BRIEF HISTORY OF THE FOUNDER

SHEIKH KHALIFA ISYAKU RABIU
KADIMUL QUR'AN

Khalifa Sheikh Isyaku Rabiu was born in the ancient city of Kano, in the year 1928 at Jingau quarters. His Parents were Sheikh Muhammad Rabiu and Hajiya Fadimatu. May their souls rest in Jannatul Firdaus.

Khalifa started studying the recitation of the Holy Qur'an under the guidance of his father from 1936 to 1942 when he had the traditional ceremony of completing the reading and learning of the Holy Qur'an.

Khalifa Sheikh Isyaku Rabiu proceeded further with his studies in Borno State (Maiduguri) where he completed the memorization and recitation of the Holy Qur'an in 1946.

Khalifa continued with the study of Tasawwuf and Dariqa under Sheikh Abubakar Mijinyawa at Bakin Ruwa Quarters, Kano. He later returned back to his father's school where he received the knowledge of Quranic science recitation (Tajwid). However, Khalifa Sheikh Isiyaku Rabiu subsequently transferred to Sheikh Abdullahi Salga's school at Sanka in the city of Kano, for him to study Islamic Law, Hadith and Jurisprudence where he graduated in 1949.

After graduation from Sheikh Abdullahi Salga's school his father gave him permission to start a business, where he started trading in Kurmi Market in 1949. In February 1952 Khalifa registered his business as a company called Isiyaku Rabiu and Sons Limited.

As time went on in 1973, Khalifa changed the company name to Isiyaku Rabiu Group Of Companies a conglomerate of twelve companies dealing in Trading, Manufacturing, Insurance, Banking, Aviation and Real Estate with over 1000 employees. Khalifa Sheikh Isiyaku Rabiu was the Chairman and Chief Executive officer of Isiyaku Rabiu & Sons Ltd, Kano Vehicle and

Accessories Ltd, Bagauda Textile Mills Ltd, Rabiu Bottling Company Ltd, Kano Suit and Packing Cases Factory Ltd, IRS Rice Mills Limited, IRS Airlines Limited, Afro Sacks Nigeria Limited, Kano Sugar Industries Limited and Combined Services Nigeria Limited.

In 1969 Khalifa and some other Businessmen in Kano established the First indigenous trading company, Kano Merchants Trading Company which later switched to Bagauda Textile Mills Ltd. He also played active role in the establishment of companies like, Nigerian Victory Assurance Company, Stanbic Merchant Bank Nigeria (first Chairman), Habib Nigeria Bank Limited, Giwarite Nigeria Limited and Combined Services Nigeria Limited.

Khalifa Sheikh Isiyaku Rabiu was a Director in many other companies across the nation and other countries and was also a Member, Governing Council of University Of Ibadan, Islamic University of Niger, Niamey, International University of Africa, Khartoum Sudan, Senate Member, Faisal University, Njamena, Chad, Member, Organisation of Islamic Conference Saudi Arabia, Member, Muslim world league, Saudi Arabia. And also a member of its committee on Mosques, Member Council of Ulama, Nigeria.

Sheikh Isiyaku Rabiu was appointed as leader of the Tijjaniyya Movement in Nigeria and the neighboring countries in 1994, and also gained the title of 'KHALIFA'. He was the President of Sheikh Muhammadu Rabiu Islamic Foundation International, an Islamic organization for both humanitarian and Islamic propagation.

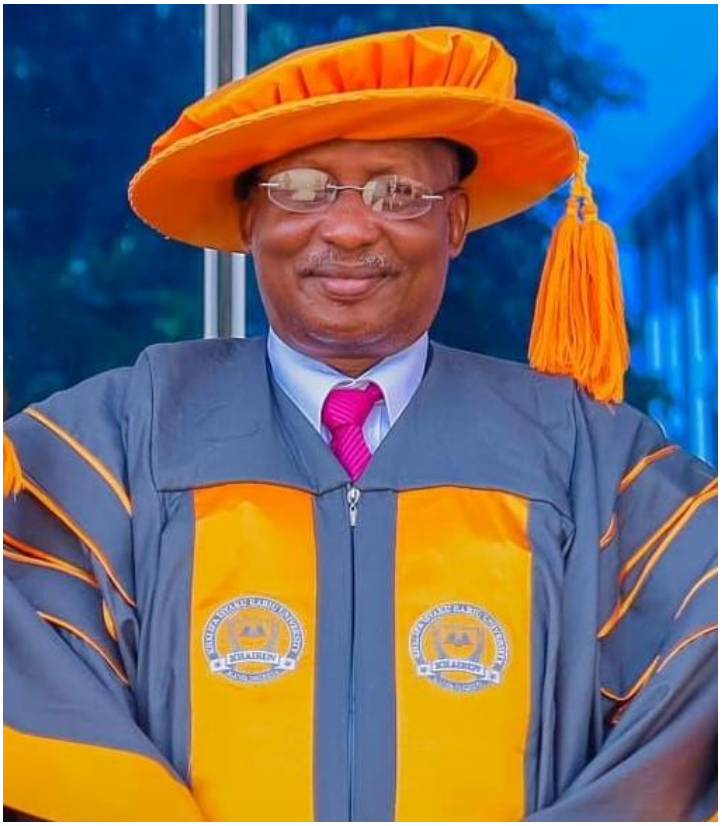
Khalifa received Award of Men of Achievement in 1991 by the Cooperate Press Services Ltd, Lagos and Kano State Government Sports Award, the Industrial Giants Merit Award in 1998, Ahmadu Bello International Award In 1999 and also honoured with the Order of the Federal Republic (OFR) during the government of president Olusegun Obasanjo, in recognition of his contributions in uplifting the standard of living in his community and the nation at large. And so many other awards.

He is just the one single person in history of Kano, and the Northern Nigeria in Nigeria that has succeeded in the establishment of Private schools from kindergarten to university level. May his gentle soul continue to rest in Jannatul Firdaus.

Chancellor and Principal Officers of the University

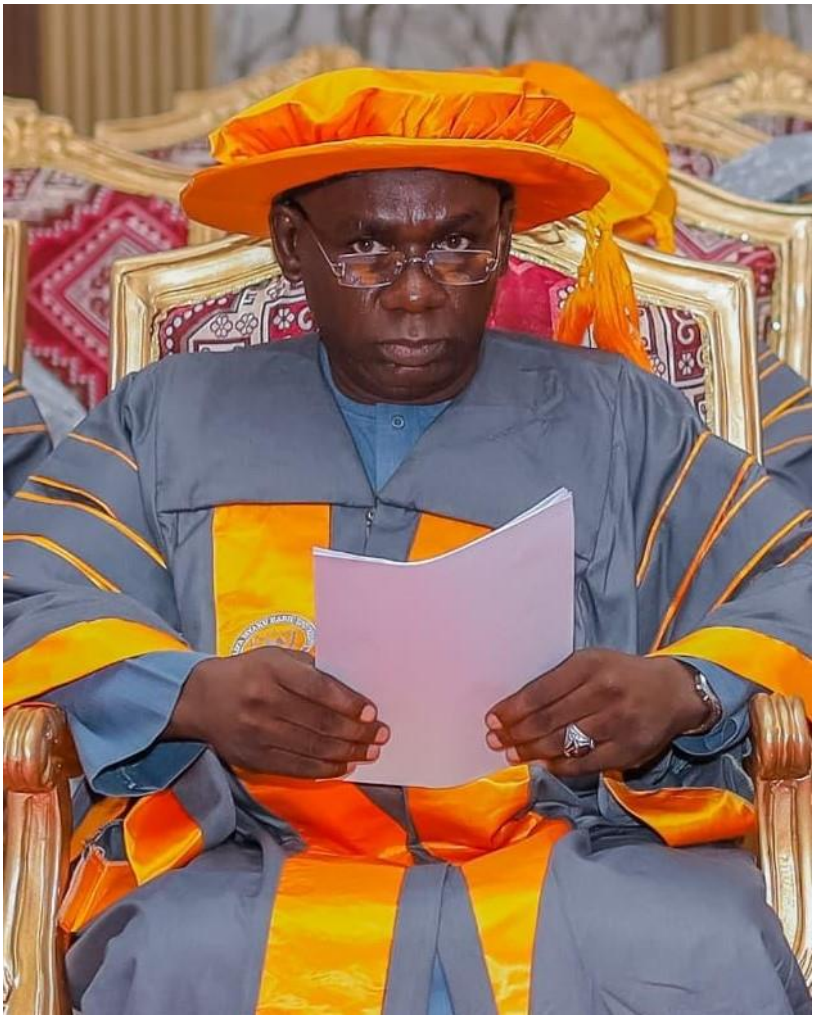
CHANCELLOR
Alhaji Samaila Mohammed Mera (CON)
Emir of Argungu

PRO-CHANCELLOR
Prof. Kabiru Isyaku OON, FNAE, mni



VICE-CHANCELLOR

Prof. Abdulrashid Garba, *PhD; fcasson; mnae, icasson*



REGISTERAR

Malam Yusuf Datti

BURSAR

Dr. Najaatu Bala Rabiu CNA, ACTI,

UNIVERSITY LIBRARIAN
Nazir Muhammad, CLN, MNLA

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INTRODUCTION TO STUDENTS' HANDBOOK

In the year 2022, the National Universities Commission (NUC) announced an addition of a new private university in Kano State. That was the proclamation of the Khalifa Isyaku Rabiu University, Kano. The University's acronym is KHAIRUN. The Founder of the University, was Khalifa Isyaku Rabi'u (Khadimul Qur'an), *rahimahulLah*. Until his *wafat* he demonstrated keen interest and desire to witness the completion of his long standing ambition of building an educational empire, from Kindergarten to the University level. Allah (SWT) in His infinite mercies did not plan for that. In His divine wisdom, Allah SWT has however, blessed the worthwhile ambition of this gentleman - today, KHAIRUN is a reality. It is an addition to the various schools he has established from the scratch. May Allah SWT continue to rest his gentle soul in Jannat el-Firdaus.

Presently, KHAIRUN has three Faculties, ten Departments and sixteen academic programmes, namely: Allied Medical Sciences with three Departments and three programmes; Science and Computing with five Departments and ten programmes; and Engineering with two Departments and three programmes. Each of these programmes has been equipped with state of the art equipment in classes and in the laboratories. In addition to all these there are smart

classrooms for easy tutelage, strong internet access, and a vibrant website. The University Library is well equipped with current holdings and e-resources. There is also a well-equipped hostel facility for both male and female, and for international students. All these are provided for students in order to ease academic pursuit.

While we remain prayerful for Allah's protection, the University has provided adequate security measures to protect lives and properties, and against any incursion by insurgent elements. To crown all these, the University has a well-planned arrangements on ground to ensure strict compliance to all University regulations, social norms and values, and for the observance and enforcement of our highly cherished Islamic traditions. Staff and students are therefore encouraged to be wary of, to support and be ready to imbibe the peculiarities of KHAIRUN environment.

I want to, on behalf of Proprietors, Board of Trustees, Governing Council and Management of KHAIRUN, welcome all the newly admitted students to this promising citadel of learning. I also wish to congratulate you for the single advantage and rare privilege of being pioneer students.

Abdulrashid Garba, *PhD; fcasson; mnae, icasson*
Vice-Chancellor

The University Logo

The Logo is circle in shape containing a book and a pen embossed on brown strip. The book and pen depicts hallmark of knowledge. The brown colour represents soil from which life began; on to which the resources for sustaining life on earth exist; and into which life shall end. This signify that the University emphasizes knowledge and its translation into real life applications guided by code of ethics that leads to good ending. The writing printed in the Logo's upper semicircle is the name of the **Founder** of the University.

Khalifa Isyaku Rabiu

This represents an exemplary life of commitment, dedications, hardwork and sacrifice in the service to humanity, worthy of emulation by students and staff of the University.

Motto

"Functional Education is Light"

The University is dedicated at producing total person with the requisite skills, knowledge and values relevant to the 21st century.

The University Colour (Orange and Ash)

The **Orange,** as a blend of red and yellow is associated with energy and happiness that boosts aspirations, stimulates mental activity and enhances confidence and understanding. Thus, the University emphasize to stimulate its students to attain utmost capabilities in their educational pursuits.

The **Ash** characterizes transparency which portrays the uniqueness of the colour. It is sometimes equated with grey and can be used for font colour, headers, graphics, and even products to appeal to mass audience. KHAIRUN's stunning façade is decorated in soft ash and its variations

Vision

The vision of the University is to be a World-Class teaching and research University, producing educated, self-discipline, confident and independent minded graduates (Character and Learning)

Mission

The mission of the University is to produce educated, morally sound and skilled graduates that will respond to the Challenges of 21st century

Philosophy Goals and Objectives

The University will embrace openness in the pursuit of knowledge and will welcome intellectually restless students, who use their talents to put ideas to test. Education in the University will not be viewed only as a gateway to personal development but also as a pathway to improve society. The University will strive to help students develop knowledge, appreciation, understanding, ability and skills which will prepare them for responsible living in a complex World

The university has a faith-based philosophy presupposes the integration of faith and learning. The university is prepared to invest the time necessary to prepare students intellectually and spiritually to be productive citizens in the 21st century. The students will be assisted to reach their highest potentials.

Goals and Objectives

a) Encourage the advancement of learning and to hold out all persons without distinction of race, creed, sex

or political conviction the opportunity of acquiring a higher and liberal education;

b) Provide resources for instruction and other facilities for the pursuit of learning in all its branches, and to make those facilities available on proper terms to such persons as are equipped to benefit from them;

c) Encourage and promote scholarship and conduct research in all fields of learning and human endeavor;

d) Evolve academic programmes to suit the changing social and economic needs of the society through continuous review of curricular and development of new programmes through programme structural flexibility to respond to societal technological changes;

e) Create and expand access and opportunities for education, attract and retain quality students, researchers, teachers, and other academic and non-academic staff thereby assisting in developing human capital development and mitigation of the brain drain currently afflicting Nigeria;

f) Produce internationally acceptable graduates that would compete favorably with their peers anywhere in the World;

g) Cary out basic and applied research leading to the domestication and application of new technology to the Nigeria context through collaborative linkages with other academic and research institutions in Africa and the rest of the world;

h) Establish a center for entrepreneurial studies to stimulate job creation and innovative capacity in students from onset of their studies, in such a way that graduates shall be resourceful, self-reliant and job creators; and

i) Undertake other activities appropriate for teaching and community service as expected of a University of high standard.

Academic and Official Costume

The official costume for academic ceremonies will be in line with university academic colours (Ash, Dark Ash and Light Ash)

Faculty	Colour	Meaning
Allied Medical Science (FAMS)	Red	energy, strength and power

AUTHORITIES OF THE UNIVERSITY

The University Authority are the Proprietors, Officers of the Board of Trustees, the Council, the Senate, Faculty Board, the Congregation and Convocation.

Proprietor

The proprietor of KHAIRUN is the Muhammad Rabiu Islamic Foundation International responsible for the appointment of Board of Trustees.

Board of Trustees

Board of Trustees is the highest governing body of the University charged with the overall policy direction and financing of the University.

Council

Council is another governing body appointed by Board of Trustees which is charged with general management of the affairs of the University, and in particular, the control of the property and expenditure of the University. The membership of the Council consist of the Pro-Chancellor, Vice-Chancellor and representatives of the

senate, congregation, convocation NUC, interest groups, Kano State government, proprietor's nominee and the Registrar.

Senate

The senate is responsible for the organization and control of admission, teaching, and discipline of students and promotion of research at the University. The membership of the senate consist of the Vice-Chancellor, University Librarian, Dean of faculties, including Dean, Student Affairs, Directors of academic centers, Heads of academic departments, Director academic planning, all Professors of the University, one elected from each faculty not below the rank of senior lecturer, and the registrar who shall be the secretary.

Faculty and Departmental Administration

Faculties shall be the center of teaching and research. It is directly responsible for the control of teaching, examination and evaluation of students. Each faculty should have faculty board while a department shall have departmental board. The Dean and Head of department shall handle the administration of the faculty and the department respectively.

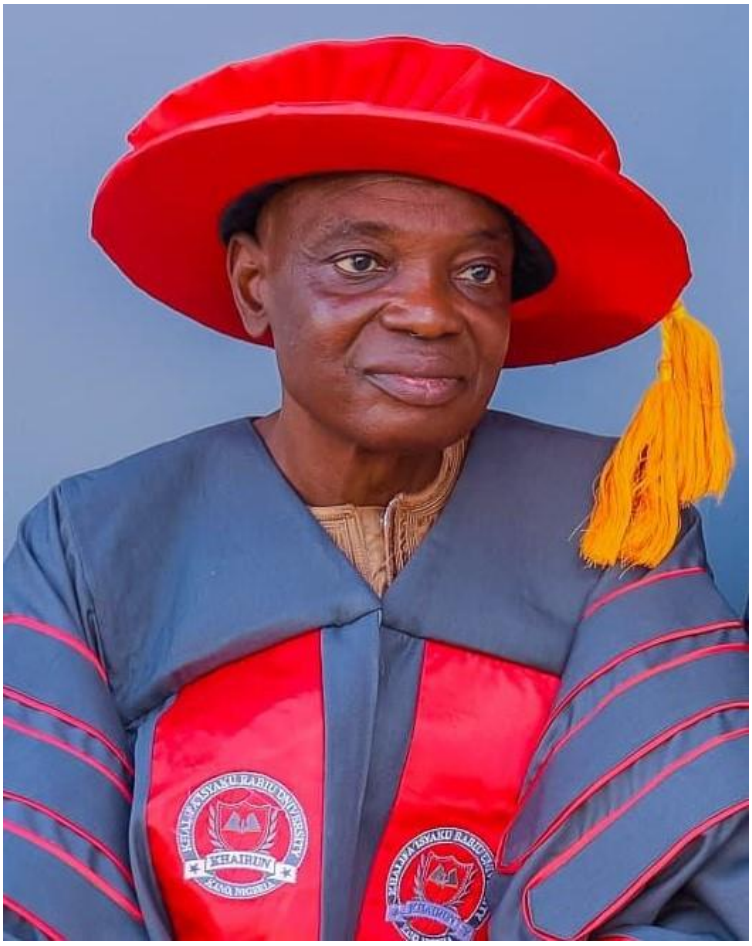
Congregation

The congregation provide an opportunity for members to meet and express their views on all matters affecting the interest and welfare of the University and its members. Members consist of all academic staff and non-academic staff holding degree conferred by recognized universities or any other qualifications recognized by the University.

Convocation

The convocation shall have the functions of awarding certificate, diplomas and degree, both undergraduate and post graduate of the University. Members consist of Pro-Chancellor and chairman of council, Vice-Chancellor, University Librarian, Bursar, registrar, all full time academic staff, and graduate of the University

FACULTY OF ALLIED MEDICAL SCIENCES



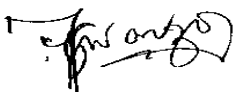
Prof Muhammad Yalwa Gwarzo PhD. FWACMLS
Dean Faculty of Allied Medical Sciences

FOREWORD

On behalf of the Faculty of Allied Medical Sciences, I wish to extend a warm welcome to you and offer my congratulations for securing admission into our

prestigious university, as it reflects your success in a competitive selection process. Hence, you should work hard to consolidate the success in order to achieve the desired goal of graduating with good result, a prequisite for success in the competitive labour market. It is pertinent to note that success in graduation is not only dependent on hardwork, but also strick adherence to the rules and regulations of the University. The Faculty staff members are your friends, teachers and guides, thus they will strive to provide guidance and conducive environment for learning. The University handbook provides you with guidance for your stay during the course of study in the University and necessary information on the curricula of programmes in the Faculty. Currently we have three Departments in the Faculty viz: Medical Laboratory Science, Nursing Sciences and Medical Radiography. Earning a degree in any of the programmes will be a gateway for you into the exciting world of Health Care provision. I wish you successful academic and professional pursuit in the Faculty.

Best Wishes



Prof Muhammad Yalwa Gwarzo PhD. FWACMLS
Dean Faculty of Allied Medical Sciences

DEPARTMENT OF MEDICAL RADIOGRAPHY

The faculty of Allied Medical Sciences is among the take-off faculties with Professor Muhammad Yalwa Gwarzo as its pioneer Dean. The faculty, which started in the 2022/2023 session has three (3) departments for the moment.

Programmes and Degrees

The programmes are **Allied Medical Sciences** which covers the following degree areas.

Table 1: List of Programmes and Degree

S/N	Programme	Degree(s) in view
1.	Medical Laboratory Science	BMLS
2.	Nursing Sciences	B.N.Sc
3.	Radiography	B.Rad

Duration

The duration of first degree programmes is normally ten (10) semesters in the faculty of Allied Medical Sciences. Where a student fails to graduate at the minimum time, he may be allowed a maximum of half the duration of his

degree programme over and above the stipulated time. Any period of approved suspension of studies shall not be counted. A student accepted on transfer shall spend a minimum of two sessions in the University before graduation.

Mode Entrance

S/N	Mode of Entrance	Potential Level	Duration			
			Minimum		Maximum	
1	UTME	1	Year	Semester	Year	Semester
			5	10	7	14
2	DE	2	4	8	6	12

B.Rad. Radiography

Philosophy

Radiography has experienced rapid and tremendous changes in the recent past due to scientific/ technological advances in medical imaging/therapy and associated role development. Consequently, the body of knowledge necessary to cope with these advances and the abilities, expertise, skills and responsibilities has similarly expanded.

From the initial analogue/ photographic approach stage to radiography practice to the present electronic signal transfer and wholly digital process embracing automation with artificial intelligence in its operations; there is need for a paradigm shift in training. Radiography education must thus address these issues in frame work and be poised for a continuous review as the need arises.

Objectives

The programme is designed to:

1. Prepare students with sufficient theoretical scientific knowledge base and practical skills that enable them assume professional positions as radiographers/ diagnostic medical image scientists who can use the most complex medical imaging equipment for radio-diagnostic and therapeutic procedures.

2. Develop in students, the relevant practical and technological competence in radiography practice at primary, secondary and tertiary levels of healthcare and in the global environment.

3. Assist students in the development of interpersonal skills necessary to function as members of the health team.

4. Develop in students good working knowledge and skills in all modalities and be equipped to specialise in any of the subspecialties after qualification.

5. Prepare students with sufficient knowledge and analytical skills that equip them for further studies, and research development.

6. Generate in students an appreciation of the role of radiography in healthcare delivery, environmental and social relevance, such as rural radiography, bioinformatics and information technology,

7. Develop in students the spirit of entrepreneurship so that on graduation, they can cope with self-employment especially in the radiography/ medical imaging industry.

Unique Features of the Programme

The programme has peculiar features, as it stands out to be among the first to introduce artificial intelligence, rural radiography and radiography education into the undergraduate curriculum. These features aim to meet both local and international needs in the practice of radiography profession, particularly, the Nigerian trained

radiography graduates are in high demand and currently working everywhere all over the world.

In addition, the program has been drawn to compete with the best radiography program in the United Kingdom, United States of America, Australia, Canada and the world over. Other Medical imaging modalities in the BMAS has been unbundled into its component parts as MRI, CT, Ultrasonography and Scintigraphy and consequently received more emphasis than the former BMAS. This is to enable graduates acquire relevant skills during training to cope with the demands of clients in these emerging areas of medical imaging/radiography

Admission and Graduation Requirements

Admission requirements: There are two modes of admission into the degree programme.

Five-Year Degree Programme: prospective candidates can be admitted into Radiography programme if they have obtained minimum of five credit passes in Senior Secondary Certificate (SSC) subjects or its equivalent, which should include English Language, Mathematics, Physics, Chemistry and Biology at not more than two

sittings and appropriate pass in UTME conducted by the Joint Admission and Matriculation (JAMB).

Direct Entry (DE) Admission (Four-Year Programme): Candidates for Direct Entry shall possess first degree in Physical, Biological or Basic Medical Sciences at not less than second class lower division in addition to meeting the five credit passes in Senior Secondary Certificate subjects (or its equivalent) earlier stated, two of which must be at Advance Level. The subject can be Chemistry, Physics or Biology at not less than C grade. Candidates who passed Diploma in X-ray Technician course from accredited School of Health Technology plus 5 credit passes in English language, Chemistry, Mathematics, Physics and Biology at SSC or its equivalent are eligible for Direct Entry.

Minimum Standards for Graduation

Graduation Requirements: The programme is run in three stages:

Stage I – The students must successfully complete the first year in the basic sciences related to the programme namely, Biology, Chemistry and Physics.

Stage II – The students must successfully complete all the courses in the basic medical sciences and professional courses at the 200 level before sitting for the first Radiology Professional Examination.

Stage III – Student must be successful in the first Professional Examination before progressing to 400 level and sitting for the second Professional Examination at the 500 level of the course.

The courses that constitute first Professional Examination are Radiographic Technique, Hospital practice and Care of Patient, Radiographic Anatomy and Physiology, Radiation Physics/Biology, Protection and Dosimetry. In addition to successful completion of Basic Medical Sciences in Anatomy, Physiology and Biochemistry.

The second Professional Examination (Part II) comprises the following courses: Radiographic Equipment, Radiographic Technique, Radiographic Imaging Process, Other Imaging Modalities – Sonography, CT and N/M, Radiotherapy and Oncology and Research Methods/Seminars. The pass mark for the professional courses shall be 50% while 40% or 45% shall be

applicable to other courses as may be required in the course system. The degree shall be unclassified.

All students must meet the following criteria for graduation:
completion of 5 years of training for UTME candidates and 4 years for Direct Entry candidates;

i. successful completion of all registered courses for the award of degree;

Progression from level to level

There shall be a special means of progression across the levels, and status of students (promotion, re-sit, repeat, withdrawal) will be on percentage of credits *passed* or *failed*. The breakdown in each status is explained below:

a) For promotion to level 200:

A candidates must pass all chemistry, biology, mathematics, and physics **subjects** in level 100 before proceeding.

b) For promotion from 200 to 500 levels:

A candidate must pass the total credits of core courses registered. That general courses such as "General studies" do not count in determining candidate's status but are required for graduation.

c.) Re-sit:

A candidate who fails not more than ¼ (25%) credits of core courses registered in a session would be required to re-sit the courses failed. A student who fails any of the re-sit examination shall be recommended to repeat the level.

d) Repeat:

i. A candidate who fails more than ¼ (25%) but not more than (≤) ½ (50%) of total credit unit registered in a session will be required to repeat the level automatically.
ii. Should the candidate fail the repeating class to the extent that his status is Repeat, the candidate will be recommended to withdraw. i.e a candidate can't repeat a level twice.
iii. A candidate who fails more than ½ (50%) of core credits registered would be advised to withdraw from the programme authomatically.
iv. However, once a candidate reaches 400 level, even if he fails more than 50% of courses/credits, he/she would be allowed to repeat that year. This privilege would be given only once.

1.11 Examination Regulation

1.11.1 Candidate will be required to register for courses within and outside the Department as contained in the KHAIRUN, Kano- B.Rad curriculum. All courses taught during the semester shall be examined at the end of the semester and candidates shall be credited with the number of units assigned to each courses.

i. There must be continuous assessment (CA), which will be part of final evaluation of the students.

ii. Candidates must have at least 75% attendance in lectures, clinical postings and other academic activities required by the course before qualifying to write the final examinations in each course registered for the semester.

1.11.2 Distribution of marks:

i. Continuous Assessment = 40%

ii. Written Examinations = 60%

Total = 100%

iii. There shall be a final examination for each course and shall be in the form of theory,

Multiple Choice Questions (MCQs), practical/clinical, oral examinations or combination of any of the options listed as required by the course and the Departmental board.

1.11.3 In the case of normal Clinical radiography courses, a candidate who fails the practical/clinical examinations shall be required to repeat the clinical postings for a period of at least four (4) weeks before a re-sit examination is conducted for the course.

**In such an instance, the candidate will have to pay special charges for this purpose

All courses taught during the semester shall be examined at the end of the semester and candidates shall be credited with the number of units assigned to each course.

1.12 Professional Examination

There shall be two (2) professional examinations at 300L (1st professional) and 500L (2nd /final professional) examinations. They are normally moderated by an appointed examiner of the Radiographers Registration Board of Nigeria (RRBN).

Similarly, candidates at the 300L must be indexed by the RRBN before qualifying for the 1st professional examination.

A candidate who fails any of the professional examination will automatically REPEAT the level.

1.12.1 Indexing of Candidates:

i. Undergraduate students of the B.Rad. programme MUST be presented to the Radiographers Registration Board of Nigeria (RRBN) for indexing at the beginning of 300 Level, having passed all 100 and 200 Level courses. Only indexed candidates are qualified to sit for the first professional examination.

ii. Similarly, successfully indexed candidates that happen to progress to 500L shall be presented for the final 2nd professional examination at the end of 2nd semester.

Following successful completion of the B.Rad programme in KHAIRUN, Kano, candidates who will expected to satisfy a documentation process and be presented for induction by the Registrar/CEO of the RRBN or his representative. Similarly, all inducted candidates must proceed to a MANDATORY one year internship programme

in accredited internship training institution recognized by the RRBN.

1.13 Examination Duration

This will be based on the credit load for each course. Ranging between 1-3 hours for taught courses. However, practical/clinical examinations differ, its 2 hours for a single credit course and depending on the examiners moderation.

1.14 Examiners

a. **Chief Examiner:** The Head of Department of Med. Radiography shall be the chief examiner for all the courses offered in the Department.

b. **Internal Examiner:** The examiner must be a minimum of Lecturer II by rank.

c. **External Examiners:** The external examiners must be a minimum of Senior Lecturer and shall moderate the normal and pre-professional examinations. The external examiner must also moderate the final (500 Level) graduation examination in accordance with existing examination regulations of KHAIRUN, Kano.

1.15 Pass Mark

i. The minimum pass mark for all courses at the 100 levels and general university course shall be 40%.
ii. All courses at other levels shall be 50%.

The total number of units taken along with grades obtained in each course shall be recorded for the purpose of calculating the cumulative grade point average [CGPA]. The CGPA shall be used for the determination of the class of the level pass.

1.16 Award of Degree

This program will lead to the award of unclassified Bachelor of Radiography Degree to be denoted by letters "**B. Rad".** which shall be awarded at the end of the five or four -year programme and after having passed all the courses registered at various levels of the programme.

1.17 Research Projects

Each student shall embark on approved research projects relevant to the various areas of specialty in Radiography training programme.

1.18 Course Grading

The marks obtained in each course shall be assigned the appropriate letter grades.

MARKS	LETTER GRADE	GPA
70& above	A	5
60- 69	B	4
50- 59	C	3
49 and below	F	0

PROGRESSION FROM LEVEL TO LEVEL

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i. The minimum pass mark for all courses at the 100 levels and general university course shall be 40%.
ii. All courses at other levels shall be 50%.

The total number of units taken along with grades obtained in each course shall be recorded for the purpose of calculating the cumulative grade point average [CGPA]. The CGPA shall be used for the determination of the class of the level pass.

1.16 AWARD OF DEGREE

This program will lead to the award of unclassified Bachelor of Radiography Degree to be denoted by letters "**B. Rad".** which shall be awarded at the end of the five or four -year programme and after having passed all the courses registered at various levels of the programme.

1.17 RESEARCH PROJECTS

Each student shall embark on approved research projects relevant to the various areas of specialty in Radiography training programme.

1.18 COURSE GRADING:

The marks obtained in each course shall be assigned the appropriate letter grades.

MARKS	LETTER GRADE	GPA
70& above	A	5
60- 69	B	4
50- 59	C	3
49 and below	F	0

i. successful completion of all required clinical postings/placements and required number of clinical cases observed/carried out.

ii. All competencies must be completed as outlined in the log book for training.

GLOBAL COURSE STRUCTURE

100 Level.

Course Code	Course Title	Unit(s)	Status	LH	PH
GST 111	Communication in English	2	C	15	45
GST 112	Nigerian Peoples and Culture	2	C	30	-
BIO 101	General Biology I	2	C	30	-
BIO 102	General Biology II	2	C	30	-
BIO 107	General Biology Practical I	1	C	-	45
BIO 108	General Biology Practical II	1	C	-	45
CHM 101	General Chemistry I	2	C	30	-
CHM 102	General Chemistry II	2	C	30	-
CHM 107	General Chemistry Practical I	1	C	-	45
CHM 108	General Chemistry Practical II	1	C	-	45
COS 101	Introduction to Computer Science	3	C	30	45
MTH 101	Elementary Mathematics I	2	C	30	-

Course Code	Course Title	Unit(s)	Status	LH	PH
PHY 101	General Physics I	2	C	30	-
PHY 107	General Physics Practical I	1	C	-	45
PHY 102	General Physics II	2	C	30	-
PHY 108	General Physics Practical II	1	C	-	45
MTH 101	Mathematics for Health Sciences	3	C	45	-
Total		**30**			

200 Level.

Course Code	Course Title	Unit(s)	Status	LH	PH
GST 212	Philosophy, Logic and Human Existence	2	C	30	-
ENT 211	Entrepreneurship and Innovation	2	C	30	-
ANA 201	Anatomy of Upper and Lower limbs	2	C	15	45
ANA 204	Anatomy of Thorax, Abdomen and Perineum	2	C	15	45
ANA 302	Neuroanatomy	2	C	30	-
ANA 203	General and Systemic Embryology	2	C	30	-

Course Code	Course Title	Unit(s)	Status	LH	PH
BCH 201	General Biochemistry I (Chemistry of Biomolecules)	2	C	30	-
BCH 202	Bioenergetics, Metabolism and Inborn Errors of Metabolism	2	C	30	-
PIO 201	Introductory Physiology and Blood	2	C	30	-
PIO 214	Introduction to Cardiovascular and Respiratory Physiology	2	C	30	-
PIO 204	Introduction to Laboratory Physiology	1	C	-	45
RAD 201	Basic/ Radiation Physics in Radiology	2	C	30	-

Course Code	Course Title	Unit(s)	Status	LH	PH
RAD 210	Basic Patient Care, Hospital Practice and Professional Ethics	2	C	30	-
MCB 201	Introduction to General Microbiology	2	C	30	-
ANA 201	General Histology	2	C	15	45
PIO 201	Gastrointestinal tract and Renal Physiology	2	C	30	-
PIO 202	Endocrinology & Reproductive Physiology	2	C	30	-
PIO 203	Excitable Tissues, CNS, Special Senses Physiology	2	C	30	-
RAD 203	Introduction to Radiography	2	C	30	-
Total		**37**			

300 Level.

Course Code	Course Title	Unit(s)	Status	LH	PH
GST 312	Peace and Conflict Resolution	2	C	30	-
ENT 312	Venture Creation	2	C	15	45
RAD 301	Radiobiology, Radiation Dosimetry and Protection	2	C	15	45
RAD 302	Physics of Cross-sectional Imaging	2	C	30	-
RAD 341	Radiographic Technique I	2	C	15	45
RAD 331	Radiographic Imaging Process I	2	C	15	45
RAD 332	Artificial Intelligence in Radiography	1	C	15	45

Course Code	Course Title	Unit(s)	Status	LH	PH
RAD 381	Radiographic Anatomy and Physiology	2	C	30	45
RAD 311	Psychology and Medical Sociology for Radiographers	2	C	30	-
RAD 321	Radiographic Equipment I	2	C	15	45
RAD 384	Pharmacology for Medical Imaging	2	C	30	-
RAD 351	Radiology Administration and Management	1	C	15	-
RAD 352	Entrepreneurship/Education in Radiography	2	C	30	-
RAD 372	Clinical Posting I	3	C	-	135

Course Code	Course Title	Unit(s)	Status	LH	PH
ANA 301	Gross Anatomy of Head and Neck	3	C	30	45
RAD 302	Radiographic Technique (Lower Limb, Pelvis/Hip and vertebral Spine).	2	C	15	45
RAD 303	Surface Anatomy for Radiographers	2	C	15	45
ANA 304	Radiobiology, Dosimetry and Protection II	2	C	30	-
PTH 301	General Pathology	2	C	30	-
PTH 302	Systemic Pathology	2	C	30	-
RAD 306	Radiographic Anatomy and Physiology II	2	C	30	-

Course Code	Course Title	Unit(s)	Status	LH	PH
RAD 305	Medical Jurisprudence for Radiographers	2	C	30	-
Total		**44**			

400 Level.

Course Code	Course Title	Unit(s)	Status	LH	PH
COMED 491	Biostatistics for Health Sciences	2	C	30	-
RAD 492	Research Methodology	2	C	30	-
RAD 441	Radiographic Technique II	2	C	15	45
RAD 442	Ultrasound Imaging /Computerised Tomography	2	C	15	45
RAD 447	Radio-Nuclide Imaging/Thermography/MRI	2	C	30	-
RAD 421	Radiographic Equipment II	2	C	30	-
RAD 431	Radiographic Imaging Process	2	C	15	45

Course Code	Course Title	Unit(s)	Status	LH	PH
	II				
RAD 471	Clinical Posting II	3	C	-	135
RAD 474	Students Industrial Work Experience (SIWES)	3	C	-	135
RAD 482	Radiographic Pathology	2	C	30	-
RAD 402	Interventional Radiography	2	C	30	-
RAD 403	Echocardiography and ECG	2	C	30	-
RAD 404	MRI, Nuclear Med., and Thermography	2	C	30	-
RAD 405	Mammography (clinical applications and Complex techniques)	2	C	30	-

Course Code	Course Title	Unit(s)	Status	LH	PH
RAD 407	Veterinary Radiography	2	C	30	-
GST 401	Character Building, Professionalism and Team Work in Healthcare	2	C	30	-
Total		**34**			

500 Level.

Course Code	Course Title	Unit(s)	Status	LH	PH
RAD 531	Radiographic Imaging Process III (Special Topics)	2	C	15	45
RAD 521	Radiographic Equipment III	2	C	15	45
RAD 581	Imaging Critique/Pattern Recognition	2	C	30	-
RAD 591	Research Seminar	2	C	15	45
RAD 592	Project	4	C	30	90
RAD 544	Radiographic Technique III	2	C	15	45
RAD 561	Radiotherapy/Oncology I	2	C	15	45
RAD 551	Rural Radiography	1	C	15	-
RAD 572	Clinical Posting III	4	C	-	135

Course Code	Course Title	Unit(s)	Status	LH	PH
RAD 501	Ultrasound–II (Protocols and Clinical Applications)	3	C	30	45
RAD 503	CT II (Protocols and Clinical Applications)	3	C	45	-
RAD 505	Quality Assurance in Radiography	2	C	30	-
RAD 506	Forensic Radiography	2	C	30	-
RAD 507	Industrial Radiography	2	C	15	45
Total		**33**			

COURSE CONTENTS AND LEARNING OUTCOMES

100 LEVEL

GST 111: Communication in English
(2 Units C: LH 15; PH 45)

Course Contents

This course prepares the student to have a sound grasps of sound patterns in English Language (vowels and consonants, phonetics and phonology), English word classes (lexical and grammatical words, definitions, forms, functions, usages, collocations). Sentence in English (types: structural and functional, simple and complex). Grammar and Usage (tense, mood, modality and concord, aspects of a language use in everyday life). Logical and Critical Thinking and Reasoning Methods (Logic and Syllogism, Inductive and Deductive Argument and Reasoning Methods, Analogy, Generalisation and Explanations). Ethical considerations, Copyright Rules and Infringements. Writing Activities: (Pre-writing, Writing, Post writing, Editing and Proofreading; Brainstorming, outlining, Paragraphing, Types of writing, Summary, Essays, Letter, Curriculum

Vitae, Report writing, Note making and many others. Mechanics of writing). Comprehension Strategies: (Reading and types of Reading, Comprehension Skills, 3RsQ). Information and Communication Technology in modern Language Learning. Language skills for effective communication. Major word formation processes. Writing and reading comprehension strategies. Logical and critical reasoning for meaningful presentations. Art of public speaking and listening.

GST 112: Nigerian Peoples and Culture
(2 Units C: LH 30)

Course Contents

Nigerian history, Culture and Art up to 1800 (Yoruba, Hausa and Igbo peoples and culture; peoples and culture of the ethnic minority groups). Nigeria under colonial rule (the advent of colonial rule in Nigeria; Colonial administration of Nigeria). Evolution of Nigeria as a political unit (amalgamation of Nigeria in 1914; formation of political parties in Nigeria; Nationalist movement and struggle for independence). Nigeria and challenges of nation building (military intervention in Nigerian politics; Nigerian Civil War). Concept of trade and economics of self-reliance (indigenous trade and

market system; indigenous apprenticeship system among Nigeria people; trade, skill acquisition and self-reliance). Social justices and national development (law definition and classification. Judiciary and fundamental rights. Individual, norms and values (basic Nigeria norms and values, patterns of citizenship acquisition; citizenship and civic responsibilities; indigenous languages, usage and development; negative attitudes and conducts. Cultism, kidnapping and other related social vices). Re-orientation, moral and national values (The 3R's – Reconstruction, Rehabilitation and Re-orientation; Re-orientation Strategies: Operation Feed the Nation (OFN), Green Revolution, Austerity Measures, War Against Indiscipline (WAI), War Against Indiscipline and Corruption (WAIC), Mass Mobilization for Self-Reliance, Social Justice and Economic Recovery (MAMSER), National Orientation Agency (NOA). Current socio-political and cultural developments in Nigeria.

BIO 101: General Principles of Biology
(2 Units C: LH 30)

Course Contents
Cell structure and organization; functions of cellular organelles; characteristics and classification of living things; chromosomes, genes their relationships and importance. General reproduction. Interrelationships of organisms (competitions, parasitism, predation, symbiosis, commensalisms, mutualism, saprophytism). Heredity and evolution (introduction to Darwinism and Lamarckism, Mendelian laws, explanation of key genetic terms). Elements of ecology and types of habitats.

BIO: 102 General Principles of Biology II
(2 Units C: LH 30)

Course Contents
Basic characteristics, identification and classification of viruses, bacteria and fungi. A generalised survey of the plant and animal kingdoms based mainly on the study of similarities and differences in the external features. Ecological adaptations. Briefs on physiology to include nutrition, respiration, circulatory systems, excretion, reproduction, growth and development.

CHM 101: General Chemistry I
(2 Units C: LH 30)

Course Contents
This course describes Atoms, molecules and chemical reaction. Chemical equation and stoichiometry. Atomic structure and periodicity. Modern electronic theory of atoms. Radioactivity. Chemical bonding. Properties of gases. Equilibria and Thermodynamics. Chemical Kinetic. Electrochemistry.

CHM 102: General Chemistry II
(2 Units C: LH 30)

Course Contents
This course provides a historical survey of the development and importance of Organic Chemistry. Fullerenes as fourth allotrope of carbon, uses as nanotubules, nanostructures, nanochemistry. Electronic theory in organic chemistry. Isolation and purification of organic compounds. Determination of structures of

organic compounds including qualitative and quantitative analysis in organic chemistry. Nomenclature and functional group classes of organic compounds. Introductory reaction mechanism and kinetics. Stereochemistry. The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives. The Chemistry of selected metals and non-metals. Comparative chemistry of group IA, IIA and IVA elements. Introduction to transition metal chemistry.

CHM107: Practical Chemistry I
(1 Unit C: PH 45)

Course Contents
This is a practical course carried out in the Laboratory experiments, it is designed to reflect topics presented in courses CHM 101 and CHM 102. These include acid-base titrations, qualitative analysis, redox reactions, gravimetric analysis, data analysis and presentation.

CHM 108: General Chemistry Practical II
(1 Unit C: PH 45)

Course Contents
Continuation of CHM 107. Additional laboratory experiments to include functional group analysis, quantitative analysis using volumetric methods.

MTH 101: Elementary Mathematics (Algebra and Trigonometry)
(2 Units C: LH 30)

Course contents
This is an elementary course; Elementary set theory, subset, union, intersection, complements, venn diagrams. Real numbers; Integers, Rational and Irrational numbers, mathematical, induction, Sequences and Series, Theory of Quadratic equations, Binomial theorem. Complex numbers; Algebra of complex numbers; the Argand Diagram. De-Moivre's theorem, nth roots of unity, Circular measure, Trigonometric functions of angles of any magnitude, addition and factor formulae.

COS 101: Introduction to Computing Sciences
(3 Units C: LH 30; PH 45)

Course Contents
Brief history of computing. Description of the basic components of a computer/computing device. Input/Output devices and peripherals. Hardware, software and human ware. Diverse and growing computer/digital applications. Information processing and its roles in society. The Internet, its applications and its impact on the world today. The different areas/programs of the computing discipline. The job specialisations for computing professionals. The future of computing.

Lab Work: Practical demonstration of the basic parts of a computer. Illustration of different operating systems of different computing devices including desktops, laptops, tablets, smart boards and smart phones. Demonstration of commonly used applications such as word processors, spreadsheets, presentation software and graphics. Illustration of input and output devices including printers, scanners, projectors and smart-boards. Practical demonstration of the Internet and its various

applications. Illustration of browsers and search engines. How to access online resources.

PHY 101: General Physics I (Mechanics)
(2 Units C: LH 30)

Course Contents
Space and time. Units and dimension, Vectors and Scalars. Differentiation of vectors: displacement, velocity and acceleration. Kinematics. Newton laws of motion (Inertial frames, Impulse, force and action at a distance, momentum conservation). Relative motion. Application of Newtonian mechanics. Equations of motion. Conservation principles in physics. Conservative forces. Conservation of linear momentum. Kinetic energy and work. Potential energy. System of particles. Centre of mass. Rotational motion: Torque, vector product, moment, rotation of coordinate axes and angular momentum. Polar coordinates. Conservation of angular momentum. Circular motion. Moments of inertia. gyroscopes and precession. Gravitation: Newton's Law of Gravitation. Kepler's Laws of Planetary Motion. Gravitational Potential Energy. Escape velocity. Satellites motion and orbits.

PHY 102: General Physics II (Electricity & Magnetism)
(2 Units C: LH30)

Course Contents

This course explains the forces in nature; Electrostatics; electric charge and its properties, methods of charging. Coulomb's law and superposition. electric field and potential. Gauss's law. Capacitance. Electric dipoles. Energy in electric fields. Conductors and insulators, current, voltage and resistance. Ohm's law and analysis of DC circuits. Magnetic fields. Lorentz force. Biot-Savart and Ampère's laws. magnetic dipoles. Dielectrics. Energy in magnetic fields. Electromotive force. Electromagnetic induction. Self and mutual inductances. Faraday and Lenz's laws. Step up and step-down transformers: Maxwell's equations. Electromagnetic oscillations and waves. AC voltages and currents applied to inductors, capacitors, resistance, and combinations.

PHY 107: General Practical Physics I
(1 Unit C: PH 45)

Course Contents

This introductory course emphasises quantitative measurements, the treatment of measurement errors and graphical analysis. A variety of experimental techniques should be employed. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity etc., covered in PHY 101 and PHY 102. However, emphasis is placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

PHY 108: General Practical Physics II
(1 Unit C: PH 45)

Course Contents

This practical course is a continuation of PHY 107 and is intended to be taught during the second semester of the 100 level to cover the practical aspect of the theoretical courses that have been covered with emphasis on quantitative measurements. The treatment of measurement errors, and graphical analysis. However,

emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

KHAIRUN-MTH 101 Elementary Mathematics for Health Sciences
(3 Units, C, LH 45)

Course Contents
Elementary set theory. Subsets. Union. Intersection. Complements. Venn diagram. Real numbers. Integers. Rational numbers. Irrational numbers. Mathematical Induction. Sequences and series. Theory of quadratic equations. Binomial theorem. Complex numbers. Algebra of complex numbers; the Argand Diagram. De-Moivre's theorem. nth roots of unity. Circular measure. Trigonometric functions of angles of any magnitude. Trigonometric formulae.

200 LEVEL

GST 212: Philosophy, Logic and Human Existence (2 Units C: LH 30)

Course Contents

This course defines the scope of philosophy; notions; meanings; branches and problems of philosophy. Logic as an indispensable tool of philosophy. Elements of syllogism, symbolic logic— the first nine rules of inference. Informal fallacies, laws of thought, nature of arguments. Valid and invalid arguments, logic of form and logic of content — deduction, induction and inferences. Creative and critical thinking. Impact of philosophy on human existence. Philosophy and politics, philosophy and human conduct, philosophy and religion, philosophy and human values, philosophy and character molding and many others.

ENT 211: Entrepreneurship and Innovation (2 Units C: LH 30)

Course Contents

Concept of Entrepreneurship (Entrepreneurship, Intrapreneurship/Corporate Entrepreneurship,). Theories,

Rationale and relevance of Entrepreneurship (Schumpeterian and other perspectives, Risk-Taking, Necessity and opportunity-based entrepreneurship and Creative destruction). Characteristics of Entrepreneurs (Opportunity seeker, Risk taker, Natural and Nurtured, Problem solver and change agent, Innovator and creative thinker). Entrepreneurial thinking (Critical thinking, Reflective thinking, and Creative thinking). Innovation (Concept of innovation, Dimensions of innovation, Change and innovation, Knowledge and innovation). Enterprise formation, partnership and networking (Basics of Business Plan, Forms of business ownership, Business registration and Forming alliances and join ventures). Contemporary Entrepreneurship Issues (Knowledge, Skills and Technology, Intellectual property, Virtual office, Networking). Entrepreneurship in Nigeria (Biography of inspirational Entrepreneurs, Youth and women entrepreneurship, Entrepreneurship support institutions, Youth enterprise networks and Environmental and cultural barriers to entrepreneurship). Basic principles of e-commerce.

ANA 201: Anatomy of Upper and Lower Limbs
(2 Units: C: LH 15; PH 45)

Course Contents

Descriptive terms, plans and terms of relationship of the human body, terms of comparison, attachment of muscles, types of muscles, movements of joints. Osteology, principles of kinesiology, general organization of body system. Cutaneous innervation of the upper limb; pectoral region; breast; axilla; shoulder region; arm and cubital fossa; flexor compartment of forearm; extensor compartment of forearm; hand; venous and lymphatic drainage of the upper limb. Applied anatomy of nerves; blood supply of the upper limb. Cutaneous innervation of the lower limb; femoral triangle; adductor canal and medial side of the thigh; gluteal region; back of the thigh, popliteal fossa; extensor compartment of the leg and dorsum of the foot; peroneal and flexor compartment of the leg; sole of the foot, arches of the foot; mechanism of walking; venous and lymphatic drainage of the lower limb; applied anatomy of the nerves and blood supply to the lower limb.

ANA 202: Anatomy of Thorax, Abdomen, Pelvis & Perineum
(2 Units C: LH 15; PH 45)

Course Contents

The course in an introduction to the trunk; thoracic cage; intercostal space; thoracic cavity; pleural cavities; lungs; mediastinum general; anterior & superior mediastinum; middle; mediastinum – heart and pericardium; heart applied anatomy; posterior mediastinum. General anatomy of abdomen and abdominal regions; anterior abdominal wall muscles; inguinal canal – inguinal and femoral hernias; peritoneal cavity and spaces; abdominal oesophagus, stomach, duodenum, spleen, small intestine, large intestine, appendix; portal venous system; portocaval anastomoses; liver and gallbladder. Pancreas and biliary apparatus; kidneys, suprarenal glands, and ureters; diaphragm; posterior abdominal wall; aorta and inferior vena cava; posterior abdominal wall muscles; lumbosacral plexus; bony and ligamentous pelvis; pelvic diaphragm (floor); male reproductive organs; female reproductive organs; male and female external genitalia; perineum; rectum and anal canal; pelvic blood vessels; abdomino-pelvic nervous system.

ANA 203: General and Systemic Embryology
(2 Units C: LH 30)

Course Contents

This is concerned with the explanation of Spermatogenesis, oogenesis; ovarian follicles; ovulation; corpus luteum; menstruation; uterine cycle; hormonal control of uterine cycle; fertilization; cleavage; implantation; reproductive technologies-IVF/surrogacy/embryo transfer; embryo manipulation & potency/twinning; molecular embryology and transgenesis; gastrulation; notochord, neurulation; derivatives of the germ layers; folding of the embryo; fetal membranes; placenta; development of limbs and teratology. Growth and perinatology; congenital malformations – general introduction. The cardiovascular system, skin, structure of the nails and hair. Macrophagic system; cellular immunology; lymphoid organs; glands – endocrine and exocrine. Respiratory system. Digestive system. Urinary and genital systems. Electron micrograph studies of each organ.

ANA 203: Neuroanatomy
(2 Units C: LH 30)

Course Contents
Neuroembryology; introduction to the central nervous system; spinal cord morphology; spinal cord-tracts; lower medulla-pyramids; decussation, tubercles; upper medulla-olive, pons-basis pontis and middle cerebellar penduncle; pons tegmentum; midbrain-tectum; midbrain-tegmentum; cerebellum; diencephalon-thalamus; diencephalon-hyphothalamus; epithalamus, subthalamus; ascending pathways and descending pathways, ventricles; pyramidal system; cerebral hemispheres, sulci and gyri, internal structure of cerebrum, basal ganglia; cortex-cytoarchitectonics, brodman areas, limbic system blood supply to the brain and spinal sord. Applied Anatomy.

PIO 201: Introductory Physiology and Blood
(2 Units C: LH 30)

Course Contents
Introduction and history of physiology. Structure and functions of cell membranes. Transport process. Special transport mechanism in amphibian bladder, kidney, gall

bladder, intestine, astrocytes and exocrine glands. Biophysical principles. Homeostasis and control systems including temperature regulation. Biological rhythms. Composition and functions of blood. Haemopoiesis. WBC and differential count. Plasma proteins Coagulation, fibrinolysis and platelet functions. Blood groups –ABO system – Rh system. Blood transfusion – indication for collection and storage of blood, hazards of blood transfusions. Reticulo- endothelial system. Imunity and immodeficiency disease and HIV.

PIO 214: Introduction to Cardiovascular and Respiratory Physiology
(2 Units C; LH 30)

Course Contents
The heart; events of the cardiac cycle cardiac output and control of cardiac contractility. Cardiac electrophysiology. Properties of cardiac muscle. Cardiac cycle. Cardiac output - measurement and control. Haemodynamics of circulation. Arterial blood pressure and its regulation. Cardiovascular reflexes. Peripheral resistance and local control of the circulation. Regional blood flow. Cardiovascular changes in exercise, haemorrhage and shock. Respiratory Physiology –

Functions of upper respiratory tract. Mechanics of respiration including compliance, surfactant, lung volume and capacities; pulmonary gas exchange. Blood gas transport. Pulmonary function tests; Nervous and chemical control of respiration. Response to hypoxia, high altitude and exercise. Artificial respiration.

PIO 204: Introduction to Laboratory Physiology/Neurophysiology
(2 Units C: LH 15; PH 45)

Course Contents
Laboratory sessions on basic physiology experiments, especially those related to the frog sciatic nerve, smooth muscles and blood physiology. Classification of Nerve fibres. Membrane potentials, Nerve generation and conduction of impulses. Synapses and synaptic transmission. Functional organisation of CNS, autonomic neurotransmitters and autonomic effects.

BCH 201: General Biochemistry I
(2 Units C: LH 30)

Course Contents
Introductory chemistry of amino acids; their properties, reactions and biological functions. Classification of amino acids: neutral, basic and acidic; polar and non-polar; essential and non-essential amino acids. Peptides. Introductory chemistry and classification of proteins. Biological functions of proteins. Methods of their isolation, purification and identification. Primary, secondary, tertiary and quaternary structures of proteins. Basic principles of tests for proteins and amino acids. Introductory chemistry of carbohydrates, lipids and nucleic acids. Nomenclature of nucleosides, and nucleotides; effects of acid and alkali on hydrolysis of nucleic acids.

BCH 202: General Biochemistry II, Metabolism and Bioenergetics
(2 Units C: LH 30)

Course Contents
The cell theory. Structures and functions of major cell components. Cell types, constancy and diversity. Cell

organelles of prokaryotes and eukaryotes. Chemical composition of cells. Centrifugation; Methods of cell fractionation. Structure, function and fractionation of extra-cellular organelles. Water, total body water and its distribution. Regulation of water and electrolyte balance. Disorder of water and electrolyte balance. Acidity and alkalinity, pH and pK values and their effects on cellular activities.

RAD 201: Basic Physics in Radiology
(2 Units C: LH 30)

Course Contents
This deals with the fundamental and derived quantities and units. Equation of motion, concepts of force work energy, power, momentum energy conservation. Fields, Electrostatics, Physical Factors governing capacitance, charging and discharging capacitor and their uses in Radiological Equipment, basic x-ray circuitry and many others. Basic computer Architecture and peripherals. Electromagnetic and Electromagnetic induction, Lenz laws, Mutual and Self-induction. principles and construction of the transformer. Transformer Parameters, uses of mutual and self-inductance in autotransformers and High Tension transformers, AC theory and sources

of electric power supply. current electricity, solid state devices, Rectification, principles and uses in Radiology, concept of energy. Atomic structure, Bohr's atom elements of quantum mechanics applied to atom, Heisenberg's uncertainty theory, de Broglie wavelength, Schrodinger equation and configuration of atoms. The nuclear structure and models, nuclear instability and radioactivity, Wave and Quantum methods of Energy Transfer and applications in radiology, production of X-rays, Radioactivity and radioactive decay, half-life, counters, units of activity and measurement, K-capture. The atom, isotopes, isobars, isomers, nuclear binding energies, and inverse square law, effects of filtration. Luminescence and their applications. Interaction of radiation (emr and particulate radiation) with matter and their applications in medical imaging and radiotherapy. Attenuation of radiation shielding and filtration.

RAD 210: Basic Patient Care, Hospital Practice and Professional Ethics
(2 Units C: LH 15; PH 45)

Course Contents
The course describe the basic first Aid, Principles 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 the Patient. Use of Hospital and Nursing Equipment. Moving and lifting. Drugs, Hospital Practice: The Radiographer in the hospital team. Medico-Legal aspects. Health Services Organisation and Management. Professional Ethics. Nursing procedures; Understanding the recipients of patient's care; Concepts and basic care of patients; emergency situations and first aid treatment. Principles of asepsis and infection. Assessment of vital signs. Documentation and Reporting. Hospital posting weekly forward/clinical/hospital experience in nursing/care of patients. Nursing Posting to familiarise themselves with the use of some basic Hospital and Nursing Equipment.

The students shall be posted for weeks practicals to recognised and relevant placement areas of their choice during the industrial training. Continuous assessment of students will be undertaken jointly by their industry-based supervisors, ITF officials and institutional supervisors. Presentation of a seminar on major duties performed and skills acquired during the training.

MCB 201: Medical Microbiology
(2 Units C: LH 30)

Course Contents

Introduction to Medical Microbiology. Basic concepts and terminologies, infection and disease pathogenicity and virulence, immunity, hypersensitivity, latency and communicability. Pathogenic properties of bacteria: invasiveness, toxigenicity and exotoxins, virulence properties. Host defense mechanisms: skin and mucous membrane barriers, phagocytic defense and inflammation, bacterial infection. The pathogenicity, morphology and cultural characteristics of certain groups of bacteria. Gram-positive bacteria – bacillus, clostridium, staphylococcus and streptococcus; gram-negative bacteria – the family enter bacteria, Neisseria, pseudomonas and vibrio; mycotic infection, types of mycoses. The morphology, laboratory diagnosis and treatment of disease caused by certain groups of fungi to include aspergillus, blastomyces, candida, cryptocossus, histoplasma, sporotrichum and yeasts; viral infections: classification of viruses, distinctive properties of viruses, method for the diagnosis of viral infections.

KHAIRUN-ANA 201, General Histology
(2 Units, Core, LH=15, PH= 45)

Course Content

Methods of Histology and Cytology. Direct observation of living tissues and cell. Examination of killed tissue; Differential centrifugation. Histochemical Methods; Principles of Microscopic Analysis X-ray Diffraction. The cell-nucleus, Cytoplasmic Organelles, cell membrane chemical composition of protoplasm, macromolecules. Cell Division-Mitosis, Meiosis, Factors affecting cell division. Epithelium-Classification. Structural Features. Function Blood-formed elements of blood. Blood cell formation. Destruction of blood cells. The bone marrow. Connective Tissue proper - Extracellular, components, cellular elements chemistry, functions classification, Histological features Histogenesis and histophysiology Cartilage Types and Classification; Chemistry; Regeneration; Regressive change in Cartilage, Histophysiology. The Bone classifications. Development of Muscular Tissue. Types of muscle. Chemistry, Molecular basis of Muscular contraction. Histogenesis and regeneration of muscular tissues. The Nervous: structure, types and distribution. Peripheral nerve endings, Neuroglia, synapse and the

relationships of nervous. Development of Nervous. Blood Vascular system. Fine structure of capillary wall. Arteries, veins. The heart. Histogenesis of blood vessels and heart. Impulse conducting system. Lymphatic system Vessels. Organs - lymph nodes. Histogenesis and regeneration. The spleen - Histological organization functions. The thymus- Histological organization functions, involution of thymus. Mammary Gland, Resting and Active Functions-endocrine control, regression and involution of mammary gland. Histogenesis. Skin. Endocrine system. Reproductive system (Male & Female).

KHAIRUN-PIO 201: Gastrointestinal and Renal Physiology
(2 Units, Core, LH =30, PH=0)

Course Content
The course introduces students 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 Ayodenum: Composition, properties and functions of pancreatic juice. 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 bite 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 - Genie, neural, hormonal small intestine reflexes. Intestino intestinal and an intestinal inhibitory reflex; gastro-intestinal reflex. Renals: The Kidneys. Functions of the kidneys. Excretion of Metabolic wastes, products and foreign chemicals.

Regulation of water and electrolyte balances. Regulation of body fluid osmolality and electrolyte concentrations. Regulation of acid-base balance, regulation of arterial blood pressure. Secretion, metabolism and excretion of hormones Gluconeogenesis. The functional unit of the kidney-Nephron, Regional Differences in Nephron structure: cortical and juxtamedullary Nephrons. Physiology of Urine formation: Mechanism of urine concentration counter-current.

KHAIRUN-PIO 202, Endocrinology & Reproductive Physiology
(2 Units, Core, LH=30, PH= 0)

Course Content
It describes the nature of hypothamo-hypophyseal relationship. Synthesis, storage and release of the neurohypophyseal and adenohypophyseal hormones. Functions of the hypothalamus to include regulation of body temperature, thirst appetite and food intake. Regulation of adenophypophyseal function and higher autonomic control. Functions and control of the secretions of the pituitary, thyroid, parathyroid, pancreas and adrenal glands. Abnormalities of endocrine functions. Normal integration in the control of calcium

and glucose metabolism. Reproduction: Fertilization. Structures of ectodermal, mesodermal and endodermal origins and embryogenesis of different organs. Medical genetics. Physiologic anatomy of male reproductive system. Spermatogenesis. Male sexual act-nervous coordination. Male sexual hormones. Cryptochidism. Physiological anatomy of the female reproductive system. The female sex hormones. Oestrous and menstrual cycles. Physiology of pregnancy, parturition and lactation. Pregnancy tests. Contraception and physiological basis of infertility.

KHAIRUN-PIO 203, Excitable Tissues (CNS & Special Senses)
(2 Units, Core, LH=30, PH= 0)

Course Content
Structure and functions of nerves, cardiac muscle, smooth muscle and skeletal muscle. Muscles: Structure, Excitation, Theories of excitation-contraction. Membrane potentials. Nerve generation and conduction of impulse and its physiological properties. Synapses and synaptic transmission. Physiology of vision: structure of the eyeball. Optics – eye an optical instrument. Refraction of light and refractive errors.

Accommodation. Visual pathways and visual defects. Structure of retina. Biochemistry of vision. Visual acuity, fields of vision and color vision. Physiology of hearing. Auditory stimulus and sound appreciation. Sound characteristics: pitch, intensity and quality. Auditory pathways, neural basis of audition. Types of deafness and tests of both nerve functions. Audiometry. Vestibular pathway and vestibule-ocular reflex. Physiology of taste: gustatory system receptors – taste buds and sensation of tastes. Afferent pathways. Tests for taste and abnormality of taste. Physiology of smell: olfactory receptors and pathways. Tests of olfaction. Abnormalities of olfaction and olfactometry. Functional organization of CNS. Autonomic neurotransmitters and autonomic effects. Peripheral nervous system. The reflex arc and general properties of reflexes. Receptors and receptor potentials. Cerebrospinal fluid and the blood-brain barrier. The human brain — cerebrum, brain stem, basal ganglia, thalamus, hypothalamus and cerebella. The limbic system. Electrophysiology of the cerebral cortex, the electroencephalogram. Alertness and sleep. Postural regulation and postural reflexes. Speech, learning and memory.

KHAIRUN-RAD 203, Introduction to Radiography (2 Units, Core, LH=30, PH= 0)

Course Content

The course gives details history of X-Ray discovery. Early radiographers in the world, Africa, Nigeria, and Northern Nigeria. History of Radiography education in Nigeria. History of Radiography education in Northern Nigeria. The nature of the Surrounding. Matter and Energy. Sources of Ionizing Radiation. Development of Modern Radiology. Patient preparation for various radiographic examinations. Image evaluation. Anatomical terminology, positioning terminology, and projection terminology. The radiographic image: Image formation and density. Image Contrast. Magnification and distortion. Image sharpness. Image acquisition and display. Digital imaging: Image acquisition. Factors affecting image quality. Imaging informatics. Image processing. Exposure factors: Milliampere seconds. Kilovoltage peak. Focus-to-receptor distance. Intensifying screens. Digital imaging. Secondary radiation grids. Choice of exposure factors. Factors contributing to optimum radiographic Image quality. Reports of radiation injury. Basic radiation protection Filtration. Collimation. Intensifying Screens. Protective

Apparel. Gonadal Shielding. Protective Barriers. Standard Units of Measurement: Length. Mass. Time. Units. Terminology for Radiologic Science: Numeric Prefixes, Radiologic Units. The Diagnostic Imaging Team.

300 LEVEL

GST 312: Peace and Conflict Resolution
(2 Units C: LH 30)

Course Contents

Concepts of Peace, Conflict and Security in a multi-ethnic nation. Types and Theories of Conflicts: Ethnic, Religious, Economic, Geo-political Conflicts; Structural Conflict Theory, Realist Theory of Conflict, Frustration-Aggression Conflict Theory. Root causes of Conflict and Violence in Africa: Indigene and settlers Phenomenon; Boundaries/boarder disputes; Political disputes; Ethnic disputes and rivalries; Economic Inequalities; Social disputes; Nationalist Movements and Agitations; Selected Conflict Case Studies– Tiv-Junkun; Zango Kataf; Ife/Madakeke; Aguleri/Amuleri Native Birom/Fulani settlers; Faamers/Herders. Chieftaincy and Land disputes and many others. Peace Building, Management of Conflicts and Security: Peace & Human Development. Approaches to Peace & Conflict Management (Religious, Government, Community Leaders and many others). Elements of Peace Studies and Conflict Resolution: Conflict dynamics assessment Scales: Constructive & Destructive. Justice and Legal

framework: Concepts of Social Justice; The Nigeria Legal System. Insurgency and Terrorism. Peace Mediation and Peace Keeping. Peace & Security Council (International, National and Local levels) Agents of Conflict resolution – Conventions, Treaties Community Policing: Evolution and Imperatives. Alternative Dispute Resolution, ADR. Dialogue b). Arbitration, c). Negotiation d). Collaboration and many others. Roles of International Organisations in Conflict Resolution. (a). The United Nations, UN and its Conflict Resolution Organs. (b). The African Union & Peace Security Council (c). ECOWAS in Peace Keeping. Media and Traditional Institutions in Peace Building. Managing Post-Conflict Situations/Crisis: Refugees. Internally Displaced Persons, IDPs. The role of NGOs in Post-Conflict Situations/Crisis.

ENT 312: Venture Creation
(2 Units C: LH 15; PH 45)

Course Contents
Opportunity Identification (Sources of business opportunities in Nigeria, Environmental scanning, Demand and supply gap/unmet needs/market gaps/Market Research, Unutilised resources, Social and

climate conditions and Technology adoption gap). New business development (business planning, market research). Entrepreneurial Finance. Venture capital, Equity finance, Micro finance, Personal savings, small business investment organisations and Business plan competition). Entrepreneurial marketing and e-commerce (Principles of marketing, Customer Acquisition & Retention, B2B, C2C and B2C models of e-commerce, First Mover Advantage, E-commerce business models and Successful E-Commerce Companies,). Small Business Management/Family Business: Leadership & Management, Basic book keeping, Nature of family business and Family Business Growth Model. Negotiation and Business communication (Strategy and tactics of negotiation/bargaining, Traditional and modern business communication methods). Opportunity Discovery Demonstrations (Business idea generation presentations, Business idea Contest, Brainstorming sessions, Idea pitching). Technological Solutions (The Concept of Market/Customer Solution, Customer Solution and Emerging Technologies, Business Applications of New Technologies - Artificial Intelligence (AI), Virtual/Mixed Reality (VR), Internet of Things (IoTs), Blockchain, Cloud Computing, Renewable Energy and

many others. Digital Business and E-Commerce Strategies).

RAD 301: Radiobiology, Radiation Dosimetry and Protection
(2 Units C: LH 15; PH 45)

Course Contents
Cell theory and genetic apparatus, radiation chemistry, effect of radiation on DNA molecules, amino acid, protein and many others, cellular damages, survival curves. Theories of Biological effects of radiation, short and long term effect (stochastic and non-stochastic, radio sensitivity and Modifiers, post irradiation clinic events, organ pathology syndromes, evidence from Hiroshima and Nagasaki. Target theory and lethal Dose. Measurement of radiation and their units/instrumentation, units of radiation measurement. Role of International Committee on Radiological protection, Radiation dosimetry and instrumentation. The purpose and scope of radiation protection. Systems of dose limitation. Radiological design and materials, Personnel monitoring.

RAD 302: Physics of Cross-sectional Imaging
(2 Units C; LH 30)

Course Contents

The course explains the principles of CT: X ray projection, attenuation and acquisition of transmission profiles. The linear attenuation coefficient, the density of the material and the photon energy, beer's law, Hounsfield units, Gantry and table, X-ray tube and generator, collimation and filtration, detectors, image reconstruction and processing. Basic physics of ultrasound: The nature of sound waves and characteristics of ultrasound, propagation in tissues, piezoelectricity, transducers and beam shapes. Doppler ultrasound physics. Components of A, B, M mode and real-time scanners, measurement of size, scan converters and processing. Pulsed and continuous wave Doppler measurements and Imaging, duplex scanners, 2D echo, ultrasound bone densitometry. physics: Protons, Alignments, Precession, Lamour frequency, Precession, frequency, Gyromagnetic constant, Vectors, Phase and

Frequency, RF Pulse, T1 Relaxation, T2 Relaxation, TE and TR, Spatial encoding, K-Space.

RAD 341: Radiography Techniques I
(2 Units C: LH 15; PH 45)

Learning Outcomes

Course Contents
This is an introduction to Radiography. Principles of Image formation, Factors affecting image quality. Radiation Protection in a clinical setting. Appropriate technique presentation format. Identification and preparation of the patient for the radiographic examination of the upper extremity: Fingers, thumb, hand and many others. Shoulder girdle and thorax. Radiography of the skull, Dental Radiography, skeletal surveys; plain Radiography of the viscera and soft tissue. Accident and emergency Radiography. Introduction to investigations involving contrast media Pharmaco-Radiography. The contrast examination of the gastrointestinal system, excretory system, Obstetric and Gynaecological examination. Sialography, operating theatre techniques.,

RAD 331: Radiographic Imaging Process I
(2 Units C: LH 15; PH 45)

Course Contents
Photographic principles, X-ray film materials and structure. The Radiographic image, Latent image formation, Fluorescence and its application in Radiography. Intensifying screens, X-ray film cassettes, structure and care. Cassette function tests. Chemistry of processing solutions, hazards, sensitometry, storage of X-ray films. Identification and presentation of Radiographs; viewing of Radiographs. Processing – manual and automatic silver recovery.

RAD 332: Artificial Intelligence in Radiography
(2 Units C: LH 15; PH 45)

Course Contents
This course a basic 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.

RAD 381: Radiographic Anatomy and Physiology I
(2 Units C: LH 15; PH 45)

Course Contents
Conventional and contrast Radiographic Anatomy of the system. Anatomy applied to ultrasound and nuclear medicine. Surface anatomy and cross- sectional anatomy. Identification and recognition of normal and pathological changes in anatomical structures and physiological processes. Basic manifestations and presentations of various pathological conditions and diseases entities on radiographs, ultrasound, CT and MR images covering the major organs and systems of the body.

RAD 311: Psychology and Medical Sociology for Radiography Students
(2 Units C: LH 30)

Course Contents
This is an exegesis to the Psychology of the sick patient; management of children, the elderly, the disabled, potentially violent patients, and patients in terminal stages of disease. Communication with and general care of patient's relatives. Professional attitude of the Radiologic Scientist's relationship with staff; acceptance of responsibility for care of patient; motivation and emotional adjustment.

RAD 321: Radiographic Equipment I
(2 Units C: LH 15; PH 45)

Course Contents
This is an introduction to the mains supply, Basic Principles of Generators including Falling load generators and frequency multipliers. Control and stabilising equipment. High tension circuits, Meters, Switches and circuit breakers.

RAD 384: Pharmacology for Medical Imaging
(2 Units C: LH 30)

Course Contents

Iodinated contrast media. High osmolality. Low osmolality. Radio pharmaceuticals. MRI contrast media. CT contrast media. Ultrasound contrast media. Allergy and contrast media reactions. Air or negative contrast media. Birium and positive contrast medium. Double contrast media.Origin and sources of Drugs; Routes of Administration of Drugs; Pharmacokinetics; Absorption of Drugs; Excretion of Drug; Drug Toxicity, Adverse drug Reactions; Drug Interactions; Cholinergic and adrenergic; Vomiting – Antiemetic; Constipation – purgatives; H2 receptor antagonists; Oxygen therapy, Bronchodilator Drugs; Asthma, Cough Suppressants; Respiratory Stimulants; Anticoagulants Heparin, Fibrinolysis; Vasodilator; Diuretics; renal failure; Immunity; Major Features of Malignant Disease; Principles of Cancer Chemotherapy; radio-activity; Nervous system Stimulants; Anticonvulsant Drugs.

RAD 351: Radiology Administration and Management
(1 Unit C: LH 15)

Course Contents
Application of Managerial functions, Health Management Structure Health Care Policy. Inter-dependence of various departments. Radiology department and organizational structure. Financial resources and management. Vital Personnel Management, Management and communication process. Patient – flow and appointment system. Public Relations. Evaluation of Management principles and performance. Total quality management.

RAD 372: Clinical Posting I
(3 Units C: LH 30; PH 45)

Course Contents
Clinical posting at designated hospitals 12 hours per week 2 days' release.

RAD 352: Entrepreneurship/ Education in Radiography (2 Units C: LH 30)

Course Contents

Concept of entrepreneurship; Business opportunities in radiography/medical imaging profession.

Prerequisites for setting up a radiography/medical imaging facility and site selection. Finding opportunities and sustainable development strategies for the future. Regulatory and safety requirements. Total quality management strategies in a competitive environment. Networking options and tele-radiography in private practice. Ethical issues. Managing growth of a business venture. Education training methods, instructor-led classroom, interactive methods, hands-on training, computer based training, video training and coach/mentoring methods. Emphasis on knowledge, skills and attitudes needed to function in health care environment and inter-disciplinary expertise. Community and public health. Theories and models and their application to real world. Comparative training duration/curricula of radiography in Nigeria, UK, USA and many others.

KHAIRUN-ANA 301, Gross Anatomy of Head & Neck
(3 Units, Core, LH=30, PH= 45)

Course Content

Cervical vertebrae. Bones of the skull. Interior of the cranium mandible. Scalp temple and face I. Scalp temple and face. Side of the neck-posterior triangle. Anterior triangle of neck. Cranial cavity. Deep dissection of neck including thyroid and parathyroid glands. Deep dissection of blood vessels. Nerves of neck paravertebral region. Orbit and lachrymal apparatus. Side of neck/posterior triangle. Anterior triangle of the neck. Parotid, temporal & infratemporal regions. Submandibular regio. Mouth. Pharynx and soft palate. Nasal cavity/paranasal sinuses. Larynx/tongue/eyeball. External, middle and internal ear.

KHAIRUN-RAD 302: Radiographic Technique (Vertebra, pelvic girdle, hip and lower limb) (2 Units, Core, LH=15, PH= 45)

Course Content

This takes students to the identification and preparation of the patient for the radiographic examination of the vertebral column (cervical, thoracic, lumbar, sacrum, coccyx and sacro-iliac joint). Identification and preparation of the patient for the radiographic examination of the pelvic girdle. Identification and preparation of the patient for the radiographic examination of the hip. Identification and preparation of the patient for the radiographic examination of the lower limb (femur, knee, leg, ankle, foot, toes,). Indications for the radiographic examination of the vertebral column (cervical, thoracic, lumbar, sacrum, coccyx and sacro-iliac joint). Indications for the radiographic examination of the pelvic girdle. Indications for the radiographic examination of the hip. Indications for the radiographic examination of the lower limb (femur, knee, leg, ankle, foot, toes,). Radiation protection guidelines when imaging the radiosensitive regions of the vertebral column (cervical, thoracic, lumbar, sacrum, coccyx and sacro-iliac joint), pelvic girdle, hip and lower limb

(femur, knee, leg, ankle, foot, toes,). Basic Radiographic examination of the vertebral column (cervical, thoracic, lumbar, sacro-iliac joint), pelvic girdle, hip and lower limb (toes, foot, calcaneum, ankle, leg, knee joint, femur). Supplementary radiographic projections of the vertebral column (cervical, thoracic, lumbar, sacro-iliac joint), pelvic girdle, hip and lower limb (toes, foot, calcaneum, ankle, leg, knee joint, femur).

KHAIRUN-RAD 303, Surface Anatomy for Radiographers
(2 Units, Core, LH=15, PH= 45)

Course Content
The anatomical and radiographic terminologies. Re-visit the body planes and their applications across most all imaging modalities. References radiographic lines of the head and neck as applied in cephalometric. Tomography. Dental imaging. Skull imaging. Landmarks and their corresponding internal structures involving the head. Landmarks and their corresponding internal structures involving the Neck. Landmarks and their corresponding internal structures involving the Chest. Landmarks and their corresponding internal structures involving the Spine. Landmarks and their corresponding internal

structures involving the Upper limb, Abdomen. Landmarks and their corresponding internal structures involving the pelvic girdle. Landmarks and their corresponding internal structures involving the femur. Landmarks and their corresponding internal structures involving the knee. Landmarks and their corresponding internal structures involving the leg, ankle and toes.

KHAIRUN-RAD 304: Radiobiology, Radiation Dosimetry and Protection II
(2 Units, Core, LH=30, PH= 0)

Course Content
This is an overview of Radiation Effects. The physical and chemical mechanisms of radiation effects, DNA strand breaks. Chromosomal aberrations. Theory of modelling of DNA & CA damage. Cell survival curves. Mitotic cell cycle and radiosensitivity. Cell genetics, repair mechanisms and modelling. Physiological Responses of Tissues & Organs to radiation injury. Acute Radiation Effects. Models of Radiation Detriment. Effective Dose. Effective Dose Applications. Internal Distribution of Radionuclides. Mechanisms of Carcinogenesis. Radiation Carcinogenesis. Epidemiology & Risk Models. Evidence/Mechanisms of

Radiation Hormesis. Radiation Hormesis. Embryo/Fetal Exposures & Anatomical Development. Radiation Sensitivity: Normal Tissue vs. Tumor Systems. Basis of Radiation Protection: basis of radiation protection standards; ICRP principles – justification, optimization, dose limitations. Basic atomic physics and radiation biology: basic atomic and nuclear physics; basic biology; interaction of radiation with matter; biological effects of radiation; quantities and units. Detection and measurement of radiation: detection and measurement methods; monitoring – area, personal dosimetry (external, real time and external), biological. Legislation: legal and regulatory basis: internal recommendations/ conventions; European Union legislation; IRR17; other relevant health and safety legislation. Practices, interventions and exposure situations: sealed sources and associated practices; unsealed sources and practices; X-ray sources and practices; other sources and practices; interventions (including natural radiation, especially radon). Control of exposure: operational radiation protection; hazard and risk assessment; minimisation of risk; control of releases; critical dose concept/dose calculation for critical group; ergonomics; operating rules and contingency planning; emergency procedures; remedial action/ decontamination; analysis of past

incidents including experience feedback. Organisation of radiation protection: role of qualified experts; safety culture; communication skills; record keeping; permits to work and other authorisations; designation of areas and classification of workers; quality control/auditing; dealing with contractors. Management of Radioactive materials and waste disposal: registration and authorisation of practices (and exemptions); waste management – principles of management, principles of disposal; environmental impact assessments; transport (including exemptions)