, the Roentgen, the Rad. Simple principle of dosimeters. Fluorescent effect of X -rays. The photographic film as a dosimeter. X-ray quality, KVP, Half-Value layer and Routine method of quality assurance. Radiation Protection - Historical development. Biological effects. Permissible exposure. International recommendations and current "Code of Practice on Exposure to ionizing Radiation". Protective materials. Design of X-ray tube and X - ray room protection. Protection of patients, public and environment. Personnel monitoring and survey of the department. Radioactivity - Radioactivity decay and radioactive substances, Production of Radioisotopes and Radiation detectors.

### **RDG 203: INTRODUCTION TO RADIOGRAPHIC PROCEDURES**

Introduction to radiography. Principle of image formation, factors affecting image quality. Appropriate imaging technique. Radiation protection in a clinical setting, appropriate techniques, image presentation. Identification and preparation of the patient for different radiographic examinations. Image presentation format Terminologies relating to radiographic anatomy; physiology and pathology. The student will be oriented to the profession of radiography in relation to various accreditation and credentialing agencies. Professional opportunities for growth and development will be discussed.

### **RDG 205 HOSPITAL PROCEDURES AND PATIENT CARE**

This course is intended to emphasize the importance of the patient and his welfare, providing the student with an overview of radiography, and its role in the health care delivery system. The course will provide a basic understanding of skills needed to allow the student to work comfortably and safely with patients. Some of the areas covered will include basic nursing care, proper body

mechanics, aseptic technique, communication, and patient monitoring to include vital signs and medical emergencies. Pharmacology and the use of radiographic contrast, including risk factors and reactions, will be taught. During the lectures on specified topics, practical demonstrations are provided. The teamwork involved in patient treatment is highlighted and the student is made to appreciate his role. Topics to be covered include; basic first aid, principle of nursing, general and special preparation, general and special care, professional attitude of the Radiographer, hygiene, infection and principles of asepsis. Special and emergency care of patient. Moving and lifting technique. Pharmacological classification of Drugs. Pharmacology and the use of radiographic contrast, including risk factors and reactions, will be taught. Design and citing of Radio-diagnostic and Radiotherapy department. Medico-legal aspects.

#### **RDG 204 HOSPITAL PRACTICE (CLINICAL POSTING)**

This course will provide the student with an overview of radiography, and its role in the health care delivery. Radiographer in the Hospital team Use of Hospital and Nursing Equipment. Attendance at a hospital employee orientation session will train the student in handling blood and bodily fluid borne pathogens, chemical and fire safety. The student will receive training for CPR certification. Students will learn to critically evaluate patients and examinations to determine possible risks to the patient or staff. The course will also include a clinical component under the supervision of a radiology nurse. The student is attached to work in the accident and emergency department for a specific period. The student will be expected to pass both clinical and classroom competency evaluations related to this course.

#### **RDG 206 GENERAL PATHOLOGY-I**

This course is designed to enable the student to study the general principles and mechanisms of diseases (with emphasis on aetiology and pathogenesis) and gain an understating of the basic medical terminology used to describe various pathologic conditions occurring in the human body. Knowledge of diseases etiology and spreading. Tumors - benign and malignant tumors. Diseases of the blood forming tissues.

#### **RDG 303: RADIOGRAPHIC PATHOLOGY**

This course is designed to enable the second-year radiography student to integrate information learned from courses in radiographic positioning and anatomy into pathological processes diagnosed from radiographs. Commonly seen pathologies will be discussed and their radiographic appearance demonstrated. Included in this course will be the formal presentation of a paper that has been independently researched by the student.

## ***RADIOGRAPHIC TECHNIQUE COURSES***

Courses line up for this subject is to ensure full exposure of student to the procedures for radiographic examinations. It emphasizes the close relationship between the theory and practical. It involved using the knowledge of anatomy, physiology, radiation physics/protection to produce diagnostically accepted radiographs. It involves introduction to radiography: Principles of Image formation. Factors affecting Image quality, and radiation protection in clinical setting; appropriate technique presentation format; Identification and preparation of patient for the radiographic examination

### **RDG 301: RADIOGRAPHIC TECHNIQUE-I**

This course will provide students with General anatomy terminologies and positioning principles. It will also provide theoretical foundations and laboratory demonstrations necessary to develop the psychomotor skills that are essential for the achievement of routine diagnostic radiographs and those requiring supplementary views for patients at any stage of the life span. Radiation protection and Applications of Principle will be discussed. Students will be able to describe the radiographic planes of the body, cavities, and anatomical landmarks; Describe bone classifications and types of joints; explain the characteristics associated with patient body hiatus; Define terminologies associated with radiographic exams; and discuss the general principles of radiographic positioning. Coursework will cover essential anatomy and clinical radiographic positioning used for radiography of (a) Chest, (b) Upper Limb: fingers, thumb, hand, wrist, elbow, fore arm etc. and (d) Bony Thorax. Coursework also includes concepts of mobile radiography and operating room applications. Pediatric radiographic practices will be included. The course contents will be accomplished through the use of lectures, demonstrations in the Radiographic Laboratory with a Radiographic Phantom and self-instruction.

### **RDG 304: RADIOGRAPHIC TECHNIQUE-II**

This course will provide students with General anatomy terminologies and positioning principles. It will also provide theoretical foundations and laboratory demonstrations necessary to develop the psychomotor skills that are essential for the achievement of routine diagnostic radiographs and those requiring supplementary views for patients at any stage of the life span. Specifically, Radiographic projections for lower limbs, pelvic girdle and hip: Vertebral column (cervical, cervico-thoracic and thoraco-lumber).

### **RDG 401: RADIOGRAPHIC TECHNIQUE-III**

This course will provide students with General anatomy terminologies and positioning principles. It will also provide theoretical foundations and laboratory demonstrations necessary to develop the psychomotor skills that are essential for the achievement of routine diagnostic radiographs and those requiring supplementary views for patients at any stage of the life span. Specifically, review of general patient care (Care before, during and after the procedure); Radiographic examination of the skull; Dental Radiography; Skeletal surveys; Plain radiography of the viscera and soft tissue; Accident and emergency radiography.

#### **RDG 402: RADIOGRAPHIC TECHNTQUE-IV**

This course will provide students with General anatomy terminologies and positioning principles. It will also provide theoretical foundations and laboratory demonstrations necessary to develop the psychomotor skills that are essential for the achievement of routine diagnostic radiographs and those requiring supplementary views for patients at any stage of the life span. Specifically, a review of general patient care (Care before, during and after the procedure); Introduction to investigations involving contrast media; Pharmacy radiography; Urinary system, HSG, and Fistulography.

#### **RDG 501: RADIOGRAPHIC TECHNIQUE-V**

This course will provide students with General anatomy terminologies and positioning principles. It will also provide theoretical foundations and laboratory demonstrations necessary to develop the psychomotor skills that are essential for the achievement of routine diagnostic radiographs and those requiring supplementary views for patients at any stage of the life span. Specifically, a review of general patient care (Care before, during and after the procedure); Contrast examination of the gastrointestinal system; Sialography; Dacryocystography; Arthrography; Mammography and operating theater/ward radiography techniques.

#### **RDG 502: RADIOGRAPHIC TECHNIQUE VI**

This course will provide students with General anatomy terminologies and positioning principles. It will also provide theoretical foundations and laboratory demonstrations necessary to develop the psychomotor skills that are essential for the achievement of routine diagnostic Radiographs and those requiring supplementary views for patients at any stage of the life span. Specifically, a review of general patient care (Care before, during and after the procedure); other specialized radiographic procedures — Angiography; Myelography; air encephalography; Cholangiography should be covered in details.

#### ***RADIOGRAPHIC EQUIPMENT COURSES***

This Course is in series of I, II, III, IV & V. It will teach: Mains supply, Basic principles of Generators including falling load and frequency multipliers. Control and stabilizing equipment. High-tension circuits, Meters, Exposure Timers and switches. Fuses, Circuit breakers. Interlocking Circuits. The X-ray tube: Construction and operation, high-tension cables. Tube stands, effect and control of scatter radiation. General principles of scatter radiation. Grids, collimators and beam centering devices, portable and mobile units. Special Equipment's -Tomographic equipment's, Fluoroscopic equipment. Dental equipment, Mammography equipment, equipment for Neuro Radiography, accident and emergency equipment. Imaging intensifiers. Rapid Series Equipment.

### **RDG 310 RADIOGRAPHIC EQUIPMENT-I**

This course includes the study of imaging equipment and its safe operation in clinical application. Generators. X-ray circuitry, tube components, and QA monitoring maintenance are covered. Mains Supply. Basic principles of Generators including falling load and frequency multipliers. Control and Stabilizing equipment. High-tension circuits, Meters, Exposure Timers and switches. Fuses, Circuit Breakers, Interlocking Circuits. The X-ray tube: Construction and operation, high-tension cables. Tube Stands, effect and control of scatter radiation. General principles of scatter radiation. Grids, collimators and beam centering devices, portable and mobile units. Computed Tomography, MRI, Mammography and Diagnostic Imaging equipment are discussed.

### **RDG 403: RADIOGRAPHIC EQUIPMENT-II**

X-ray tube: construction and operation, high-tension cables; Tube stands, effect and control of scatter radiation, and general principle of scatter radiation; Grids, Collimators and beam centering devices; Portable and mobile units

### **RDG 404: RADIOGRAPHIC EQUIPMENT-III**

Special equipment- tomographic equipment; Fluoroscopic equipment: Dental equipment; Mammographic equipment

### **RDG 503: RADIOGRAPHIC EQUIPMENT-IV**

Equipment for Neuro-radiography; Accident and emergency equipment; Image intensifiers; Rapid series equipment

### **RDG 504: RADIOGRAPHIC EQUIPMENT-V**

Basic principles of modern imaging modalities (CR, DDK); Care and maintenance of equipment; Practical and "Trouble shooting" knowledge based on the entire course in radiographic equipment.

### **RDG 507: Medical Ethics and Jurisprudence3**



## **COURSE CONTENTS**

The criminal procedure code (1908), all the provisions of the above-mentioned law. Medical jurisprudence, legal procedures, Human body: Elements of anatomy & physiology, identification, Death- its medicolegal aspects, post-mortem examination, medicolegal aspects of radiography.

### **RDG 415: Magnetic Resonance imaging 2CU**

#### **Course Contents**

Designs of MR scanners: Open, closed systems. Superconductors, Permanent magnets, Resistive magnets. Cooling mechanisms, Nitrogen, Helium and many others. Oxygen levels. Oxygen gauges and meters, Oxygen displacement by helium. Loss of superconductivity. Quench, Shielding systems, The Faraday's cage. Strength of Magnets. Magnet homogeneity. Shimming, Characteristics of the main magnet Strength of the field produced. Tesla (T). Gauss. Magnets in clinical use and in research. Parameters, image quality and trades off: SNR, Slice Thickness FOV, Matrix, NEX, Pixels and voxels. Slice thickness, slice Gap. Noise, Partial volumes. FOV, Matrix, Number of excitations, Acquisition time. TR, TE, Receive bandwidth. Spatial Encoding and Image Formation: The homogenous magnetic field, Behaviour of protons in the magnetic field, Protons and Larmor frequency, Slice direction, Phase direction and Frequency direction.

Spatial Encoding and Image Formation: The homogenous magnetic field, Behavior of protons in the magnetic field, Protons and Larmor frequency, Slice direction, Phase direction and Frequency direction, Slice encoding gradient, Slice select gradient, Use of varying bandwidth, Modifying the steepness of the gradient, Gradient fields, Frequency encoding, Phase encoding, K – Space filling, Fourier transformation. Techniques --- Central Nervous System: Coil selection, Immobilization devices, Ear defenders, Aids for claustrophobic patients—mirror glasses, eye shields, Artifact considerations, Use of saturation bands, Flow compensation, Indications for MRI in the brain and spines, Parameters and, image quality considerations, Patient positioning, Important landmarks and reference points, Protocol selection, Essential and complementary sequences, Image weighting for particular, indications, Thick and thin slices, High resolution slices, Contrast enhancement, Introduction to diffusion weighted imaging

### **RDG 417: Ultrasound Imaging I 2CU**

#### **Course Contents**

Common ultrasound terminologies. Normal Pelvic Anatomy: Uterus – anatomy and ultrasound examination. Vagina – sonographic appearance. Ovaries – Anatomy to include shape, size in prepubertal, menstrual and post menstrual stages. Supporting structures – Divisions of the pelvis ie

true & false pelvis, location and functions of supporting muscular structures. Sites of fluid accumulation – anterior and posterior cul-de-sac, space of Retzius and fornices. Vasculature – roles of uterine and ovarian arteries. Physiology: Menstrual Cycle – role of the pituitary gland in menstruation should be stated. pregnancy Test – indicators of pregnancy. Fertilisation – formation of embryo. Infertility and Endocrinology. Contraceptives. Sonographic findings with IUCDs. First Trimester: Gestational Sac – embryology of the gestational sac. Sonographic findings of gestational sac development: Yolk Sac, Ovaries (corpus Luteum), Pregnancy failure – Fetal demise, anembryonic pregnancy (blighted ovum), threatened abortion, inevitable, missed, habitual, complete/spontaneous abortion. Ectopic pregnancy. Sonographic examination in the first trimester. Determination of presence or absence of fetal life. Determination of fetal number.

### **RADG 517: Ultrasound Imaging II 2CU**

#### **COURSE CONTENTS**

Simple description of common artefacts and their origin, Dosimetry, bio effects regulations and standard of practice, quality assurance and equipment specifications. Second and Third Trimester (Normal Anatomy): Basic guidelines for obstetric sonograms. Foetal biometry, Basic survey of foetal anatomy to rule out abnormality. Evaluation of foetal Cranium, Spine, Heart, abdominal organs and limbs.

Abdominal Sonography: Liver, Structure and Anatomy: Sonographic appearances in normal and disease conditions. Biliary Tree: Anatomy of the gall bladder, nature & function of the Bile ducts, Bile and splinctor of odds should be stressed. Normal anatomical variants – functional fold, Phrygian cap, Hertmann'spouh, Scanning techniques d. Indications & laboratory values. Pancreas: Anatomy – subdivisions, Pancreatic ducts; duct of wirsung, ducts of santorim, blood supply, functions – endocrine & exocrine systems. Scanning techniques & laboratory values.

### **RDG 411: Computed Tomography 2**

#### **Course Contents**

Introduction to Computed Tomography: Basic terminology, Components – imaging, computer and display systems, Digital image processing overview, Image manipulation. Overview of imaging parameters; Protocol selection, Motion reduction. Overview of clinical applications of CT, Information gained, Pathology demonstrated, Basic positioning guidelines. Patient and personal safety: Radiation dose considerations, Table weight limits, Pregnancy, Emergency in the scanning area, Contraindications to patient scanning. Computer Technology: Review of Computers and their operation, Digital Image Processing; CT Components: Equipment and Software: Data acquisition

and Reconstruction: Acquisition methods, Spiral CT, Scanogram, Technical Factors, Image Quality/Manipulation, Radiation Dose, Artifacts, Correcting Suboptimal Images, Display/Recording/Storage and Quality Assurance.

Cross-Sectional Anatomy of CNS Computed Tomography of the Head and Central Nervous System: Scanning Considerations: Preparation criteria, Positioning criteria, Planes / anatomy best demonstrated, Technical parameters, Artifact and motion reduction, Windowing, Pathology: Clinical Indications Anatomic Locations.

### ***RADIOGRAPHIC IMAGE PRODUCTION & EVALUATION COURSES RDG***

#### **306: RADIOGRAPHIC IMAGE PRODUCTION & EVALUATION -I**

The course introduces technical factors involved with the production processing and evaluation of the radiographic image. The course discusses in depth, the production of X-ray, its attenuation and filtration. This course includes the characteristics of radiographic film, intensifying screens, & filters. The basics of processing radiographic film processor, including the manual & automatic processing. The darkroom structure & protocol are also discussed.

#### **RDG 405: RADIOGRAPHIC IMAGE PRODUCTION & EVALUATION -II**

This course is a continuation of the concepts covered in RDG 3320. This course includes the basic principles of image production, including radiographic density, contrast and definition. Appreciation and application of all the factors that will enable the Radiographer to produce x-ray films of good quality and diagnostic value. The various parameters that affect the technical quality of the radiograph are also discussed. Image analysis exposure controls, and exposure calculations are emphasized in this course. The lectures will be linked with practical demonstration to illustrate the importance of all that goes to make up correct exposure conditions for obtaining a quality radiograph.

#### **RDG 406: RADIOGRAPHIC IMAGE PRODUCTION & EVALUATION -III**

This course is a continuation of the concepts covered in RDG 3320 and RDG 4321. The course will teach the principles of fiber optics and video transmission and explain the principles of fluoroscopy according to: image acquisition, equipment operation, procedures performed and radiation exposure dose to the patient and radiographer. It will also explain the principles of conventional tomography and the principles of magnification radiography according to: image acquisition, equipment operation, procedures performed and radiation exposure dose to the patient & radiographer. The course will discuss the basic principles of computed tomography according to:

image acquisition, equipment operation, procedures performed and radiation exposure dose to the patient and radiographer.

#### **RDG 505: RADIOGRAPHIC IMAGE PRODUCTION & EVALUATION -IV**

This course is a continuation of the concepts covered in RDG 3320 and RDG 4321. Digital image acquisition, display, and modification are covered. Computed radiography (CR), and digital radiography (DR) methods are discussed. Students will be able to explain the principles of digital imaging in terms of image acquisition equipment operation, terminology descriptions, exposure latitude, dynamic range, image quality parameters, image analysis, and radiation exposure dose to the patient. The course will examine some special imaging processes like: xeroradiography, Duplication of radiographs and Subtraction radiography.

#### **RDG 506: RADIOGRAPHIC IMAGE PRODUCTION & EVALUATION-V**

This course is a continuation of RDG 3320, RDG 4321, RDG 4222 and RDG 5223. In this course, students will demonstrate ability to design and guide in the structural set up and functional operation of X-ray Dark- room, care, maintenance and minor repairs of X-ray dark room equipment, including conventional and daylight systems etc. This course entails comprehensive practical hands-on based on all imaging courses. Students should demonstrate ability to design and guide in the structural set up and functional operation of an X-ray Department. Essential knowledge, care, maintenance and minor repairs of X-ray equipment, including conventional and day light system. Digital systems and Fluoroscopy.

#### **RDG 419: Artificial intelligence 2 Course Contents**

Introduction to artificial intelligence: understanding natural languages, knowledge representation, expert systems (CT Scan, MRI, Ultrasonography and many others, Pattern recognition, Medical Image Analysis, image Segmentation, registration, visualisation, computing. Deterministic versus statistical models, global versus local representations of appearances, neural networks and texture analysis. Principles of mathematical modelling of biological systems, computer algorithms and extraction of qualitative information/automations of systems and processes Deep learning and Machine learning in imaging. Applications of AI in Radiography as it affects patient documentation and data management, Image acquisition, processing, interpretation and storage/retrieval

### ***RADIOGRAPHIC ANATOMY & PHYSIOLOGY COURSES***

A series of courses in Radiographic Anatomy. RDG 3225 Radiographic Anatomy-I, RDG 3326 Radiographic Anatomy-II, RDG 4348 Radiographic Anatomy-III. RDG 4349 Radiographic Anatomy-IV. The series provides the study of anatomy of the body using radiographic films, commonly called x-rays from both the projection and cross-sectional point of view. Conventional and contrast Radiographic Anatomy of the systems are also studied. Emphasis is placed on the development of a systemic perspective of anatomical structures and physiological processes.

### **RDG 303: RADIOGRAPHIC ANATOMY & PHYSIOLOGY -I**

Specifically, the topics include: body organization; cell structure and functions; tissue classifications: the integumentary system; the skeletal system; the muscular system; the respiratory system; the digestive system: and the urinary system. Knowledge of the normal structure and function of the different parts of the body must be coupled with some idea of the way in which disease arises and extends, so that the radiographer can assist in the various procedures used in diagnosis and treatment. The syllabus gives the main headings-the names of organs and systems to indicate the scope of teaching required both in diagnosis and treatment. Knowledge of the **size** and position of an organ is of paramount importance. Laboratory experience supports classroom learning.

### **RDG 308: RADIOGRAPHIC ANATOMY & PHYSIOLOGY-II**

This course continues the study of the anatomy and physiology of the human body. The course provides the study of anatomy using radiographic films, commonly called x-rays from both the projection and cross-sectional point of view. Conventional and contrast Radiographic Anatomy of the systems are also studied. Topics include: the reproductive system; the cardiovascular system; the blood and lymphatic systems; the nervous and sensory systems: the endocrine system; and the immune system. Laboratory experience supports classroom learning. Surface, radiographic and cross-sectional anatomy of the spine (cervical, thoracic, lumbar, sacral and coccyx); The pelvic girdle, hip joint, femur and patella, tibia and fibula, knee joint ankle joint. bones of the foot.

### ***CLINICAL RADIOGRAPHY PRACTICUM***

#### **RDG 312: CLINICAL RADIOGRAPHY-I**

Students are provided with practical experience in the functioning of the radiology department. Included are basic radiology office skills, familiarizing students with the clinical affiliate and developing fundamental skills in radiologic technology, darkroom technique, equipment

manipulation and patient interaction. This course represents the beginning of the clinical competency program. Students shall attend postings at the department of Radiology, Barau Dikko Teaching Hospital and future affiliated Hospitals (at least 18 hours per week) with hands on clinical radiographic examinations covered in RDG 301 Radiographic Technique-I including: (a) Chest, (b) Upper Limb: fingers, thumb, hand, wrist, elbow, fore arm etc. and (d) Bony Thorax.

#### **RDG 407: CLINICAL RADIOGRAPHY-II**

This clinical practicum represents a continuation of the clinical competency program. Students shall attend postings at the department of Radiology; Barau Dikko Teaching Hospital and future affiliated Hospitals (at least 18 hours per week) with hands on clinical radiographic examinations covered in RDG 304 Radiographic Technique-II including: (a) Lower extremity (b) Pelvic girdle and Hip (c) Vertebral column including cervical, cervico-thoracic. Thoracic-thoraco-lumbar etc. This also includes training in Computed Tomography (CT), Ultrasound and Magnetic Resonance Imaging (MRI).

#### **RDG 408: CLINICAL RADIOGRAPHY-III**

This clinical practicum represents a continuation of the clinical competency program. Students shall attend postings at the department of Radiology; Barau Dikko Teaching Hospital and future affiliated Hospitals (at least 18 hours per week) with hands on clinical radiographic examinations covered in RDG 401 Radiographic Technique-III including: (a) skull; (b) Dental Radiography; (c) Skeletal surveys; (d) Plain radiography of the viscera and soft tissue; (e) Accident and emergency radiography. This also includes training in Computed Tomography (CT), Ultrasound and Magnetic Resonance Imaging (MRI).

#### **RDG 507: CLINICAL RADIOGRAPHY-IV**

This clinical practicum represents a continuation of the clinical competency program. Students shall attend postings at the department of Radiology; Barau Dikko Teaching Hospital and future affiliated Hospitals (at least 18 hours per week) with hands on clinical radiographic examinations covered in RDG 402 Radiographic Technique-IV including: Introduction to investigations involving contrast media: Pharmacy radiography; Urinary system. HSG, and Fistulography. Contrast examination of the gastrointestinal system; Sialography; Dacryocystography; Arthrography; Mammography, Operating theatre and admission ward radiography techniques.

#### **RDG 508: CLINICAL RADIOGRAPHY-V**

This clinical practicum represents the final of the clinical competency program. Students shall attend postings at the department of Radiology; Barau Dikko Teaching Hospital and future affiliated Hospitals (at least 18 hours per week) with hands on clinical radiographic examinations covered in

all previous radiographic examinations and RDG 502 Radiographic Technique-VI including: other specialized radiographic procedures-angiography; Myelography; air encephalography; Cholangiography should be covered in details.

### **RDG 301 PHARMACOLOGY (PCL 3201 GENERAL PHARMACOLOGY)**

Origin and source of drugs; Routes of Administration of drugs; Pharmacokinetics; Absorption of drugs; Excretion of drugs; Drugs Toxicity, Adverse drug Reactions. Drug Interactions; Cholinergic and adrenergic; Vomiting. Constipation - purgatives; H<sub>2</sub> Receptor antagonists; Oxygen therapy, Bronchodilator drugs. Asthma. Cough Suppressants; respiratory stimulants; Anticoagulants. Heparin, Fibrinolysis; Vasodilators; Diuretics; renal failure. Immunity, Major Features of Malignant Diseases; Principles of Cancer Chemotherapy; radioactivity; Nervous system stimulants; Anticonvulsant drugs,

### **RDG 301: CLINICAL BIOCHEMISTRY AND IMMUNOLOGY**

Liver functions tests - detoxification, deamination, bilirubin test. Jaundice, Fouchest test for bile pigment. Carbohydrate metabolism - glucose tolerance test, etc. abnormalities in protein metabolism. Clotting factor, flocculation tests. Colloidal Gold reaction, thymol Turbidity test. Enzymes. Acute Hepatic necrosis. Liver failure. Viral Hepatitis. Chronic Hepatitis. Cirrhosis, Formation of Gall stones. Insulin. Diabetes, Synthesis of hemoglobin. Porphyrinuria. Electrolytes and Acid - base balance. Acidosis and alkalosis. Kidney Immunity types and processes etc.

### **RDG 410: RESEARCH METHODOLOGY-I**

Application of bio-statistical tools and methods; Types of Scientific enquiry; Research design; Formulation of hypothesis; Data collection methods; Validity and reliability issues and their importance, sensitivity and deduction, inductive and inferences; Ethics in Medical Research.

### **RDG 509: RESEARCH METHODOLOGY-II**

Application of bio-statistical tools and methods; Types of Scientific enquiry; Research design; Formulation of hypothesis: Data collection methods; Validity and reliability issues and their importance, sensitivity and deduction, inductive and inferences; Ethics in Medical Research.

### **RDG 412: RADIOLOGICAL HEALTH MANAGEMENT**

Application of managerial structure, healthcare policy, interdependence of various Departments. Radiology department and organizational structure, financial resources and management. Vital statistics and records, inventory, information control, personnel Management; management and communication process; patient patient-flow and appointment system.

Public relations, evaluation of management principles and performance. Principles of Counseling; interaction skills; information classification and management; counseling patients, Tact and diplomacy in counseling

**RDG 5237: COMMUNITY HEATH FOR RADIOGRAPHY STUDENTS** Epidemiology - definition, principles and methods. Health Education, Environmental health. Occupational Health, Public health administration /health care: Epidemiology of communicable and non-communicable diseases; Social medicine, National and International Regulations relating to health.

#### **RDG 412: BIostatistics in Health (COM 2201 BIostatistics)**

Orientation to statistics, definition and examples of basic statistical terminology; Data presentation. Populations, samples and the Normal distribution. Design of experiments. Introduction to Demography in medicine; Procedures for hypothesis testing. Analysis of variance. Correlation and Regression. Chi Square. Nonparametric technique, relative risk and measures of strength of association

#### **RDG 305: RADIATION BIOLOGY**

The course discusses the concept of radiation biology in order to equip students to apply effective radiation protection measures to patients, personnel and members of the public. The course introduces Cell Theory and genetic apparatus. The radiation effects on molecules, cells, tissues and the body as a whole is also taught. Radiation chemistry. Effect of Radiation on DNA molecules, amino acid, protein, etc., and Cellular damage, survival curves will also be discussed. The course will establish fundamental concepts of radiation biology through a discussion of radiation interaction with tissue, radio sensitivity, early and late effects of radiation. Theories of Biological effects of Radiation, short- and long-term effects (stochastic and non-stochastic). Radio sensitivity and modifiers, post irradiation clinical events. Organ pathology Syndromes, Evidence from Hiroshima and Nagasaki. Target Theory and Lethal Dose.

#### **RDG 409: PRINCIPLES OF RADIOTHERAPY AND ONCOLOGY**

Application of ionizing radiation to Tumours and other Diseases; Superficial and Deep therapy; Heat and Immunotherapy; Nature and type of cancer, staging of cancer, causes and management; Radiotherapy and Chemotherapy; Equipment for production of radiation therapy Beam; Radiation



Beam Measurement; Beam Modifiers and applicators; Simulators and their uses; Manual and Automatic Planning; Definition and units of radiotherapy/radiation; Production of x- and gamma rays; Fractionation in radiation therapy; Types of radiotherapy; Complications of radiotherapy

### **RDG 316: PSYCHOLOGY FOR RADIOGRAPHERS**

The Psychology of the sick patient, management of children, the elderly, the disabled; Potentially violent patients and patients in terminal stages of diseases; Communication with and general care of patients and relationship with staff; Acceptance of responsibility for care of patient; Motivation and emotional adjustment

### **RDG 418: RESEARCH SEMINAR**

The Research seminar Course is an informal forum for the presentation and discussion of work in progress and published works. This is an opportunity for us to find out about current research being undertaken, to develop our own research, and to share ideas. The Research Seminar course consists of scientific seminars including published work, work published in abstracts, and research in progress presented in seminar form. They are designed as scientific seminars including newly published work and research in progress. The main aim is to gather journal publications with a view to addressing scientific topics in-depth, and breaking new ground. Each student will be required to make two seminar presentations. Further, each student will be required to produce a manuscript in the usual journal format on the topic under investigation. For each candidate, literature review and/or development of relevant models related to intended dissertation topics will be acceptable. Presentation of paper by each student on an approved topic to a department colloquium.

### **RDG 416: IMAGE CRITIQUE & PATTERN RECOGNITION**

Definition, pathophysiology, and patterns of the following: pneumonia, tuberculosis, pulmonary carcinoma, hyper-trans-radiant and cystic lung lesions. Approach to focal bone lesions, choice of imaging modality, patient demographic consideration; Benign and malignant focal bone lesions, sites of predilection, periosteal reaction, soft tissue extension, and multiplicity of lesion. Bone infection, pathophysiology. Clinical and radiographic features, acute and chronic, radionuclide scanning in bone infection; Joint infection, septic and tuberculosis arthritis; tuberculous and pyogenic spondylitis.

Trauma imaging, definition and classification of fractures, special types of fracture, process of fracture healing, complication of fracture healing; Regional trauma, head injury; emphasis on the value of CT and its pattern. Review of the plain film and cross sectional anatomy of the abdomen,

mention of the four quadrant and the nine quadrant models; Indications for plain abdominal radiograph; Image critique of AP supine and upright abdominal radiographs: Pattern recognition on abdominal radiograph; mention of abnormal gas, masses, stones and bones pattern; GIT contrast studies; mention of types of GI contrast medium; review of the normal barium swallow, meal, small bowel follow through and enema; Pattern on barium swallow; mention of esophageal ulcers, strictures and varices; Pattern on barium meal; discussion on peptic ulcer, gastric masses and thickened mucosal folds; Pattern on small bowel follow through, fold thickening, stricture and nodular patterns; Colonic pattern, colonic carcinoma, diverticulosis, and thumb printing patterns. Review of the radiographic anatomy of the kidneys, ureters, urinary bladder and the urethra; Image critique of the plain radiography of the abdomen for the urinary tract and the intravenous urography films; Plain film and IVU patterns of abnormal kidneys/pelvic/lyceal system, ureters, bladder and urethra; Renal ultrasonography; normal renal and bladder anatomy, patterns of kidney and bladder lesions (hydronephrosis, calculi, masses, cystic lesions). Micturition cystography and retrograde urethrography; normal anatomy, mention of abnormal pattern

#### **RDG 511: QUALITY ASSURANCE**

The Quality assurance course teaches planned and systematic actions that provide adequate confidence that a diagnostic x-ray facility will produce consistently high-quality images with minimum exposure of the patients and healing arts personnel. The course entails the determination of what constitutes high quality to be made by the facility producing the images. Knowledge that Quality assurance actions include both "quality control" techniques and "quality administration" procedures will be taught in this course.

#### **RDG 422 Mammography 2 COURSE CONTENTS**

History of mammography: Mention W.C Roentgen, 1895, Albert Salomon (German Surgeon) on 1913, Comparison of surgical tissue and healthy breast. Uses of Mammography. Equipment for mammography. Compression devices, the magnification setup, use of grids and automatic exposure controls, X-ray generators in Mammography. Anatomy of breast (Overview), Factors of good quality Mammogram: Radiographer, Patient factor, equipment. Technique factors: Adequate penetration, Contrast and patient dose. Patient preparation, techniques and views. Male Mammography: breast cancer and gynaecomastia. Indication and techniques for ductography.

#### **RDG 510: RESEARCH PROJECT**

Each student must produce a bound thesis report on an approved topic based on any relevant/acceptable area of study in Medical Imaging Science; It must be a research work carried out by the student under an approved supervisor in the final year as part of the partial fulfillment of the B. RAD degree requirements. Assessment of the project would be by grading of the project content by the panel of internal assessors and external assessors, including supervisors, to be chaired by the Head of Department.

### **RDG 305: RADIATION PROTECTION & DOSIMETRY**

This course introduces the current standards for radiation protection through a discussion of the two triads of radiation protection, the fundamentals of radiation protection for personnel, patients and the public, including structural requirements, personnel monitoring, gonadal shielding and other factors which affect the amount of radiation exposure during diagnostic procedures. The course concludes with a discussion of Radiation health and safety requirements of federal and state regulatory agencies, accreditation agencies and health care organizations in Nigeria. The course will help students meet the entry to practice competencies of the registry for radiation, health and safety in diagnostic imaging. Units of radiation measurement and Role of International Committee on Radiological protection, radiation dosimetry and instruments are discussed. The purpose and scope of Radiation protection, systems of Dose limitation and personnel monitoring are emphasized.

### **RDG 413: RADIOGRAPHIC ANATOMY &PHYSIOLOGY -III**

This course continues the study of the anatomy and physiology of the human body. Definition of skull; classification of cranial bones into calvaria, bones of the floor of the skull and facial bones; mention of the boundaries, articulations and foramina associated with cranial bones; sutures of the skull and fontanelles and their classification by age (adult and infants); The facial bones; anatomic position , shape and functions and radiographic/cross sectional imaging appearance: The temporomandibular joint; anatomy on closed and opened mouth view; radiographic and cross sectional imaging correlation; The paranasal sinuses: definition development, shapes and radiographic/cross sectional imaging anatomy; mention the view for demonstration of each paranasal sinuses. The orbit; definition, shape, axial projection of the orbits and its significance in position for optic foramen view, the bony orbits: The petrous of the temporal bones and its content; The external ear. middle ear (tympanic cavity) including the mastoid portion, the inner ear (vestibular cavity). The brain: normal anatomy on ultrasound. CT, and MRI; The cerebral circulation; blood vessels of the brain, the carotid angiogram. internal and external carotids, intracranial portion of the internal carotid artery and its terminal branches; The cerebral veins and the great veins of the neck on ultrasound, CTA & MRA.

#### **RDG 414: RADIOGRAPHIC ANATOMY &PHYSIOLOGY -IV**

The urinary systems: General functions of the urinary system: Components of the urinary system. Functions of the kidneys, ureters and the urinary bladder; Radiographic anatomy of the kidneys, ureters, urinary bladder and urethra including the cross-sectional anatomy/imaging and relations; Normal orientation and position of the kidneys. Renal blood vessels; Macroscopic and microscopic structures of the kidneys with emphasis on the structure of the Nephrons: Urine production. The gastrointestinal tract: General functions of the gastrointestinal systems; Components of the gastrointestinal tract; Upper gastrointestinal tract; The oral cavity (mouth). Pharynx, Esophagus, stomach, small intestine, large intestine; Boundaries and functions of the oral cavity; The accessory organs in the oral cavity and their functions; The salivary glands, production of saliva and functions; The pharynx: Radiographic anatomy: Cavities that communicates with the pharynx; The process of deglutition/swallowing; The Esophagus: Relations and functions; The process of swallowing and peristalsis in the esophagus; Anatomy of the stomach: Location, orientation, openings and curvatures including its subdivisions; Mucosal folds of the stomach; Distribution of barium suspension and air in the stomach during barium meal in various positions; The different types of body habitus as it affects the position of the stomach and other abdominal organs: Anatomy of the duodenum and its relations to the head of the pancreas; Mechanical and Chemical processes of digestion; Lower gastrointestinal tract; Anatomy and differences between the jejunum and ileum; Quadrant and cross sectional locations of the different parts of the small bowel; Anatomy of the large intestine and the appendix; Differences between small and large intestine; Distribution of barium and air in the large intestine during barium enema. The accessory organs of digestion: Anatomy of the Salivary glands, pancreas, liver and gall bladder/bile ducts.

#### **MCB 314: MICROBIOLOGY &PARASITOLOGY**

Infectious agents. Commensal microbes. Pathogens, types of infectious agents - Viruses - general features and structure. Bacteria - general features and structure, laboratory studies of bacteria. Microbes in our environment. Sources and mode of spread of infections. Natural and acquired resistance to infection, determination of Innate Immunity, individual differences and influences of age. Hormones, sex and nutritional factors. Mechanism of innate immunity. Bactericidal substances of the tissues and body fluid. Antiseptic. Disinfectant and Sterilization. Deep tissue infections. Superficial bacterial infection. Fungal infections, deep or systemic mycosis. Respiratory diseases

cause by fungi. Osseous infections. Viral infections. Parasitic infections. Hospital associated infections.

**RDG 401 CAREER PREPAREDNESS (EEP 3201 ENTEPRENUERSHIP SKILS)** The entire program equipped the graduating students with academic and clinical experience to be eligible to practice as a radiographer on successful completion of the degree. Career Preparedness is a class forum preparing graduating students to qualify as contributing members of the allied health team, who will care for patients under the supervision of qualified physicians. They are required to demonstrate their *preparedness* and aptitude for. management, research, or pursue a *career* as a medical imaging expert

### **RDG 512: RADIOGRAPHERS EXAMINATION REVIEW**

The B.RAD degree program at BUK prepares its graduating students to challenge any professional licensing examination globally. This review course provides study guides and exam review resources to help students prepare for the radiography test offered by any radiography professional licensing examination including; the Radiographers Registration Board of American Registry of Radiologic Technologists (ARRT) among others. These materials contain suggestions from experienced RT s for radiography exam preparation and radiography examination books that provide ARRT practice test questions.

### **Remuneration of External Examiners**

- i. External Examiners shall be paid an honorarium by the University as Senate may from time to time determine.
- ii. The University shall also be responsible for the cost of postages of draft question paper, tourist air and/or first-class seat or rail return passage, and kilometer rate and hotel bills for them while visiting the University for examination